

Structure & Syllabus

of

Master of Computer Applications (MCA)

2 Year (4 Semesters) Course



Isht
22/01/2021

R
22/01/2021

R. Jit
22/01/21

Isht
22/01/21

Isht
22/01/21

Isht
22/11/2020

Isht
22/11/21

Isht
22/11/21

Isht
22/11/21

**DEPARTMENT OF COMPUTER SCIENCE AND
APPLICATIONS,
DR. HARISINGH GOUR UNIVERSITY,
(A CENTRAL UNIVERSITY)
SAGAR-470003(MP-INDIA)**

Isht
18/1/21
Chairman, BOS
Computer Science and Applications

Isht

Approved by School Board Dated...22/11/21

In view of the AICTE Circular, number AICTE/AB/MCA/2020-21 dated 03.07.2020 regarding Change in the duration of MCA Program from 3 Years to 2 Years w.e.f. 2020-21, Board of studies modified the course curriculum of MCA course from 3 year to 2 year course. The following shall be rules and regulations regarding conduct of academic activities of the Master of Computer Applications (MCA) programme:

1. Name of the program : **Master of Computer Applications (MCA)**
2. Duration of the program : 2 Years
 - (a) Minimum duration : 2 Years
 - (b) Maximum duration : As per University Ordinance
3. Structure of the program:

MCA Credit Distribution

Semester	Core Course (CC) Credits	Elective Course (EC) Credits	Open Elective (OE) Credits	Total Credits
I	24	--	--	24
II	24	--	02	26
III	16	08	02	26
IV	10	12	--	18
TOTAL	74	20	04	94

4. **Medium of Instruction & Examination:** Medium of instruction as well as examination will be English only.
5. **Attendance:** Students must secure minimum 75% attendance in each course to appear in the End Semester Examination. If a student fails to secure 75% attendance in a course the he or she will not be allowed to appear in End Semester Examination of the respective course. Relaxation may be granted as per University Ordinance.

6. **Scheme of Examination:**

(a) Mid Semester Examination (ME)

: 20 Marks

DS huclo
18/11/21

Chairman, BOS
Computer Science & Applications

Approved by School Board

21/12/21

1

21/12/21

(b) Internal Assessment (IA) : 20 Marks

(c) End Semester Examination (ESE) : 60 Marks

a. Mid Semester Examination: 20 Marks

Syllabus and pattern of examination will be decided by the corresponding course instructor(s)/coordinators.

b. Internal Assessment : 20 Marks

The 15 marks of internal assessment will be evaluated on any one or more than one methods of the following:

- i. Classroom activities.
- ii. Presentation
- iii. Assignment
- iv. Quizzes
- v. Practical based Test

Remaining 05 marks will be assigned for attendance. The marks for attendance shall be awarded as follows:

- | | |
|---------------------------|----------|
| i. 75% and below : | 00 Mark |
| ii. >75% and upto 80% : | 01 Mark |
| iii. > 80% and upto 85% : | 02 Marks |
| iv. > 85% and upto 90% : | 03 Marks |
| v. > 90% and upto 95% : | 04 Marks |
| vi. > 95% : | 05 Marks |

c. End Semester Examination : 60 Marks

Each exam paper of End Semester shall be of 60 marks and of 3 hours duration. The pattern of Questions asked shall be as mentioned in the University Ordinance.

Note: A student shall be eligible to appear in End Semester Examination of course if he/she appeared in Mid Semester Examination and Internal Assessment and fulfils the minimum requirement of attendance, failing which he/she will not be permitted to appear in the End Semester Examination of respective courses.

d. Dissertation Evaluation:

The dissertation work is evaluated on the basis of following heads:

- I. Mid 1- Presentation & evaluation of Synopsis: 20 Marks

- II. Mid 2- Presentation & evaluation of Progress of work: 20 Marks
- III. End Semester:
- a. Evaluation of Dissertation: 30 Marks
 - b. Presentation: 15 Marks
 - c. Viva : 15 Marks

Dissertation copied from other students will be considered to have used unfair means. If two projects are found identical by more than 40% then zero marks will be awarded to both of them. In such a case the projects will have to be resubmitted on new topic or revised. Course coordinator will be appointed for this purpose.

Committee for Evaluation:

The evaluation of component I and II will be carried out by a committee consisting of the Chairman of BoS or his/her nominee, supervisor (if dissertation is carried out under the supervision of faculty members of the department) and one faculty member.

Components III will be evaluated by a committee consisting of the Chairman of BoS or his/her nominee, supervisor (if project is carried out under the supervision of faculty member of the department), one faculty members of the department, and an external examiner invited from other University/Industry/Society.

7. Credit and Teaching hours:

The credit and teaching hours shall be distributed as under:

Theory	1- Credit = 15 hours / per semester 2- Credit = 30 hours / per semester 3- Credit = 45 hours / per semester 4- Credit = 60 hours / per semester
Practical	1- Credit = 30 hours / per semester 2- Credit = 60 hours / per semester
Tutorial	1- Credit = 15 hours / per semester

The teacher to student ratio for tutorial/practical class will be divided into groups for tutorial and practical classes if so required. Dispute, if any, regarding functionality of academic programs, the decision of Head of Department will be the final and binding for students.

DShukla
18/1/21

Chairman, BoS
Computer Science & Applications







Course Objective and Learning Outcomes

The broad objective of the two year MCA programme is to prepare student's productive careers for software industry, corporate sector, Govt. organizations and academia by providing skill based environment for teaching and research in the core and emerging areas of the discipline.

The Programme's thrust is on giving the students a thorough and sound background in theoretical and skill-oriented courses relevant to the latest computer software development. The programme emphasizes the application of software technology to solve mathematical, computing, communications/networking and commercial problems.

This two year Programme has been designed with a semester approach in mind. First two semesters provide theoretical knowledge and basic computing skills of computer science. Third semester focuses on the advance computing knowledge and techniques. Final semester has desertation work and specialized papers of different domains and applications of computer science.

Master of Computer Applications (MCA) programme is a theoretical and practical based course having the following objectives:

1. Produce knowledgeable and skilled human resources who are employable in IT industry, research work and in higher education.
2. Impart knowledge required for planning, designing and building complex application software systems as well as provide support to automated systems or application.
3. Produce entrepreneurs who can develop customized solutions for small to large Enterprises.
4. Develop academically competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that compassionately foster the scientific temper with a sense of social responsibility.
5. Develop students to become globally competent.

Dshuclg
18/11/21

Chairman, BOS
Computer Science & Applications

After completing these courses students shall be competent in following areas:

1. Planning, designing and building complex application software systems as well as to provide support to automated systems or application.
2. Entrepreneurship for customized solutions as per requirement for small to large Enterprises.
3. Academic soundness and scientific research with a sense of social responsibility.
4. Working with emerging technologies.

DSK
18/1/21

Chairman, BOS
Computer Science & Applications

CSA

HS

Approved by School Board Dated...22/11/21

Course Structure:

Semester I										
Course Code	Course Title	Cre dit	L	T	P	Sessional		ESE	Total	
						ME	IA			
CSA-CC-1201	Computer Organization and Architecture	4	3	1	-	20	20	60	100	
CSA-CC-1202	Programming using C	4	3	1	-	20	20	60	100	
CSA-CC-1203	Data Structure	4	3	1	-	20	20	60	100	
CSA-CC-1204	Discrete Mathematics	4	3	1	-	20	20	60	100	
CSA-CC-1205	Operating System	4	3	1	-	20	20	60	100	
Software Laboratory Practical										
CSA-CC-1206	C Programming Lab	2	-	-	4	20	20	60	100	
CSA-CC-1207	Data Structure Lab	2	-	-	4	20	20	60	100	
	Total Credits	24	15	5	8				700	

Semester II									
Course Code	Course Title	Credit	L	T	P	Sessional		ESE	Total
						ME	IA		
CSA-CC-2201	Java Programming	4	3	1	-	20	20	60	100
CSA-CC-2202	Database Management Systems	4	3	1	-	20	20	60	100
CSA-CC-2203	Scientific Computing	4	3	1	-	20	20	60	100
CSA-CC-2204	Theory of Computation	4	3	1	-	20	20	60	100
CSA-CC-2205	Data Communication & Computer Networks	4	3	1		20	20	60	100
Software Laboratory Practical									
CSA-CC-2206	Java Programming Lab	2	-	-	4	20	20	60	100
CSA-CC-2207	DBMS Lab	2	-	-	4	20	20	60	100
Out Department Paper									
Out Department	Out Department	02	-	-	-	20	20	60	100
	Total Credits	26	15	5	8	-	-	-	800
Paper offered for other Department									
CSA-OE-2201	Computer Education – I	02	2	-	-	20	20	60	100

Semester III									
Course Code	Course Title	Credit	L	T	P	Sessional		ESE	Total
						ME	IA		
CSA-CC-3201	Software Engineering	4	3	1	-	20	20	60	100
CSA-CC-3202	AI & Machine Learning	4	3	1	-	20	20	60	100
CSA-CC-3203	Programming with Python	4	3	1	-	20	20	60	100
Elective 1 (Opt any one of following)									
CSA-EC-3201	R Programming	4	3	1	-	20	20	60	100
CSA-EC-3202	PHP	4	3	1	-	20	20	60	100
CSA-EC-3203	.NET Programming	4	3	1	-	20	20	60	100

CSA-EC-3204	Android Programming	4	3	1	-	20	20	60	100
Elective 2 (Opt any one of following)									
CSA-EC-3205	Combinatorics and Graph Theory	4	3	1	-	20	20	60	100
CSA-EC-3206	Computer Graphics and Animation	4	3	1	-	20	20	60	100
CSA-EC-3207	Design and Analysis of Algorithm	4	3	1	-	20	20	60	100
CSA-EC-3208	Microprocessors	4	3	1	-	20	20	60	100
CSA-EC-3209	Object Oriented Analysis and Design	4	3	1	-	20	20	60	100
Software Laboratory (Practical)									
CSA-CC-3204	Python Programming Lab	2	-	-	4	20	20	60	100
CSA-CC-3205	Lab based on Elective 1	2	-	-	4	20	20	60	100
Out Department Course									
Out Department	Out Department	02	-	-	-	20	20	60	100
Participation / Presentation/ Industrial Visit									
CSA-SE-3201	Industrial Tour, Seminar Participation, Minor project, training	02	-	-	-	20	20	60	100
Total Credits		28	15	05	08	-	-	-	900
Paper offered for other Department									
CSA-OE-3202	Computer Education – II	02	2	-	-	20	20	60	100

Semester IV									
Course Code	Course Title	Credit	L	T	P	Sessional		ESE	Total
						ME	IA		
Elective 3 (Opt any one of following)									
CSA-EC-4201	Data Mining and Knowledge Discovery	4	3	1	-	20	20	60	100
CSA-EC-4202	Privacy & Security in Online Social Media	4	3	1	-	20	20	60	100
CSA-EC-4203	Compiler Design	4	3	1	-	20	20	60	100
CSA-EC-4204	Wireless Networks	4	3	1	-	20	20	60	100
CSA-EC-4205	Cyber Security	4	3	1	-	20	20	60	100
Elective 4 (Opt any one of following)									
CSA-EC-4206	Big Data and Analytics	4	3	1	-	20	20	60	100
CSA-EC-4207	Human-Computer Interaction	4	3	1	-	20	20	60	100
CSA-EC-4208	Mobile Communication and Computing	4	3	1	-	20	20	60	100
CSA-EC-4209	Parallel and Distributed Systems	4	3	1	-	20	20	60	100
CSA-EC-4210	Blockchain Technology	4	3	1	-	20	20	60	100
Elective 5 (Opt any one of following)									
CSA-EC-4211	Information Theory, Coding and Cryptography	4	3	1	-	20	20	60	100

CSA-EC-4212	Cloud Computing and IoT	4	3	1	-	20	20	60	100
CSA-EC-4213	Natural Language Processing	4	3	1	-	20	20	60	100
CSA-EC-4214	Simulation and Modelling	4	3	1	-	20	20	60	100
CSA-EC - 4215	Digital Image Processing & Computer Vision	4	3	1	-	20	20	60	100
Dissertation Work									
CSA-EC-4201	Dissertation	6	-	-	-	20	20	60	100
	Total Credits	18	9	3	00	-	-	-	400

Summary				
Semester	1	2	3	4
Semester-wise Total Credits	24	26	26	18
Total Credits	94			

L: Lecture, T: Tutorial, P: Practical.

ME: Mid Examination, IA: Internal Assessment, ESE: End Semester Examination

DS huc19
18/11/21

Chairman, BOS
Computer Science & Applications

g/s/21

Cmy

Approved by School Board Dated...22/11/21...

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-1201	Computer Organization and Architecture	4	3	1	-	20	20	60	100

Course Objective:

1. To be aware of number system
2. Get idea of internal architecture of central processing unit.
3. To learn the functioning of exchange of information of electronic devices embedded on motherboard.
4. To learn the memory classification and organization.

Course Contents:

Unit	Topic	Proposed Lectures
I	Representation of information and Basic Building Blocks: Number System: Binary, Octal, Hexadecimal and their conversion, Character Codes: BCD, ASCII, EBCDIC. Digital Codes: Gray Code, XS-3 Code.	12
II	Logic circuits : Basic Logic Functions, Synthesis of Logic Functions Using AND, OR and NOT Gates, Minimization of Logic Expression, Synthesis with NAND and NOR Gates, Implementation of Logic Gates, Flip-Flops, Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable Logic Devices , Sequential Circuits.	12
III	Basic Structure of Computer Hardware and Software: Functional units, Basic operational concepts, Bus structures, Software, Performance, Distributed Computing. Addressing Methods: Basic Concepts, Memory Locations, Main Memory Operations, Addressing Modes, Basic I/O operations, Stacks and Queues, Subroutines.	12
IV	Processing Unit : Some Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Considerations, Micro Programmed Control, Signed Addition and Subtraction, Arithmetic and Branching Conditions, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating Point Numbers and Operations.	12
V	Input-output Organization: Accessing I/O Devices, Interrupts, Direct Memory Access, I/O Hardware, Standard I/O Interfaces. Memory: Semiconductor RAM memories, Read-Only Memories, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements.	12

Suggested Reading:

1. Willam Stalling, "Computer Organization and Architecture" Pearson Education Asia
2. Mano Morris, "Computer System Architecture" PHI
3. Zaky and Hamacher, "Computer Organization: McGraw Hill
4. B. Ram, "Computer Fundamental Architecture and Organization" New Age
5. Tannenbaum, "Structured Computer Organization" PHI.
6. Hayes: Computer Architecture and Organization, Mc Graw Hill.
7. G.L. Jr.: Computer design, Computech Press Langdon.
8. Bywater: Hardware- Software Design of digital System

E-Resources:

1. <https://nptel.ac.in/courses/117105080/>
2. <https://dvikan.no/ntnu-studentserver/kompendier/digital-systems-design.pdf>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>
4. <https://nptel.ac.in/courses/106103068/pdf/coa.pdf>
5. <https://nptel.ac.in/courses/106102062/>
6. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

E-books (at IP 14.139.234.164):

1. Ghosh, 'Computer Organization', Noida, McGraw Hill, (available at <http://mcgrawhilleducation.pdn.ipublishcentral.com/bookshelf>)
2. Govindara, Jalu, 'Computer Architecture & Organization' Noida, McGraw Hill, (available at: <http://mcgrawhilleducation.pdn.ipublishcentral.com/bookshelf>)

Learning Outcome: Course student will be able to:

- Understand the roles, functions and duties of components of internal architecture of Central Processing Unit.
- Describe the memory organization

D Shukla
18/1/21

Chairman, BOS
Computer Science & Applications

M. S. L.

Approved by School Board Dated... 22/1/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-1202	Programming Using C	4	3	1	-	20	20	60	100

Course Objective:

1. To impart the concepts of programming.
2. To understand the concepts C programming language.
3. To learn advanced features of C language.

Course Contents:

Unit	Topic	Proposed Lectures
I	Basics of programming: Approaches to problem solving, Use of high level programming language for systematic development of programs, Concept of algorithm and flowchart, Concept and role of structured programming. Basics of C: History of C, Salient features of C, Structure of C Program, Compiling C Program, Link and Run C Program, Character set, Tokens, Keywords, Identifiers, Constants, Variables, Instructions, Data types, Standard Input/Output, Operators and expressions.	12
II	Conditional Program Execution: if, if-else, and nested if-else statements, Switch statements, Restrictions on switch values, Use of break and default with switch, Comparison of switch and if-else. Loops and Iteration: for, while and do-while loops, Multiple loop variables, Nested loops, Assignment operators, break and continue statement. Functions: Introduction, Types, Declaration of a Function, Function calls, Defining functions, Function Prototypes, Passing arguments to a function Return values and their types, Writing multifunction program, Calling function by value, Recursive functions.	12
III	Arrays: Array notation and representation, Declaring one-dimensional array, Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays, Multidimensional arrays. Pointers: Introduction, Characteristics, * and & operators, Pointer type declaration and assignment, Pointer arithmetic, Call by reference, Passing pointers to functions, array of pointers, Pointers to functions, Pointer to pointer, Array of pointers. Strings: Introduction, Initializing strings, Accessing string elements, Array of strings, Passing strings to functions, String functions.	12
IV	Structure: Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations on structures, Structure within structure, Array of structure, Pointers to structure. Union: Introduction, Declaring union, Usage of unions, Operations on	12

	union. Enumerated data types. Storage classes: Introduction, Types- automatic, register, static and external.	
V	Dynamic Memory Allocation: Introduction, Library functions – malloc, calloc, realloc and free. File Handling: Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through command line argument, Record I/O in files. Graphics: Introduction, Constant, Data types and global variables used in graphics, Library functions used in drawing, Drawing and filling images, GUI interaction within the program.	12

Suggested Reading:

1. "Schaum's Outlines- Programming in C", by Gottfried B., McGraw-Hill Publications.
2. "The C Programming Language", by Brian Kernighan and Dennis Ritchie, Prentice Hall.
3. "Problem Solving and Program Design in C", by Hanly J. R. and Koffman E. B., Pearson Education.
4. "How to Solve it by Computer" by R. G. Dromey, Prentice-Hall.
5. "Let Us C", by Kanetkar Y., BPB Publications.

E-Resources:

1. <https://nptel.ac.in/courses/106104128/>
2. http://www.kciti.edu/wp-content/uploads/2017/07/cprogramming_tutorial.pdf
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

Learning Outcome: Course student will be able to:

- Construct flowchart and write algorithms for solving basic problems.
- Write 'C' programs that incorporate use of variables, operators and expressions along with data types.
- Write simple programs using the basic elements like control statements, functions, arrays and strings.
- Write advanced programs using the concepts of pointers, structures, unions and enumerated data types.
- Apply pre-processor directives and basic file handling and graphics operations in advanced programming.

Dr. Shukla
18/11/21
Head, BOS
Department of Computer Science & Applications

[Signature]

[Signature]

Approved by School Board Dated... 22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-1203	Data Structure	4	3	1	-	20	20	60	100

Course Objective:

1. To implement basic data structures like stacks, queues, linked lists, trees, and graphs.
2. To develop ability for simple applications, like a desk calculator using stacks.
3. To make aware about advanced searching methods like B-tree, B+ tree, AVL/red-black trees.
4. Ability to use standard libraries for data structures.

Course Contents:

Unit	Topic	Proposed Lectures
I	Introduction to data structure: Data, Entity, Information, Difference between Data and Information, Data type, Build in data type, Abstract data type, Definition of data structures, Types of Data Structures: Linear and Non-Linear Data Structure, Introduction to Algorithms: Definition of Algorithms, Difference between algorithm and programs, properties of algorithm, Algorithm Design Techniques, Performance Analysis of Algorithms, Complexity of various code structures, Order of Growth, Asymptotic Notations. Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D, 2-D Array Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable.	12
II	Stacks: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Queues: Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.	12
III	Searching: Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. Sorting: Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time: Counting Sort and Bucket Sort.	12
IV	Graphs: Terminology used with Graph, Data Structure for Graph	12

	Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component. Trees: Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Complete Binary Tree, A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search Tree. Threaded Binary trees, Huffman coding using Binary Tree, AVL Tree and B Tree.	:
V	Divide and Conquer with Examples Such as Merge Sort, Quick Sort, Matrix Multiplication: Strassen's Algorithm Dynamic Programming: Dijkstra Algorithm, Bellman Ford Algorithm, All pair Shortest Path: Warshal Algorithm, Longest Common Sub-sequence Greedy Programming: Prims and Kruskal algorithm.	: 12

Suggested Reading:

1. "Fundamentals of Computer Algorithms", Horowitz Ellis, Sahni Sartaj and Rajasekharan S., Universities Press.
2. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
3. "Theory and Problems of Data Structures", Lipschutz S., Schaum's Series.
4. "Data Structures With C - SIE - SOS", Lipschutz, McGraw Hill
5. "Classic Data Structures", Samanta D., Prentice Hall India.
6. Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", Pearson Education.
7. Langsam, Yedidyah; Augenstein, Moshe J.; Tenenbaum, Aaron M. "Data structures using C and C++.

E-Resources:

1. <https://nptel.ac.in/courses/106105085/4>
2. <https://nptel.ac.in/courses/106103069/>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

E-books (at IP 14.139.234.164):

1. Mukherjee, Sudipta, 'Data Structures Using C: 1000 Problems and Solutions', Noida, McGraw, Hill, (available at <http://mcgrawhilleducation.pdn.in/publishcentral.com/bookshelf>)

Learning Outcome: At the end of course student will be able to:

- Explain the concept of data structure, abstract data types, algorithms and basic data organization schemes such as arrays and linked lists.
- Describe the applications of stacks and queues and implement various operations on them using arrays and linked lists.
- Describe the properties of graphs and trees and implement various operations such as searching and traversal on them.
- Compare incremental and divide-and-conquer approaches of designing algorithms for problems such as sorting and searching.

DShukla
18/11/21

Chairman
Computer Science & Applications

(Signature)

Approved by School Board Dated...22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-1204	Discrete Mathematics	4	3	1	-	20	20	60	100

Course Objective:

1. To understand the basic concepts of discrete mathematics
2. To design & apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction
3. To formulate & use tree and graph algorithms to solve problems
4. To evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

Course Contents:

Unit	Topic	Proposed Lectures
I	Set Theory: Introduction, Size of sets and cardinals, Subsets, Power sets, Complement, Union and Intersection, Demorgan's law, Ordered pairs and Set identities. Relations & Functions: Relations - Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation. Functions - Definition, Classification of functions, Operations on functions, Recursively defined functions. Notion of Proof: Introduction, Mathematical Induction, Strong Induction and Induction with Nonzero base cases. Algebraic Structures: Definition, Properties, Types: Semi Groups, Monoid, Groups, Abelian Groups.	12
II	Lattices: Introduction, Partial order sets, Combination of partial order sets, Hasse diagram, Introduction of lattices, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean Functions, Karnaugh maps.	12
III	Combinatorics: Multinomial theorem, principle of inclusion exclusion; pigeonhole principle; Classification of recurrence relations, summation method, extension to asymptotic solutions from solutions for subsequences; Linear homogeneous relations, characteristic root method, general solution for distinct and repeated roots, non-homogeneous relations and examples, generating functions and their application to linear homogeneous recurrence relations, non-linear recurrence relations, exponential generating functions, brief introduction to Polya theory of counting.	12
IV	Graph Theory: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Minimum spanning tree, rooted trees and binary trees, planar graphs, Euler's formula, statement of Kuratowski's theorem, dual of a planar graph, independence number and clique number, chromatic number, statement of Four-color theorem, dominating sets and covering sets.	12

V	Logic: Propositional calculus propositions and connectives, syntax; semantics truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility, natural deduction system and axiom system; Soundness and completeness. Introduction to Predicate Calculus: Syntax of first order language; Semantics structures and interpretation; Formal deductibility; First order theory, models of a first order theory (definition only), validity, soundness, completeness, compactness (statement only), outline of resolution principle.	12
---	---	----

Suggested Reading:

1. "Discrete Mathematics and Its Applications", K.H. Rosen, Tata McGraw Hill.
2. "Discrete Mathematical Structure with Application to Computer Science", J. P. Trembley, R. P. Manohar.
3. "Elements of Discrete Mathematics A Computer Oriented Approach", C.L. Liu, D. P. Mohapatra.
4. "Discrete Mathematics for Computer Scientists", J. L. Mott, A. Kandel and T. P. Baker.
5. "Discrete Mathematics in Computer Science", D. F. Stanat and D. E. McAllister.
6. "Introductory Combinatorics", R. A. Brualdi.
7. "Graph Theory with Applications to Engineering and Computer Science", N. Deo.
8. "Introduction to Graph Theory", Douglas B. West.
9. "Introduction to Mathematical Logic", E. Mendelsohn.

E-Resources:

1. <https://nptel.ac.in/downloads/111104026/>
2. <https://nptel.ac.in/courses/111106086/Lecture1.pdf>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

Learning Outcome: After this course student will be able to:

- Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions
- Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic.
- Formulate and solve recurrences and recursive functions.
- Apply the concept of combinatorics to solve basic problems in discrete mathematics Explain the concept of data structure, abstract data types, algorithms and basic data organization.
- Formulate & use tree and graph algorithms to solve problems
- Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

D Shukla
18/11/21

Chairman, BOS
Computer Science & Applications

Signature

Approved by School Board Dated 22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-1205	Operating System	4	3	1	-	20	20	60	100

Course Objective:

1. To learn basic function of operating system
2. To know resource manage aspect of operating system
3. To use command of UNIX standard libraries.

Course Contents:

Unit	Topic	Proposed Lectures
I	Introduction: What is an Operating System, Simple Batch Systems, Multiprogrammed Batches systems, Time-Sharing Systems, Personalcomputer systems, Parallel systems, Distributed Systems, Real-Time Systems. Processes: Process Concept, Process Scheduling, Operation on Processes, Cooperating Processes, Interprocess Communication	12
II	CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple- Processor Scheduling, Real-Time Scheduling, Algorithm Evaluation.	12
III	Process Synchronization: Background, The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors. Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined Approach to Deadlock Handling.	12
IV	Memory Management: Background, Logical versus Physical Address space, swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging Virtual Memory: Demand Paging, Page Replacement, Page replacement Algorithms, Performance of Demand Paging, Allocation of Frames, Thrashing, Other Considerations, Demand Segmentation.	12
V	Basic Commands of Unix, File System, General Model of a File System, Symbolic File System, Basic File System, Access Control Verification, Logical File System, Physical File System File-System Interface: File Concept, Access Methods, Directory Structure, Protection, Consistency Semantics File-System Implementation: File-System Structure, Allocation Methods, Free-Space Management, Directory Implementation, Efficiency and Performance, Recovery.	12

D. Shukla
18/1/21

Chairman, BOS
Computer Science & Applications

[Signature]

[Signature]

Approved by School Board Dated... 22/1/21

Suggested Reading:

1. Abraham Siberschatz and Peter Baer Galving "Operating System Concepts".
2. Milan Milankovic, "Operating Systems, Concept and Design" McGraw Hill.
3. R. C. Joshi "Operating System", Wiley dreamtech India Pvt. Ltd.
4. Harvey M Ddeital "Operating System" Addison Wesley Cloud Computing Bible by Barrie Sosinsky.

E-Resources:

1. <https://nptel.ac.in/downloads/106108101/>
2. <https://nptel.ac.in/courses/106102132/>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

E-books (at IP 14.139.234.164):

1. Stallings, William, 'Operating Systems: Internals and Design Principles, GI', Noida, Pearson, (available at : <https://ebookcentral.proquest.com/lib/hsgu-ebooks/home.action>)

Learning Outcome: Students will learn:

- about challenges of the resource handling of operating system of computer.
- How to apply the basic command of UNIX

DS Shukla
18/11/21

[Signature]
Chairman, BOS
Computer Science & Applications

[Signature]
[Signature]

Approved by School Board Dated... 22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-1206	C Programming Lab	2	-	-	4	20	20	60	100

Objectives: To provide hands on training in C Programming to students in order to write programmes

List of practicals will be decided by the course coordinator.

Learning Outcomes: After completing this course student will be capable enough to implement programming concept in C language on real life problems.

D Shukla
18/11/21

Chairman, BOS
Computer Science & Applications

[Signature]

Approved by School Board Dated: 22/11/21

Department of Computer Science and Applications, Dr. Harisingh Gour Vishwavidyalaya, Sagar

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-1207	Data Structure Lab	2	-	-	4	20	20	60	100

Objectives: To train the students to implement the theory and concepts data structure in programming.

List of practicals will be decided by the course coordinator.

Learning Outcomes: After completing this course student will be capable enough to implement various concepts of data structure on real life problems.

DShukla
18/11/21
Chairman, BOS
Computer Science & Applications

[Signature]

[Signature]

Approved by School Board Dated...22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-2201	Java Programming	4	3	1	-	20	20	60	100

Course Objective: ~~Students will learn~~

1. To learn the basic tools and techniques used in Java language.
2. To be aware of special and advanced features of Java language.
3. To develop skill of writing Java program for problem..

Course Contents:

Unit	Topic	Proposed Lectures
I	Principles of OOP: Programming paradigms, basic concepts, benefits of OOP, applications of OOP, Features of Java; Java Magic: Byte Code.	12
II	Basics of Java Keywords, Working of Java; Data Types in Java - Variables in Java; Naming Variables; Using Classes in Java - Standard for Coding; Declaring Methods in Java; The main Method; Invoking a Method in Java; Saving, Compiling and Executing Java Programs. Operators and Control Statements: Control Flow Statements, For Loop, While Loop, Do...While Loop, Break Statement, Continue Statement.	12
III	Arrays and Strings: The String Constructors, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, StringBuffer. Inheritance, Package and Interface: Inheritance - Types of Relationships, What is Inheritance? Why Generalize? Implementing Inheritance in Java, Access Specifiers, The Abstract Class. Packages - Defining a Package, Understanding CLASSPATH; Interface - Defining an Interface, Some Uses of Interfaces, Interfaces versus Abstract Classes.	12
IV	Exception Handling: Definition of an Exception; Exception Classes; Common Exceptions; Exception Handling Techniques. Applets: What are Applets? The Applet Class; The Applet and HTML; Life Cycle of an Applet; The Graphics Class; Painting the Applet; User Interfaces for Applet; Adding Components to user interface; AWT Controls.	12
V	Event Handling: Components of an Event; Event Classes; Event Listener; Event-Handling; Adapter Classes; Inner Classes; Anonymous Classes. JDBC: Database Management; Mechanism for connecting to a back end database; Loading the ODBC driver.	12

DShukla
18/11/21

Chairman BOS
Computer Science & Applications

Approved by School Board Dated...22/11/21

Suggested Reading:

1. Herbert Scheldt, "The complete reference Java", Seventh Edition, Tata McGraw Hill
2. Bill Verrens, "Inside the Java Virtual Machine", Tata McGraw Hill
3. Sierra and Bates, Head First Java, O'Reilly
4. R Lafore "Object Oriented Programming": Pearson
5. Horstmann, "Core Java" Pearson Education
6. E. Balaguruswami "OOps using Java"-TMH

E-Resources:

1. <http://textofvideo.nptel.ac.in/106106147/lec1.pdf>
2. <https://nptel.ac.in/courses/106106147/>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

E-books (at IP 14.139.234.164):

1. Pandey, 'Java Programming', Noida, Pearson (available at ; <https://ebookcentral.proquest.com/lib/hsgu-ebooks/home.action>)

Learning Outcome: Students will be aware about :

- Solving real world problem Java programming
- Designing GUI based applications associated with database.

D Shukla
18/11/21

Chairman, BOS
Computer Science & Applications

[Signature]

Approved by School Board Dated...22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-2202	Database Management Systems	4	3	1	-	20	20	60	100

Course Objective:

1. To know about the database system applications, data models, database design and Entity Relationship
2. To construct relational model and relational algebra.
3. To acquire the knowledge of query evaluation and designing of database applications using normalization.

Course Contents:

Unit	Topic	Proposed Lectures
I	Introduction: An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database structure.	12
II	Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.	12
III	Relational Data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.	12
IV	Introduction to SQL: Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes Queries and sub queries, Aggregate functions, Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors in SQL. PL/SQL, Triggers and clusters.	12
V	Database Design and Normalization: Functional dependencies, normal forms, first, second third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design	12

DShukla
18/11/21

Chairman
Computer Science & Applications

Approved by School Board Dated... 22/11/21

Suggested Reading:

1. Date C.J. "An Introduction to Database System". Addison Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts" McGraw Hill
3. Database Management System: V. K. Jain, Wiley Dreamtech
4. Elmasri, Navathe, "Fundamentals of Database Systems" Addison Wesley
5. Paul Beynon Davis, "Database Systems" Palgrave Macmillan
6. Bipin C. Desai, "An introduction to Database Systems", Galgotia Pub
7. Beginning SQL: Paul Wilton, Wiley dreamtech

E-Resources:

1. https://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design/pdf/1_Introduction.pdf
2. <https://nptel.ac.in/courses/106106093/>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

E-books (at IP 14.139.234.164):

1. ITL ESL, 'Database Management Systems Noida, Pearson (available at <https://ebookcentral.proquest.com/lib/hsgu-ebooks/home.action>)'
2. Naik 'Concepts of Database Management System' Noida Pearson (available at : <https://ebookcentral.proquest.com/lib/hsgu-ebooks/home.action>)
3. Silberschatz, Abraham, 'Database System Concepts', Noida, McGrawHill, (available at : <http://mcgrawhilleducation.pdn.i publishcentral.com/bookshelf>)

Learning Outcome: After completion of this course students will be aware about:

- basics of SQL and construct queries using SQL Solve real world problem java programming
- difference between traditional file system and DBMS
- working with different data base languages
- relational database theory, and be able to write relational algebra expressions for queries.

D Shukla
18/11/21

Chairman, BOS
Computer Science & Applications

gpr

Approved by School Board Dated 22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-2203	Scientific Computing	4	3	1	-	20	20	60	100

Course Objective:

1. To know about the floating – point representation of number, the error and its occurrence in numerical computation.
2. To construct what an interpolating is and how to construct various interpolating polynomials to perform interpolation and extrapolation.
3. To be expert in iterative methods to find solution of polynomial and transcendental equations.
4. To find the solution of linear equations using matrices.

Course Contents:

Unit	Topic	Proposed Lectures
I	Number System and Errors: Representation on integers and floating point numbers, Errors in computation, loss of significance. Solutions of Equations in one variable: Bisection Method, Newton Raphson Method, Fixed Point iteration, Error Analysis, Accelerating Convergence, Polynomial Evaluation – Horner's rule, Zeros of polynomials and Muller's Method	12
II	Systems of Linear Equations: Gaussian Elimination, Triangular decomposition, Pivoting strategies, Error analysis and Operations count, Ill-conditioning and condition number of system, Evaluation of determinants.	12
III	Eigenvalue Computations, Diagonalization of system of ODE, Power Method, Gerschgorin theorem, Jacobi's Method, Given's and Householder's methods for Tridiagonalization, Method of sturm sequences for tridiagonal matrix, Lanczos Method, QR Factorization.	12
IV	Curve fitting and Approximation: Lagrange's interpolation, Polynomial wiggle problem, Spline interpolation, Least Square Method – line and other curves, Orthogonal Polynomials, Tchebyshev interpolation, Fourier approximation and Fast Fourier, Transforms (FFT) algorithm	12
V	Numerical Differentiation and Integration: Numerical Differentiation – Richardson Extrapolation method, Numerical Integration – Newton Cotes quadrature for equidistant points, Gaussian Quadrature, Integration using Tchebyshev Polynomials	12

DShwela
18/11/21

Chairman, BOS
Computer Science & Applications

Approved by School Board Dated 22/11/21

Suggested Reading:

1. Numerical Methods for Mathematics, Science and Engineering John H. Mathews.
2. Numerical Analysis (7th Edition) Richard and J. Douglas Faires
3. Numerical Analysis C. E. Froberg
4. Numerical Analysis – A practical approach Maron M.J.
5. A First Course in Numerical Analysis Ralston and Rabinowitz.

E-Resources:

1. <https://nptel.ac.in/courses/111105041/>
2. <http://textofvideo.nptel.ac.in/111104079/lec1.pdf>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

E-books (at IP 14.139.234.164):

1. Walpole; Myers, 'Probability & Statistics for Engineers & Scientists', Noida, Pearson, (available at : <https://ebookcentral.proquest.com/lib/hsgu-ebooks/home.action>)

Learning Outcome: Students will be aware:

- about the floating – point representation of number, the error and its occurrence in numerical computation.
- for various interpolating polynomials to perform interpolation and extrapolation.
- about iterative methods to find solution of polynomial and transcendental equations.
- about the solution of linear equations using matrices.

D Shukla
18/11/21

Chairman, BOS
Computer Science & Applications

Copy

g/sryl

Approved by School Board Dated 22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-2204	Theory of Computation	4	3	1	-	20	20	60	100

Course Objective:

1. To learn and understand FSA, DFA, NDFA, Turing machine, regular expression, push down automaton.
2. To learn and understand properties of languages, grammars and automata.
3. To gain knowledge of computing and mathematics in order to solve problems.

Course Contents:

Unit	Topic	Proposed Lectures
I	Introduction to Theory of Computation: Basic Computational Constructs: Finite State Systems, Non Deterministic Finite Automata (NDFA), Deterministic Finite Automata (DFA), Equivalence of DFA and NDFA, Finite Automata with E-Moves, Limitations of FSM, Minimization of Finite Automata, Moore and Mealy Machines, Equivalence of Moore and Mealy Machines.	12
II	Regular Sets, Closure Properties of Regular Sets, Pumping Lemma, Applications of Pumping Lemma. Regular Expression, Laws for Regular Expression, Equivalence of Finite Automata and Regular Expression, Introduction to Regular Grammar.	12
III	Introduction to Context Free and Context Sensitive Grammar, Ambiguity, Parse Tree Representation of Derivations, Simplification of Context Free Grammar, Normal Forms (Chomsky Normal Form (CNF) and Greibach Normal Form (GNF)).	12
IV	Definition, Deterministic Push Down Automaton (DPDA), Non-Equivalence of PDA & DPDA, Equivalence of CFG and PDA, Pumping Lemma for CFL's, Closure Properties of CFL, Non-CFL.	12
V	Turing Machine(TM): Introduction, Types of Turing Machine, Universal Turing Machine and Other Modifications, Construction of Tm for Simple Problems, Turing Machine as Enumerators, Relation Between Languages of Classes, Computational Complexity Theory. Computable Functions: Partial, Total, Constant Functions, Primitive Recursive Function, Regular Function, Recursive Functions.	12

D. Shukla
18/11/21

Chairman, BOS
Computer Science & Applications

g. Singh

Approved by School Board Dated 22/11/21

Suggested Reading:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automation Theory, Languages & Computation.
2. Mishra & Chandrasekaran-Theory of Computer Science (Automata, Languages and Computation
3. Lewis & Papadimitriou Elements of the Theory of Computation, PHI
4. John C. Martin -Introduction to Languages and Theory of Computation
5. Bernard M. Moret Pearson -Theory of Computation
6. Raymond Greenlaw & H. James Hoover (Harcourt) - Fundamentals of Theory of Computation
7. C. L. Liu-Elements of Discrete Maths-TMH

E-Resources:

1. <https://nptel.ac.in/downloads/106106049/>
2. <https://nptel.ac.in/courses/106104028/3>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

e-books (at IP 14.139.234.164):

1. Kandar, 'Automata Theory and Formal Languages', Noida, Pearson, (available at : <https://ebookcentral.proquest.com/lib/hsgu-ebooks/home.action>)

Learning Outcome: After completion of course students learn

- demonstrates models, turing machine, regular expression, push down automaton .
- model, comparison and analysis of different computational models.
- applying and proving properties of languages, grammars and automata.
- knowledge of computing and mathematics to solve problem
- the mathematical foundations, algorithmic principles and computer science theory for modeling.

D Shukla
18/11/21
Chairman, BOS
Computer Science & Applications
[Signature]

[Signature]

Approved by School Board Dated.....22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-2205	Data Communication & Computer Networks	4	3	1	-	20	20	60	100

Course Objective: ~~Students will learn~~

1. To understand the procedure of data communication and networking.
2. To learn the tools, techniques, protocols of establishing communication network.
3. To be aware of problems generating during communication and their contents controls.
4. To be aware of channel based communication.

Course Contents:

Unit	Topic	Proposed Lectures
I	Introduction to computer network: Topology; Base Band & Broad Band Topology; Guided & Unguided Media. Overview of Data & Signal Bits. Baud & Bit Rate.	12
II	Basic of data communication: Modulation (AM, PM, FM); Multiplexing (TDM, FDM, STDM). Encoding (RZ, NRZ, BIPLOAR, MANCHESTER, DIFF. MANCHESTER). Digital To Analog – ASK, PSK, FSK, QPSK. Transmission methods – Synchronous & Asynchronous, Flow Control, Error Control, Error Detection methods. Goals of Layered protocols- Introduction to OSI, TCP/IP.	12
III	Bit oriented (BSC) & Character oriented Protocol (SDLC, LAPB, LAPD, LLC) HDLC- frame format, station, states, configuration, access control.	12
IV	LAN Topology: Ethernet (IEEE 802.3), Token Bus (IEEE 802.4), Token Ring (IEEE 802.5) Introduction to WAN: DQDB (IEEE 802.6) & FDDI. Switching Technologies: Circuit, Message, and Packet. X.25, X.21.	12
V	ISDN: D channel, B-Channel, International Standards, NT1, NT2, TA, TE Devices. Introduction to leased lines, DSL, Digital Carriers. Bridging & Routing: Static & Dynamic. IP, IP addressing, ARP.RARP. Congestion Control, TCP, UDP. HTTP,FTP,Telnet,SMTP.	12

DShindia
18/11/21

Chairman, BOS
Computer Science & Applications

gshingh

Approved by School Board Dated.....22/11/21

Suggested Reading:

1. B. Forouzan, "Data Communication and Networking", Tata McGraw Hill.
2. Stalling W, "Data & Computer Communications", PHI.
3. Tananbaum A.S., "Computer Networks", PHI, 1999.
4. Kurose, "Computer Networking 6 Edition, A Top down approach", Pearson.
5. Dye, "Network Fundamental" CCNA Exploration", Pearson.
6. Cisco, "CCNA Exploration, Wan Accessing the Wan", Pearson

E-Resources:

1. <https://nptel.ac.in/downloads/106105080/>
2. <https://nptel.ac.in/courses/106105082/1>
3. <https://epgp.inflibnet.ac.in/ahl.php?csrno=7>

E-books (at IP 14.139.234.164):

1. Forouzan, 'Computer Networks' , Noida, McGraw Hill, (available at :
<http://mcgrawhilleducation.pdn.in/publishcentral.com/bookshelf>)

Learning Outcome: After completion of course:

- Understand the modulation used in data communication system
- Know the classification of computer network.
- Aware about new technologies and protocols used for data communication

DShurta
18/11/21

Chairman, BOS
Computer Science & Applications

22/11/21

Approved by School Board Dated 22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-2206	Java Programming Lab	2	-	-	4	20	20	60	100

Objectives: To train the students to implement concepts of Object Oriented Programming Language.

List of practicals will be decided by the course coordinator.

Learning Outcomes: After completing this course student will be capable enough to relate and implement the real situation with various concepts of OOPs.

D Shukla
18/11/21

Chairman, BOS
Computer Science & Applications

Guy

Sh. 71

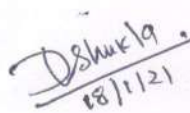
Approved by School Board Dated... 22/11/21

Course Code	Course Title	Credit				Sessional		ESE	Total
			L	T	P	ME	IA		
CSA-CC-2207	DBMS Lab	2	-	-	4	20	20	60	100

Objectives: To provide the hands on training to students for creation and manipulation of database.

List of practicals will be decided by the course coordinator.

Learning Outcomes: After completing this course student will be capable enough to access, manipulate and manage the database.


 18/1/21
 Chairman, BOS
 Computer Science & Applications



Approved by School Board Dated...22/1/21