GOVERNMENT E. RAGHAVENDRA RAO P.G. SCIENCE COLLEGE, BILASPUR (C.G.)

Affiliated to Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur (C.G)

Grade - 'B+' Accredited by NAAC

SESSION 2023-2024

Learning Outcome Based Scheme and Syllabus

of

M.Sc. Computer Science

POST GRADUATE PROGRAM IN COMPUTER SCIENCE

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. I Semester**	Year: 2023	Session: **2023-24**
1.	Course Code	**MSCCS101**		
2.	Course Title	**Compiler Design**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Specify and analyze the lexical, syntactic and semantic structures of advanced language features. • Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation. • Write a scanner, parser, and semantic analyzer without the aid of automatic generators. • Describe techniques for intermediate code and machine code optimization. • Design the structures and support required for compiling advanced language features.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Introduction**: Introduction of alphabets, Strings and Languages; Automata, Finite automata (FA), Deterministic Finite Automata (DFA) -Formal definition, simplified notations (state transition diagram, transition table), Non-deterministic Finite Automata (NFA -Formal Definition, Acceptability of a String by a DFA & NFA,), Minimizing number of states of a DFA, Finite Automata with output (Moore and Mealy Machine). Regular expressions (RE)- Definition, FA and RE, NFA to DFA conversion, Construction of Finite Automata Equivalent to a Regular Expression and vice versa.	12
II.	**Formal Languages:** Definition of a Grammar, Derivations and the Language Generated by a Grammar, Chomsky Classification of Languages, Languages and Their Relation Context-free Grammars (CFGs)-Formal definition, sentential forms, leftmost and rightmost derivations, Derivation tree, Ambiguity in grammars and Languages, Ambiguity in CFG, Left Recursive and Right Recursive Grammer. CNF and GNF.	12
III.	**Compiler Construction**: Introduction to Compiler, Analysis of the source program, phases of compiler, cousins of compiler, grouping of phases, compiler construction tools. Lexical Analysis: Role of Lexical Analyzer, Specification of tokens, Recognition of tokens, Regular expression, LEX.	12
IV.	**Syntax Analysis and Parsing Techniques**: Bottom-up parsing and top-down parsing.	12

	Top-down Parsing: elimination of left recursion, recursive descent parsing, Predictive Parsing, Bottom-Up Parsing: Operator precedence parsing, LR parsers, Construction of SLR, canonical LR and LALR parsing tables, Construction of SLR parse tables for Ambiguous grammar	
V.	**Intermediate Code Generation:** Postfix notation, Three address codes, quadruples, triples and indirect triples. **Code Optimization & Code Generation**: Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Global data flow analysis, Loop invariant computations.	12

Keywords: DFA, NFA, Context Free Grammer, Regular Language, Top-Down Parser, Bottom-up parser.

Part C - Learning Resources

Text Books, Reference Books and E-Resources

TEXT/ REFERENCE BOOKS:

- Compilers-Principles, Techniques and Tools, Alfred V. Aho, Ravi Sethi and Ullman J.D., Addison Wesley, 2nd Ed.
- Principle of Compiler Design, Alfred V. Aho, and J.D. Ullman, Narosa Publication.
- Compiler design in C, A.C. Holub, PHI.
- Compiler construction (Theory and Practice), A.Barret William and R.M. Bates, Galgotia Publication.
- Compiler Design, Kakde.
- Compiler Construction – Principles and Practice, Kenneth C. Louden Cengage Learning Indian Edition, 2006.
- Tremblay and Sorenson, The Theory and Practice of Compiler Writing, Tata McGraw Hill & Company, 1984.

E-RESOURCES:

- https://www.geeksforgeeks.org/compiler-design-tutorials/
- https://www.javatpoint.com/compiler-tutorial
- https://www.javatpoint.com/compiler-tutorial
- https://tutorialspoint.dev/computer-science/compiler-design
- https://www.tutorialspoint.com/compiler_design/index.htm
- https://mrcet.com/pdf/Lab%20Manuals/CSE/COMPILER%20DESIGN%20LAB.pdf
- https://www.iare.ac.in/sites/default/files/lab2/CD%20Lab%20Manual.pdf
- https://kgr.ac.in/storage/2021/08/CD-Lab-Manual.pdf
- https://gcekbpatna.ac.in/assets/documents/lecturenotes/compiler_design_Lab_manual.pdf
- http://vvitengineering.com/lab/CS6612-COMPILER-LABORATORY.pdf
- http://www.nrcmec.org/pdf/Manuals/CSE/student/3-1%20cd%2016-17.pdf

Part D: Assessment and Evaluation

Maximum Marks: 100
End Semester Examination (ESE): 80 Marks
Internal Assessment (IA): 20 Marks

Internal Assessment: **(i) Unit test (10 Marks):** There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. I Semester**	Year: **2023**	Session: **2023-24**
1.	Course Code	**MSCCS102**		
2.	Course Title	**Computer Organization**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government norms / Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Understand configuration and organization of computer system. • Understand and Solving Number system. • Identify among various GATES and their function. • Understand different combinational and sequential circuit • Will help to understand basics of memory management.		
6.	**Credit Value**	**04**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Number System**: Binary, Octal and Hexadecimal number system, Conversion from one number system to another, Binary arithmetic, representing negative numbers, BCD codes, ASCII codes, EBCDIC codes, Excess three code, Gray code, Floating point representation, 1's complement and 2's compliment, Arithmetic representation of signed binary numbers, 9's complement and 10"s compliment system.	12
II.	**Logic Gates and Boolean Algebra**: Properties and Symbolic Representation Of NOT, AND, OR, NOR, NAND, EX-OR, EX – NOR GATES, NOR and NAND GATES as a universal gate, Laws and identities of Boolean algebra, Demorgan's theorem, Use of Boolean algebra for simplification of logic expression, SOP and POS forms, Canonical forms, Maxterm, Minterm, Karnaugh map for 2,3,4 variable.	12
III.	**Combinational and Sequential Circuits:** Multiplexer, De multiplexers, Decoders, Encoders, Half adder, Full adder, Half subtractor, Full subtractor, n-bit adder, Adder-subtractor, Flip flops, Registers, Counters.	12
IV.	**CPU Organization and Parallel Processing:** General register organization of C.P.U, Stack organization, Instruction format, Addressing modes, Parallel processing, Pipelining, Arithmetic pipelining, Instruction pipeline, RISC pipeline, Vector processing, Array processor.	12
V.	**Memory Organization:** Memory hierarchy, Types of memory, Associative memory, Virtual memory, Main memory, semiconductor memory, Flash memory, cache memory and cache mapping, magnetic memory: hard disk, optical memory. Introduction to I /O organization and DMA.	12

Keywords: Boolean Algebra, Combinational and Sequential Circuits, Parallel Processing, Pipelining

Part C - Learning Resources	
Text Books, Reference Books and E-Resources	
TEXT/ REFERENCE BOOKS: ➢ Computer Fundamentals Architecture and Organization, B.Ram, New Age Techno Press. ➢ Digital Design, Morris Mano, PHI, 3rd Edition, 2006. ➢ M. Morris Mano, Digital Design, 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003. ➢ Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 5d., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003. ➢ R.P.jain, Modern Digital Electronics, 3ed., Tata McGraw-Hill publishing company limited , New Delhi,2003. ➢ Carl Hamacher, Zvonko Vranesic and Safwat Zaky, 5th Edition "Computer Organization", McGraw-Hill,2002. ➢ William Stallings, "Computer Organization and Architecture – Designing for Performance", 6th Edition,Pearson Education, 2003. ➢ David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002 **REFERENCE BOOKS:** ➢ An Engineering Approach To Digital Design – Fletcher, PHI. ➢ Digital Logic – Application and Design – John M. Yarbrough, Thomson ➢ Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 5th Edition, 2004. ➢ Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006. ➢ Malvino A.P, Digital Principles and Applications, Tata McGraw Hill. ➢ Computer Fundamentals: Architecture and Organization	
Part D: Assessment and Evaluation	
Maximum Marks: 100 End Semester Examination (ESE): 80 Marks Internal Assessment (IA): 20 Marks	
Internal Assessment: **(i) Unit test (10 Marks):** There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. I Semester**	Year: **2023**	Session: **2023-24**
1.	Course Code	**MSCCS103**		
2.	Course Title	**Advanced Operating System**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government norms / Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • To understand design issues related to process management and various related algorithms. • To understand design issues related to memory management. • To understand design issues related to File management. • To understand design issues related to process management. • To understand function of Distributed Operating system. • To understand importance of I/O handling management		
6.	Credit Value	**4**		
7.	**Total Marks**	**Max. Marks: 100**	**Min. Marks: 36**	

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Introduction:** Definition, Basic functions of Operating System, Types of Operating Systems, Multiprocessing, Concepts of processes, Process state, Process Control Block, Process Scheduling Criteria, Scheduling Algorithms, schedulers. Inter process synchronization and communication: need, Mutual exclusion, semaphore, classical problems in concurrent programming, critical region and conditional critical region	12
II.	**Deadlock:** Necessary Conditions, Deadlock Characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	12
III.	**Memory Management:** Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Virtual Memory, Demand Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing.	12
IV.	**File Concept:** Access Methods, Directory Structure, File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-space Management, and Recovery Disk scheduling algorithms.	12
V.	**Distributed Operating System:** Goal, disadvantages, hardware concepts: Bus-Based Multiprocessor, Switched Multiprocessor, Bus-Based Multicomputer, Switched Multicomputer; Software concepts: Network System, True Distributed System, Multiprocessor Timesharing System, Design Issues.	12

Keywords: Scheduling, Deadlock, Paging, Segmentation, Allocation Methods, Distributed Operating System

Part C - Learning Resources	
Text Books, Reference Books and E-Resources	
TEXT/REFERENCE BOOKS: ➢ Operating Systems- Concepts and design, M. Milenkovic, Tata McGraw Hill 1992. ➢ Modern Operating Systems, Andrew S Tanenbaum. ➢ Operating Systems, Mardrick and Donovan, Mcgraw Hill ➢ Principles of Operating Systems, Ullman, Galgotia Publications. ➢ Distributed Operating Systems , Andrew S. Tanenbaum, Pearson Education, 1995. ➢ Operating System Principles Abraham Silberschatz, Peter Baer Galvin, Greg Gagne,John Wiley & Sons Inc., 2006. ➢ Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjan Shivaratri, TMH,2001 ➢ Operating Systems – Operating System: Internals and Design Principles William Stallings, Prentice Hall, 2005.	
Part D: Assessment and Evaluation	
Maximum Marks: 100 End Semester Examination (ESE): 80 Marks Internal Assessment (IA): 20 Marks	
Internal Assessment: **(i) Unit test (10 Marks):** There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. I Semester**	Year: **2023**	Session: **2023-24**
1.	Course Code	**MSCCS104**		
2.	Course Title	**Data Structure and Algorithm**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government norms / Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • To understand data structure. • To implement algorithms in programming language. Identify • Discover different conversion using Stack • Determine the need different data structure • Interpret the concepts of Graph, searching and sorting algorithms		
6.	**Credit Value**	**04**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course		
Total Hours/Lectures: 60		
Unit	**Topics**	**No. of Lectures**
I.	**Introduction of Data structure:** Data types: primitive, non-primitive data types, ADT, Linear and nonlinear data structure. **List Structures:** Arrays: One dimensional, Multidimensional array, allocation methods, address calculations, sparse arrays. Linked List: Singly and Doubly Linear link lists, singly and doubly circular linked list: Definitions, operations (INSERT, DELETE, TRAVERSE) on these lists. (Insertion operation includes – insertion before a given element, insertion after a given element, insertion at given position, insertion in sorted linked list).	12
II.	**STACKS:** Definition of stack, Operations PUSH, POP, TRAVERSE, implementations using array and linked list, Applications of stack: Infix, Prefix, Postfix representation and conversion using stack, Postfix expression evaluation using stack. **QUEUES:** Introduction, and Types of Queues: Priority Queue, Circular queue, Double Ended Queue, operations (INSERT, DELETE, TRAVERSE), implementation using array and linked list and applications.	12
III.	**Trees:** Binary trees; Types of binary tree, Representation of binary tree in memory; traversing binary tree; Binary search trees; Searching and inserting in binary search trees; Deleting in a binary search tree; AVL search trees and operation on it . B trees: searching, insertion, deletion; Heap.	12
IV.	**SORTING:** Types of sorting, Sequential Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Heap Sort, Radix sort. **SEARCHING**: Linear search, Binary search, Hashing, collision resolution methods.	12

V.	**Definition of Graph** and their types, adjacency and incident (matrix & linked list) representation of graphs, Graph Traversal – Breadth first Traversal, Depth first Traversal, Connectivity of graphs; Connected components of graphs, Weighted Graphs, Shortest path Algorithm, spanning tree, Minimum Spanning tree, Kruskal and prims algorithms	12

Keywords: List, Queue, Search Trees, Sorting

Part C - Learning Resources

Text Books, Reference Books and E-Resources

TEXT/ REFERENCE BOOKS:

- Data Structure By Lipshutz, McGraw Hill.
- Data Structure By Standish, Addison-Wesley.
- Data structures Through C by G. S. Baluja.
- Data structures using C", Tenenbum, PHI, 1996
- Fundamentals of Data Structures, Horowitz and Sahani, Computer Science Press, 1978
- Data structures and Algorithm, Aefred V. Aho, Jhon E. Joperoft and J.E. Ullman.
- An Introduction to Data Structures with Applications, Jean Paul Trembley and Paul Sorenson, TMH,
- International Student Edition, 1985
- Data Structures and Program Design in C, R. Kurse, Leung & Tondo, 2nd Edition, PHI publication

E-RESOURCES:

1. https://onlinecourses.swayam2.ac.in/cec19_cs06/preview
2. https://nptel.ac.in/courses

Part D: Assessment and Evaluation

Maximum Marks: 100
End Semester Examination (ESE): 80 Marks
Internal Assessment (IA): 20 Marks

Internal Assessment:	
(i) Unit test (10 Marks): There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. II Semester**	Year: 2023	Session: **2023-24**
1.	Course Code	**MSCCS201**		
2.	Course Title	**Relational Database Management System**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Basic knowledge of database management system		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Learn and practice data modelling using the Entity-Relationship and developing database designs. • Apply normalization techniques to normalize the database. • Design database and normalize data and understand how queries are being processes and executed. • Identify advance database concepts and database models.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Basic Concepts:** Definition of database, File system Vs Database system, Database System Applications, Advantages and Disadvantages of DBMS, View of data, Schemas and Instances, Data Abstraction, Data Independence, Database Architecture, DBA and Database Users and Administrators Database architecture.	12
II.	**Introduction to Data Models:** Relational model, E-R model, Object Based Data model, semi structured data model, network data model, hierarchical data model. Relational model: Structure of relational databases, concept of Keys, Relational operations (Selection, Projection, Join, Cartesian Product, Union) File Organization ()	12
III.	**Database File Organization:** Introduction, Secondary storage devices, Serial Files, Sequential files, Index-Sequential, Direct Files Buffering of blocks, Operation on files, Heap file, Sorted File, Hashing Techniques, RAID, B Tree, B+ Tree.	12
IV.	**Database design and E-R model:** Design phases, Entity Relationship model, Entity sets, Relationship sets, Attribute, Attribute types, Constraints (Mapping Cardinalities-One to one, One to many, Many to one, Many to many), Participation Constraints (total, partial), Concept of functional dependencies and Normal forms (1NF, 2NF, 3NF and BCNF), E-R diagram, Strong and weak entity sets, Specialization, Generalization, Aggregation.	12
V.	**Transaction-** Introduction, Desirable properties of transaction, Recoverability, Serializability, Locking, Two Phase locking, Timestamp Ordering. **Recovery-** Concept, Recovery based on deferred update and immediate update, Shadow paging, ARIES recovery algorithm.	12

Keywords: Triggers, Assertion, B+ Tree, Shadow Paging, Serializability, Locking.

Part C - Learning Resources
Text Books, Reference Books and E-Resources

TEXT/REFERENCE BOOKS:

- R. Elmasri & S. Navathe, "Database Systems :Model, Language, Design and Application Programming", Pearson, 6th edition 2014,
- Henry F. Korth & Abraham Silberschats , "Data Base Management System", TMH, 1991.
- Date C.J., "An Introduction to Database Management System", Vol I &II, Addison Wesley, 1981, 1983
- S. Ceri and G. Pelaggati , "Distributed Database Principles and System" , TMH, 1984

E-RESOURCES:

- https://www.exploredatabase.com/p/blog-page.html
- https://www.tutorialandexample.com/what-is-advanced-database-management-system
- https://aries.ektf.hu/~hz/pdf-tamop/pdf-xx/Radvanyi-hdbms-eng2.pdf

Part D: Assessment and Evaluation	
Maximum Marks: 100 End Semester Examination(ESE): 80 Marks Internal Assessment(IA): 20 Marks	
Internal Assessment: **(i) Unit test (10 Marks):** There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. II Semester**	Year: **2023**	Session: **2023-24**
1.	Course Code	**MSCCS202**		
2.	Course Title	**Software Engineering**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government norms / Institutional scheme		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Select and implement different software development process models. • Extract and analyze software requirements specifications for different projects. • Apply standard coding practices. • Apply different testing and debugging techniques and analyzing their effectiveness. • Define the concepts of software quality and reliability on the basis of international quality standards.		
6.	Credit Value	**04**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Introduction to Software Engineering:** Define Software, Characteristics of S/W Definition, Evolution, Principles, Exploratory style of software development, Need of software engineering, Emergence of software engineering, Computer systems engineering.	12
II.	**Software Life Cycle Models:** Definition, Classical Waterfall model, Iterative Waterfall model, V-model, Prototyping model, Incremental development model, Evolutionary model, Rapid Application Development (RAD), Agile model, Extreme programming model, Spiral model.	12
III.	**Software Project Management (SPM):** SPM complexities, responsibilities of a software project manager, project planning, metrics for project size estimation, project estimation techniques, COCOMO model, Scheduling: Work breakdown structure, Activity networks, Critical Path Method (CPM), PERT, risk management, software configuration management.	12
IV.	**Requirements Analysis and Specification:** Requirements gathering, requirements analysis, Role of system analyst, System investigation: - Fact Finding Techniques, Software Requirements Specification (SRS): Users of SRS Document, Need of SRS, Characteristics of SRS Document, functional requirements, non-functional requirements, goals of implementation; **Software Design:** Characteristics, Outcome of the Design process, Cohesion and Coupling, Approaches to software design, Data Flow Diagram (DFD), Data dictionary.	12
V.	**Software Testing**: Verification and Validation; Error, Fault, Bug and Failure; Unit, Integration, System and Acceptance Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing. **Software Configuration Management**: Change Control and Version Control, Software Reuse, Software Re-engineering, Reverse Engineering.	12

Keywords: Rapid Application Development, PERT, SRs, Testing, Reuse

Part C - Learning Resources	
Text Books, Reference Books and E-Resources	

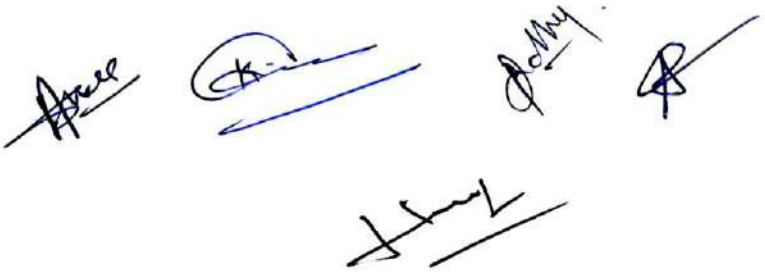
TEXT/ REFERENCE BOOKS:

- Fundamentals of Software Engineering, Rajib Mall, PHI
- Software Engineering, A Practitioner's Approach, Roger Pressman", 4th Edition, TMH.
- Software Engineering, P.S.Pressman, TMH
- An Integrated Approach of Software Engineering, Pankaj Jalote, Galgotia
- Software Engineering, M.Shooman, TMH
- Edward," System Analysis & Design ", Tata McGraw Hill, ISBN:8120317270
- James, A.S, **Analysis and Design Of Information Systems**, Mc Graw hill, New York, 1997
- **A" Level made simple Structured System Analysis and Design**, BPB publications: Dr.Madhulika Jain, Vineeta Pillai, Shashi Singh, Satish Jain.
- **Effective Methods for Software Testing**, William E. Perry
- Venkata Rao,v., **System Analysis, design & MIS**,BPB publications, 2000
- Awad, Elias., **Analysis And Design**, Galgotia publications pvt.Ltd.1998

E-RESOURCES:

- https://onlinecourses.swayam2.ac.in/cec19_cs06/preview
- https://nptel.ac.in/courses

Part D: Assessment and Evaluation	
Maximum Marks: 100 End Semester Examination (ESE): 80 Marks Internal Assessment (IA): 20 Marks	
Internal Assessment: **(i) Unit test (10 Marks):** There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**



Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. II Semester**	Year: 2023	Session: **2022-23**
1.	Course Code	**MSCCS203**		
2.	Course Title	**Data Communication and Computer Network**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Understand the basic computer network technology • Understand and explain the data communication system and its components • Identify the different types of network topologies and protocols • Understand the layers of the OSI model and TCP/IP • Expose wireless and wired LANs.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Overview of Data Communication and Networking:** Data Communications: components, data representation, direction of data flow (simplex, half duplex, full duplex); **Networks:** distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN), Protocols and standards; **Reference Models:** OSI & TCP/IP reference model comparative study. **Addressing:** Physical, Logical, Port addressing & Specific Addressing.	12
II.	**Physical Layer:** Analog & Digital signals, period and frequency, Transmission Impairments, Bandwidth Utilization, **Multiplexing:** FDM, WDM and TDM, **Switching:** Circuits switching, packet switching, massage switching; **Transmission Media:** Guided Media: Twisted Pair, Coaxial and Fiber Optic, Unguided Media: Wireless, Radio Waves, Microwaves and Infrared.	12
III.	**Flow Control:** Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC; MEDIUM ACCESS SUB LAYER: Point to point protocol, LCP, NCP, FDDI, token bus, token ring; Reservation, polling, concentration; **Multiple Access Protocols:** Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA; Traditional Ethernet, fast Ethernet.	12
IV.	**Internetworking & Devices:** Repeaters, Hubs, Bridges, Switches, Router, Gateway; **Addressing:** Internet address (IPv4 & IPv6), classful address, subnetting, classless address; **Routing:** techniques, static vs. dynamic routing. **Routing Algorithms:** shortest path algorithm, distance vector routing, link state routing **Protocols:** ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols.	12

V.	**Transport Layer and Application Layer:** UDP, TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve. DNS. SMTP, SNMP, FTP, HTTP, Firewalls.	12

Keywords: Network, OSI,

Part C - Learning Resources

Text Books, Reference Books and E-Resources

TEXT/ REFERENCE BOOKS:

- Data communication and Networking: B.A Frouzan, TMH, (Latest Edition)
- Computer Networks, A.S. Tanenbam, 4th Edition, Pearson Education /PHI
- Data and Computer Communication, W.Staling, 5th Edition, PHI/ Pearson Education.
- Computer Networking – A top-down approach featuring the internet, Kurose and Rose, Pearson Education
- Communication Networks, Walrand, TMH (latest Edition).
- Internetworking with TCP/IP, vol. 1,2,3 Douglas E. Croner, 4th Edition Pearson Education (PHI).

E-RESOURCES:

- https://faculty.ksu.edu.sa/sites/default/files/computer_networks_-_a_tanenbaum_-_5th_edition.pdf
- https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf

Part D: Assessment and Evaluation

Maximum Marks: 100
End Semester Examination (ESE): 80 Marks
Internal Assessment (IA): 20 Marks

Internal Assessment: **(xiii) Unit test (10 Marks):** There will be two tests for 10 marks. **(xiv) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. II Semester**	Year: **2023**	Session: **2023-24**
1.	Course Code	**MSCCS204**		
2.	Course Title	**Programming in Python**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Basic knowledge of programming concepts		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Define the structure and components of a Python program. • Demonstrate proficiency in handling of loops and creation of functions. Identify the methods to create and manipulate lists, tuples and dictionaries. • Discover the commonly used operations involving regular expressions and file system. • Determine the need for scraping websites and working with CSV, JSON and other file formats. • Interpret the concepts of Object-Oriented Programming as used in Python.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Introduction to Python:** installing Python; basic syntax, interactive shell, editing, saving, and running a script, The concept of data types; variables, assignments; immutable variables; numerical types, operators (Arithmetic operator, Relational Operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator) and expressions; comments in the program; understanding error messages.	12
II.	**Creating Python Programs:** Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass). **Function:** Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables.	12
III.	**Strings and text files**: manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). **String manipulations:** subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers.	12

IV.	**Lists, tuples, and dictionaries;** basic list operators, replacing, inserting, removing an element; searching and sorting lists; Accessing tuples, Operations, Working, Functions and Methods, dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.	12
V.	**Python Libraries:** Exploring python libraries like Panda, Numpy, TensorFlow, Scikit-Learn, Keras, PyTorch, SciPy etc., Modules: Importing module, Math module, Random module, Packages, Composition.	12

Keywords: List, Tuple, Dictionary, Panda, Numpy, TensorFlow, Scikit-Learn, Keras, PyTorch, SciPy.

Part C - Learning Resources

Text Books, Reference Books and E-Resources

TEXT/ REFERENCE BOOKS:

- T. Budd, Exploring Python, TMH, 1st Ed, 2011.
- Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: Learning with Python, 2012.
- Mark Lutz, Learning Python.
- Tony Gaddis, Starting Out With Python.
- Kenneth A. Lambert, Fundamentals of Python.
- James Payne, Beginning Python using Python 2.6 and Python 3.

E-RESOURCES:

- https://copyassignment.com/python/
- SWAYAM/NPTEL: https://www.youtube.com/channel/UCxu1cR5XRauYn37yg-Fh6rA
- SWAYAM/NPTEL: https://www.youtube.com/channel/UCJAgw1niUkaShdmA5aAZdQw
- Introduction to Python Programming from Coursera: https://www.coursera.org/learn/python-programming-intro
- Crash Course on Python from Coursera: https://www.coursera.org/learn/python-crash-course
- Python for everybody: https://www.coursera.org/specializations/python
- https://www.youtube.com/watch?v=XGJpThSjEPw&list=PLkkt2qQlhbKYX2Osxb-vy5qB7N-SU7IRS
- Introduction: https://www.w3schools.com/python/default.asp
- File Handling: https://www.w3schools.com/python/python_file_handling.asp
- NumPy: https://www.w3schools.com/python/numpy/default.asp
- Pandas: https://www.w3schools.com/python/pandas/default.asp
- SciPy: https://www.w3schools.com/python/scipy/index.php
- Django: https://www.w3schools.com/django/index.php
- Matplotlib: https://www.w3schools.com/python/matplotlib_intro.asp
- Machine Learning: https://www.w3schools.com/python/python_ml_getting_started.asp
- Python MySQL: https://www.w3schools.com/python/python_mysql_getstarted.asp
- Introduction to Scripting in Python Specialization: https://www.coursera.org/specializations/introduction-scripting-in-python
- Topics related to Python from Tutorials: https://www.javatpoint.com/python-tutorial http://docs.python.org/3/tutorial/index.html

http://interactivepython.org/courselib/static/pythonds http://www.ibiblio.org/g2swap/byteofpython/read/	
Part D: Assessment and Evaluation	
Maximum Marks: 100 End Semester Examination(ESE): 80 Marks Internal Assessment(IA): 20 Marks	
Internal Assessment: **(i) Unit test (10 Marks):** There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. III Semester**	Year: 2023	Session: **2023-24**
1.	Course Code	**MSCCS301**		
2.	Course Title	**Artificial Intelligence & Machine Learning**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Understand a wide variety of learning algorithms. • Understand how to evaluate models generated from data. • Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models. • Apply ML algorithms in various domains. • Simulate real world problems using ML techniques. • Apply deep learning techniques for computer vision.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Introduction:** Overview of Artificial Intelligence (AI), Foundations of A.I., History of AI, Areas and state of the art in A.I. Knowledge: Introduction, Knowledge Based system, Knowledge representation techniques.	12
II.	**Searching Techniques:** Problem solving as state space search, production system, control strategies and problem characteristics, Search techniques: Breadth First search, Depth-first search, Hill-climbing, Heuristics search, Best-First search, greedy method, A* algorithm.	12
III.	**Machine Learning:** What is Machine learning, Types of machine learning, introduction to Bayesian network, decision tree, supervised learning (linear regression, artificial neural network, Back propagation network, support vector machine), unsupervised learning (clustering, K-means clustering, hierarchical clustering, self-organization map), reinforcement learning.	12
IV.	**Measuring performance of ML models:** Measuring classification accuracy, models, data preprocessing, feature selection and generation, dimensionality reduction: Principal component analysis (PCA), training, testing and validation data sets, ensemble methods: Bagging and boosting.	12

V.	**Application of ML and Deep Learning:** Applying ML to solve real world problems in various domains like financial forecasting, classification problems, clustering, Natural language processing (NLP), health care, image classification etc. Introduction to deep learning, Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), solving computer vision and other problems through deep learning techniques.	12

Keywords: Searching Technique, Supervised Learning, Unsupervised Learning, Classification Technique, Natural Language Processing (NLP), Artificial Intelligence (AI), Machine Learning (ML), Deep Learning.

Part C - Learning Resources

Text Books, Reference Books and E-Resources

TEXT/ REFERENCE BOOKS:

- Artificial Intelligence and machine learning, Vinod Chandra S.S., Anand Hareendrn S., PHI learning private Ltd.
- Introduction to Artificial Intelligence and Expert Systems, Dan W. Patterson, PHI Publication.
- Artificial Intelligence, Elaine Rich and Kevin Knight TMH publication.
- Machine learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley publication, India , 2019 edition.
- Introduction to Machine Learning with python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O'Reilly.
- Understanding machine learning: From theory to algorithms, shai shalev-shwartez, shai ben-david, Cambridge University press.
- Machine learning with python, Abhishek Vijayvargia, BPB publication.
- Machine learning using python, U Dinesh Kumar, Manaranjan Pradhan, Wiley publication.
- Deep learning, Ian Goodfellow , Yoshua Bengio, Aoran Courville, Adaptive computation and machine learning series.
- Machine learning, Tom M. Mitchell, McGraw Hill, Indian Edition.

E-RESOURCES:

- https://www.youtube.com/watch?v=whSKA8aO6xQ&list=PLyqSpQzTE6M-SISTunGRBRiZk7opYBf_K&index=3
- http://www.hpc.iitkgp.ac.in/pdfs/AI_HPC.pdf
- https://nthu-datalab.github.io/ml/
- https://www.tensorflow.org/resources/learn-ml?gclid=CjwKCAjw_ISWBhBkEiwAdqxb9hljIi5hnqF0Cq2Fgy_JEWiD_uZbxtetr_BFUF_QztAELk8d2q3P_BoCodMQAvD_BwE

Part D: Assessment and Evaluation

Maximum Marks: 100
End Semester Examination (ESE): 80 Marks
Internal Assessment (IA): 20 Marks

Internal Assessment:	
(i) Unit test (10 Marks): There will be two tests of 10 marks. **(ii) Presentation/Assignment (10 Marks)**	**Total:** 20 Marks

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. III Semester**	Year: 2023	Session: **2023-24**
1.	Course Code	**MSCCS302**		
2.	Course Title	**Cryptography and Network Security**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Classify the symmetric encryption techniques. • Illustrate various public key cryptographic techniques. • Evaluate the authentication and hash algorithms. • Summarize the intrusion detection and its solutions to overcome the attacks. • Basic concepts of system level security.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Classical Encryption Technique:** Basics of computer network, TCP/IP model, Foundations of Cryptography and security trends, Secret key vs public key cryptography, Symmetric cipher model, substitution techniques, Transportation techniques, Mathematical tools for cryptography: modular arithmetic, Euclidean algorithm, finite fields, polynomial arithmetic.	12
II.	**Symmetric cipher:** Symmetric cipher model, Traditional block cipher: Stream and block cipher, Feistel cipher network structure, Design Principles of Block Ciphers, Data Encryption Standard (DES), Strength of DES Triple DES, Block cipher design principal, Block cipher operation, Advance encryption Standard (AES), Evaluation criteria of AES, AES transformation function, key distribution.	12
III.	**Public Key cryptography and Hash Function:** Principles of public key cryptosystem, requirement, RSA algorithm. Hash function, Key management: Diffie-Helman Key exchange, Man in the middle attack, elliptic curve arithmetic, elliptic curve cryptography, Application of cryptographic hash function, Hash and Message authentication Code (MAC), Hash and MAC algorithms, MAC based on hash function, Digital signature and Authentication protocol. Key management and distribution: Distribution of symmetric key and public key, public key Infrastructure (PKI).	12
IV.	**IP and Web security protocols:** User authentication: principle, Remote user authentication using symmetric and asymmetric encryption, Kerberos, E-mail security: Pretty Good Privacy (PGP), S/MIME, IP security: IPsec, transport layer Security: Secure Socket layer (SSL), Secure Electronic Transaction (SET).	12

V.	**Network Security and Management:** Principles of cryptography, Authentication, integrity, key distribution and certification, Access control and Firewalls, attacks and counter measures, security in many layers. Infrastructure for network management, The internet standard management framework, SMI, MIB, SNMP, Security and administration.	12

Keywords: Symmetric Cipher, Hash, Message Authentication Code (MAC), Public key, Private key, Secure Socket Layer (SSL), Secure Electronic Transaction (SET).

Part C - Learning Resources

Text Books, Reference Books and E-Resources

TEXT/REFERENCE BOOKS:

- Cryptography and Network Security, William Stallings, 4th Edition Pearson Publication.
- Network security and cryptography, Bernard Menezes, Cenage Learning India Pvt. Ltd. First edition 2010.
- Applied cryptography - protocols and algorithm, Buce Schneier, Springer Verlag 2003.
- Cryptography and Network Security, Atul Kahate , TMH Publication.
- Cryptography and Network Security, Behrouz A. Forouzan, First Edition, TMH Publication.
- Network Security: Private Communication in Public World By Charlie Kaufman ,Radia Perlman and Mike Speciner, PHI Publication.

E-RESOURCES:

- Swayam/NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs21/preview
- Swayam/NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs02/preview
- Coursera: https://www.coursera.org/search?query=Cryptography
- Coursera: https://www.coursera.org/search?query=network%20sequrity&
- https://www.gatevidyalay.com/tag/cryptography-and-network-security-tutorial/
- https://www.javatpoint.com/computer-network-security
- https://www.geeksforgeeks.org/cryptography-introduction/
- https://www.tutorialspoint.com/cryptography/index.htm
- https://www.vssut.ac.in/lecture_notes/lecture1428550736.pdf
- http://www.anuraghyd.ac.in/cse/wp-content/uploads/sites/10/NS-CRYPTO-LAB-Final11.pdf
- https://www.vvitengineering.com/lab/odd/CS6711-Security-Lab-Manual.pdf
- https://www.vidyarthiplus.com/vp/attachment.php?aid=53300
- https://kgr.ac.in/storage/2021/08/CNS-LAB-Manual.pdf

Part D: Assessment and Evaluation

Maximum Marks: 100
End Semester Examination(ESE): 75 Marks
Internal Assessment(IA): 25 Marks

Internal Assessment: **(i) Unit test (10 Marks):** There will be two tests for 10 marks. **(ii) Presentation/Seminar (10 Marks)**	**Total: 20 Marks**

➢ http://www.gpcet.ac.in/wp-content/uploads/2018/08/GCC-LAB-MANUAL.pdf ➢ https://shanpnk.weebly.com/uploads/5/8/9/4/58948709/gcclab-courseware-labmanual.pdf ➢ https://www.bharathuniv.ac.in/downloads/csc/BCS7L1%20-Grid%20&%20Cloud%20Computing%20lab.pdf

Part D: Assessment and Evaluation	
Maximum Marks: 100 End Semester Examination (ESE): 80 Marks Internal Assessment (IA): 20 Marks	
Internal Assessment: **(i) Unit test (10 Marks):** There will be three tests of 10 marks. **(ii) Presentation/Assignment (10 Marks)**	**Total:** 20 Marks

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. III Semester**	Year: 2023	Session: **2023--24**
1.	Course Code	**MSCCS303**		
2.	Course Title	**Cloud Computing**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Identify the appropriate cloud services for a given application. • Assess the comparative advantages and disadvantages of Virtualization technology. • Analyze authentication, confidentiality and privacy issues in cloud computing. • Identify security implications in cloud computing. • Understand the importance of protocols and standards in management for cloud services.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course		
Total Hours/Lectures: 60		
Unit	**Topics**	**No. of Lectures**
I.	**Introduction:** Introduction to Cloud Computing Defining Cloud computing, Characteristics, Components, deployment model, service model, Applications, Benefits of cloud computing, Limitations of cloud computing. Grid Computing, Grid vs Cloud Computing.	12
II.	**Cloud architecture, Services and Applications:** Exploring cloud computing stack – Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Defining Infrastructure as a Service (IaaS), Defining Software as a Service (SaaS), Defining Platform as a Service (PaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS).	12
III.	**Cloud Infrastructure and Virtualization:** Hardware and Infrastructure – Clients, Security, Network and Services, use of Virtualization technology, Load Balancing and Virtualization, virtualization benefits, Hypervisors, porting application, Defining cloud capacity by defining baselines and Metrics.	12
IV.	**Exploring cloud services:** Software as a Service – Overview, advantages, limits, virtualization benefits, examples. Platform as a Service – overview, advantages and functionalities, PaaS application frameworks – Drupal, Long Jump. Case study – Google Apps and Web Services.	12

V.	**Cloud Administration and Security Management:** Management responsibilities, lifecycle management, cloud management products, Cloud management standards. Cloud security, data security, Identity and presence protocol standards, Availability management in SaaS, IaaS, PaaS, Access Control, Security Vulnerability, Patch and Configuration Management, Security as a Service of cloud, Future of Security in Cloud computing.	12

Keywords: Cloud Computing, Security, Governance, Storage, Virtualization, Virtual appliances, Hypervisors.

Part C - Learning Resources

Text Books, Reference Books and E-Resources

TEXT/REFERENCE BOOKS:

- Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill Education.
- Barrie Sosinsky, "Cloud Computing Bible", Wiley India Edition.
- Anthony Velte, tobyVelte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata McGraw-Hill Edition.
- Cloud Computing:Black Book, Kailash Jayaswal et al., Kogent Learning Solutions, Dreamtech Press.
- Cloud Computing: Principals and Paradigms,RajkumarBuyya et al., Wiley India.
- Cloud Computing: Concepts, Technology & Architecture,Erl, Pearson Education India.
- Cloud Computing Bible, Barrie Sosinsky, O'Reilly Media.
- Cloud Computing: A Practical Approach, Toby Velte, Anthony Vote and Robert Elsenpeter, McGraw Hill.
- Cloud Application Architectures: Building Applications and Infrastructures in the Cloud, George Reese, O'Reilly Media.

E-RESOURCES:

- Coursera: https://www.coursera.org/courses?query=computing
- Introduction to Cloud Computing from W3shool: https://www.w3schools.in/cloud-computing/tutorials/
- Introduction to Cloud Computing from Coursera: https://www.coursera.org/learn/introduction-to-cloud
- Cloud Computing Basics: https://www.coursera.org/learn/cloud-computing-basics
- Cloud Computing Concepts: https://www.coursera.org/learn/cloud-computing
- Cloud Computing Specialization from Coursera: https://www.coursera.org/specializations/cloud-computing
- Cloud Computing from SWAYAM/NPTEL
  - https://onlinecourses.nptel.ac.in/noc22_cs20/preview
  - https://www.youtube.com/channel/UCK73enkjfQNDwdBqMyaMtRg
- https://annauniversityedu.blogspot.com/2020/10/cs8711-cloud-computing-laboratory.html
- https://drive.google.com/file/d/1oiuQYwkgFXy4R45l8us4ynnXNFqx6OkW/view
- https://www.vidyarthiplus.com/vp/attachment.php?aid=53342
- https://www.iare.ac.in/sites/default/files/lab1/CAD%20LAB%20UPDATED%20BY%20ANJAIAH-%20FINAL_0.pdf
- https://jainakshay781.files.wordpress.com/2019/02/final-cc-lp-iv-manual-1.pdf

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. III Semester**	Year: 2023	Session: **2023-24**
1.	Course Code	**MSCCS304**		
2.	Course Title	**Programming in Java**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Design console based, GUI based and web-based applications. • Understand an integrated development environment to create, debug and enterprise-level applications. • Understand Java modules. • Understand JVM. • Understand exception and file handling.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**	**Min. Marks: 36**	

Part B: Content of the Course

Total Hours/Lectures: 60

Unit	Topics	No. of Lectures
I.	**Introduction to JAVA:** What is java, History of java, Features of Java, Java virtual machine (JVM), Java development kit (JDK), JRE, Java Vs C++, Data types, Literals, Variables, and Operators, Keywords, Arrays.	12
II.	**Control Statements:** Java If-Else, Types of if-else, Switch Statements, **Looping Statements:** (While, Do-While, For and for-each), Break and Continue Statements, Simple Java Programs, Java OOPs Concept: Class fundamentals, Object.	12
III.	Closer look at Method, Nested and inner class, Exploring **Java. Lang**, String handling, String Methods, String vs String Buffer, Constructor, this keyword, Static Keyword. Inheritance: Basics, Types of inheritance, Access specifier, super Keyword, Final Keyword Abstract class, constructor in multilevel inheritance.	12
IV.	Polymorphism: Types of Polymorphism, method overriding, Method Overloading Package and Interface: Defining package, importing package Defining and implementing interface, Variable in interface, Extending interface, Nested interface.	12
V.	**Exception handling and File Handling:** Using try and catch, multiple catch classes, nested try statements, throw, throws and finally, built in exception, Uncaught exception, creating own exception class, Java File Methods, create a File, Write a file, Read a File and Delete a file.	12

Keywords: JVM, Control Statements, Inheritance, Polymorphism, Exception Handling

Part C - Learning Resources
Text Books, Reference Books and E-Resources

TEXT /REFERENCE BOOKS:

- The Complete Reference JAVA, Herbert Schildt, Tata McGraw Hill publication, 5th Edition.
- Advance JAVA, Gajendra Gupta, Firewall Media, 1st Edition, 2006.
- Core JAVA for beginners By Rashmi Kanta Das, Vikas Publication.
- Core JAVA: A Comprehensive Study by Mahesh P. Matha, PHI publication.
- Java: The complete reference By Naughton P and schildt H., Osborne Tata Mcgraw -Hill.
- Java Programming by E. Balguruswami
- JAVA network programming, Elliotte Rusty Harold, O'Reilly Publication, 3rd Edition.
- Core Java for Beginners, Rashmi Kanta Das, Vikas Publishing House Pvt. Ltd.
- JAVA in a Nutshell, David Flanagan, O'Reilly Publication, 5th Edition.
- Learning JAVA, Patrik Niemeyer and Jonathan Knudsen, O'Reilly Publication, 3rd edition.
- Introduction to Programming with JAVA – A Problem Solving Approach , John Dean, Raymond Dean, Tata Mc Graw Hill.
- Core and Advanced JAVA (Black Book), Dreamtech Press.

E-RESOURCES:

1. https://www.edureka.co/blog/advanced-java-tutorial
2. https://www.javatpoint.com/what-is-advance-java
3. https://www.w3schools.in/java
4. https://www.tutorialspoint.com/java/index.htm
5. https://www.jigsawacademy.com/blogs/tutorial/advanced-java
6. https://enos.itcollege.ee/~jpoial/allalaadimised/reading/Advanced-java.pdf

Part D: Assessment and Evaluation	
Maximum Marks: 100 End Semester Examination (ESE): 80 Marks Internal Assessment (IA): 20 Marks	
Internal Assessment: **(i) Unit test (10 Marks):** There will be three tests of 10 marks. **(ii) Presentation/Assignment (10 Marks)**	**Total:** 20 Marks

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. IV Semester**	Year: 2023	Session: **2023-24**
1.	Course Code	**MSCCS401**		
2.	Course Title	**Advanced Trends and Technologies**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Learn how the Internet of Things works. • Understand Natural Language Processing. • Understand Big data. • Develop concept of Data Mining and Data Warehousing		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**	**Min. Marks: 36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Fundamentals of IoT**: Definition of IoT, Characteristics of IoT, History of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, Overview of IoT components and IoT Communication Technologies, Challenges in IoT.	12
II.	**Applications of IoT:** Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.	12
III.	**Introduction to NLP:** Definition of NLP, Difficulty in NLP, History of NLP, Pros and Cons of NLP, Components of NLP, Applications of NLP, NLP pipeline, Phases of NLP, NLP APIs, NLP Libraries.	12
IV.	**Introduction To Big Data:** Big Data and its importance, Characteristics of Big Data, What Comes Under Big Data, Who's Generating Big Data, Challenges in Handling Big Data, How Big Data Impact on IT, Big Data Analytics, Big data applications, Future of Big Data, Risks of Big Data.	12
V.	**Data mining:** What is data mining, why it is important? Mining on what kind of data, Data mining Functionalities, steps of data mining, Knowledge discovery. Data Warehouse: - Meaning, definition, OLTP Vs. OLAP.	12
Keywords: IoT, NLP, OLAP, Data Mining		

Part C - **Learning Resource**
Text Books, Reference Books, E-Resources

Text Books:

- Big Data, Black Book: by DT Editorial Services .
- Internet of Things (IoT) by Dr Kamlesh Lakhwani Dr Hemant Kumar Gianey, Joseph Kofi Wireko Kamal Kant Hiran
- *An introduction to natural language processing*, computational linguistics, and speech recognition. Daniel *Jurafsky* & James H. *Martin.*

Reference Books:

- Christopher D. Manning and Hinrich Schütze. 1999. Foundations of Statistical Natural Language Processing. Cambridge, MA: MIT Press.
- Designing the Internet of Things Adrian McEwen, Hakim Cassimally,Wiley Publishers
- Big Data: Concepts, Technology and Architecture Balamarugan Balusamy, Nandhini Abirami R, Seifedine Kadry and Amir Gandomi, Wiley Publishers

E-Resources:

- https://onlinecourses.nptel.ac.in/noc23_cs112/preview
- https://archive.nptel.ac.in/courses/106/105/106105166/
- https://onlinecourses.swayam2.ac.in/arp19_ap52/preview
- https://onlinecourses.nptel.ac.in/noc19_cs65/preview
- https://www.udemy.com/course/internet-of-things-iot-fundamentals/
- https://www.coursera.org/learn/iot?specialization=iot
- https://www.udemy.com/course/learn-big-data-basics/
- https://www.coursera.org/learn/big-data-introduction
- https://www.coursera.org/learn/big-data-introduction?specialization=big-data
- https://onlinecourses.nptel.ac.in/noc21_cs14/preview
- https://onlinecourses.nptel.ac.in/noc19_cs56/preview

Part A: Introduction				
Program: **Master Degree**		Class: **M.Sc. IV Semester**	Year: 2023	Session: **2023-24**
1.	Course Code	**MSCCS402**		
2.	Course Title	**Web Technology**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per Government Scheme/ Institutional scheme		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Analyze a web page and identify its elements and attributes. • Create web pages using HTML, CSS, JAVASCRIPT, XHTML. • Build dynamic web pages using JavaScript (Client-side programming). • Create XML documents and Schemas. • Build interactive web applications using, PHP, AJAX. • Learn Web Hosting and Deployment.		
6.	**Credit Value**	**4**		
7.	**Total Marks**	**Max. Marks: 100**		**Min. Marks: 36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Introduction:** Introduction to world wide web & Internet, Web Browsers, Web Servers, Web pages, Uniform Resource Locator, protocols governing the web, Web Design Principles and Web site structure, Web applications, Types of Websites (Static/Dynamic), Search engine, Domain and sub domain, DNS.	12
II.	**HTML:** Introduction, Basic formatting tags: heading, paragraph, line break, bold, italic, underline, superscript, subscript, font, and image. Different attributes like align, color, bgcolor, font face, border size. Navigation Links using anchor tag: internal, external, mail and image links, Link to different web pages and sections. Lists: ordered, unordered and definition.	12
III.	**Table and Form Scripting:** Table Tag and Their Attributes, Padding and Spacing, Rowspan and colspan Form Tag, Form Attribute, Form Elements, Form Input Type, Form Input Attribute, POST and GET method, Text Input, Text Area, Checkbox, Radio Button, Select Option, Submit Button, Reset Button	12
IV.	**CSS and PERL:** Usefulness of Style Sheets, Creating Style sheets, CSS Tags, Background, Font, Text, Color, Image, Links, Table, Padding, Position etc. Introduction to PERL, Variable, Condition, Loop, Array, Implementing data Structure, String, File handling, I/O handling	12
V.	**Web Technologies:** Introduction to JavaScript, Introduction to XML, Introduction to PHP, Introduction MySQL, Introduction to Node.js, Introduction to VB, Introduction to ASP, Introduction to Web Tools: Frontpage, Dreamweaver, Photoshop, Concept of Client-Side Scripting and Server-side Scripting.	12
Keywords: www, HTML, web technologies, CSS, Perl		

Part C - **Learning Resource**
Text Books, Reference Books, E-Resources

Text Books:

1. Xavier, C, "Web Technology and Design", New Age International.
2. Ivan Bayross, "HTML, DHTML, Java Script, Perl & CGI", BPB Publication.
3. Ramesh Bangia, "Internet and Web Design", New Age International.
4. Ullman, "PHP for the Web: Visual Quick Start Guide", Pearson Education.
5. Jim Converse & Joyce Park, "PHP & MySQL Bible", Wiley India Publication
6. Raj Kamal, "Internet and Web Technologies", Tata McGraw-Hill.

Reference Books:

1. "Internet and Internet Engineering", Daniel Minoli, TMH.
2. Chuckmusiano & Bill Kenndy, O Reilly, HTML The Definite Guide"
3. Joseph Schmuller, Dynamic HTML, BPB, 2000.
4. Deitel, Deitel, Goldberg, "Internet & World Wide Web How to Program", Third Edition, Pearson Education, 2006.

E-Resources:

1. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview
2. https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javacript?action=enroll&adgroupid=154709125594&adposition=&campaignid=20395923513&creativeid=667061327480&device=c&devicemodel=&gclid=Cj0KCQjw2qKmBhCfARIsAFy8buKxlYam7tWtPzSQ46fXKZcqBmupu3gKrwgxmSmbwdtKTLNiZCkYtqgaAm7JEALw_wcB&hide_mobile_promo&keyword=&matchtype=&network=g&specialization=ibm-full-stack-cloud-developer&utm_campaign=B2C_INDIA_ibm-full-stack-cloud-developer_ibm_FTCOF_professional-certificates_arte-agency&utm_medium=sem&utm_source=
3. https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000007CS/P001071/M017403/ET/1473335362etext-Module6.pdf