Vikram University, Ujjain

Board of studies in Computer science (Faculty of Engineering Science)

SYLLABUS of M.Sc.(Computer Science) Programme

[Choice Based Credit System & Grading System (CBCS& GS)]

Exclusively for University Teaching Department (ICS,VUU)

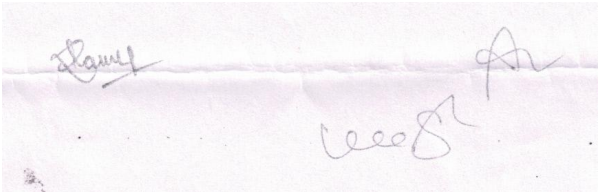
TWO YEAR M.SC (FULL TIME) PROGRAMME of UTD (ICS,VUU)

(Effective from Academic Session 2018-19)

[Modified as according to the provision of "Ordinance 14 : Choice Based Credit System"

In the meeting of Board of studies in Computer science (Faculty of Engineering Science)

held on 30/07/2018 and(Effective the Academic Session 2018-19)



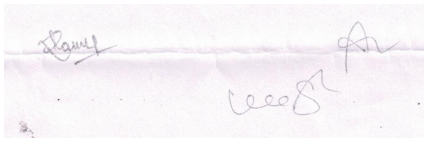
COURSE STRUCTURE

M.Sc. (Computer Science) FIRST SEMESTER

SN	Course Type	Course code	Title	End term sem Exam	Internal	Max Marks	Credits*	Distribution of Credits		
							C	L	T	P
1	Core Course	MSCS-101	Discrete Mathematical structure	60	40	100	6	4	2	
		MSCS-102	Operating system & system software	60	40	100	6	4		2
2	Course for Ability Enhancement & skill Development (AE & SD)	MSCS-103	Entrepreneurship Development	60	40	100	6	4	2	
Choose any one From MSCS 104- E1 and 104- E2										
3	Elective Discipline Centric	MSCS 104-E1	Computer organisation & Architecture	60	40	100	6	4	2	
		MSCS 104-E2	Techniques Of Operation Research	60	40	100	6	4	2	
Choose any one From MSCS 105-E1 , 105-E2 and 105-E3										
4	Elective Generic Categories	MSCS 105-E1	Object oriented programming using C++	60	40	100	6	4		2
		MSCS 105-E2	Data Communication and Computer Network	60	40	100	6	4	2	
		MSCS 105-E3	Any Course from Massive Open Online Courses (MOOCs)available at SWAYAM	60	40	100	6	4	2	
5		MSCS-106	Comprehensive Viva Voce	50	-	50	04 Virtual (VR)			
			Total			550	30+4	20	06	04

(C=Credit Per Week) / (L = Lectures Per Week)/ (T & PW =Tutorials & Practical Work per week)

***One Credit is equivalent to one hour (60 minutes) of teaching (lecture or tutorial) and two hours (120 minutes) for practical**

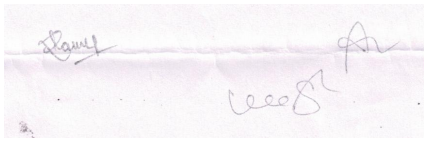


M.Sc. (Computer Science) SECOND SEMESTER

SN	Course Type	Course code	Title	End term sem Exam	Internal	Max Marks	Credits*	Distribution of Credits		
			Core Courses				**C**	**L**	**T**	**P**
1	Core Course	MSCS-201	Data Structure Using C++	60	40	100	6	4		2
		MSCS-202	Data Base Management System	60	40	100	6	4	2	
2	Course for Ability Enhancement & skill Development (AE & SD)	MSCS-203	Communication Skill	60	40	100	6	4	2	
Choose any one From MSCS 204- E1 and 204- E2										
3	Elective Discipline Centric	MSCS 204-E1	Theory of Computation	60	40	100	6	4	2	
		MSCS 204-E2	Internet Programming	60	40	100	6	4	2	
Choose any one From MSCS 205-E1 , 205-E2 and 205-E3										
4	Elective Generic Categories	MSCS 205-E1	programming with VB.Net	60	40	100	6	4		2
		MSCS205-E2	Computer System Architecture and parallel Processing	60	40	100	6	4	2	
		MSCS 205-E3	Any Course from Massive Open Online Courses (MOOCs)available at SWAYAM	60	40	100	6	4	2	
5		MSCS-206	Comprehensive Viva Voce	50	-	50	04 Virtual (VR)	20	06	04
			Total			550	30+04			

(C=Credit Per Week) / (L = Lectures Per Week)/ (T & PW =Tutorials & Project Work per week)

***One Credit is equivalent to one hour (60 minutes) of teaching (lecture or tutorial)and two hours (120 minutes) for practical**

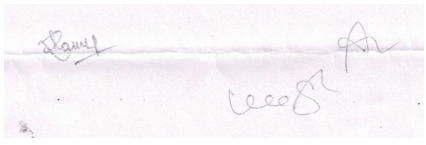


M.Sc. (Computer Science)THIRD SEMESTER

SN	Course Type	Course code	Title	End term sem Exam	Internal	Max Marks	Credits*	Distribution of Credits		
							C	L	T	P
1	Core Course	MSCS-301	Theory of Compiler Design	60	40	100	6	4	2	
		MSCS-302	Data Mining and Data Warehousing	60	40	100	6	4	2	
2	Course for Ability Enhancement & skill Development (AE & SD)	MSCS-303	Personality Development	60	40	100	6	4		2
Choose any one From MSCS 304- E1 and 304- E2										
3	Elective Discipline Centric	MSCS 304-E1	Object oriented programming with JAVA	60	40	100	6	4		2
		MSCS 304-E2	Network Security	60	40	100	6	4	2	
Choose any one From MSCS 305-E1, 305-E2 and 305- E3										
4	Elective Generic Categories	MSCS 305- E1	System Analysis and Design	60	40	100	6	4	2	
		MSCS 305- E2	Cloud Computing	60	40	100	6	4	2	
		MSCS 305-E3	Any Course from Massive Open Online Courses (MOOCs)available at SWAYAM	60	40	100	6	4	2	
5		MSCS-306	Comprehensive Viva Voce	50	-	50	04 Virtual (VR)			
			Total			550	30+04	20	06	04

C=Credit Per Week) / (L = Lectures Per Week)/ (T & PW =Tutorials &Practical Work per week)

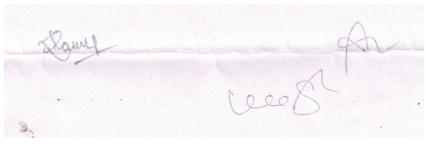
***One Credit is equivalent to one hour (60 minutes) of teaching (lecture or tutorial)and two hours (120 minutes) for practical**



M.Sc.(Computer Science) FOURTH SEMESTER

SN	Course Type	Course code	Title	End term sem Exam	Internal	Max Marks	Credits*	Distribution of Credits		
							C	L	T	P
1	Core Course	MSCS-401	Computer Graphics and Multimedia	60	40	100	6	4		2
		MSCS-402	Artificial Intelligance	60	40	100	6	4	2	
2	Course for Ability Enhancement & skill Development (AE & SD)	MSCS-403	Software Testing and Project Management	60	40	100	6	4		2
Choose any one From MSCS 404- E1 and 404- E2										
3	Elective Discipline Centric	MSCS 404-E1	Tourism Management	60	40	100	6	4	2	
		MSCS 404-E2	Design and Analysis of Algorithm	60	40	100	6	4	2	
Choose any one From MSCS 405-E1 ,405-E2 and 405- E3										
4	Elective Generic Categories	MSCS 405- E1	Internetwork Application	60	40	100	6	4	2	
		MSCS405-E2	Mobile Computing	60	40	100	6	4	2	
		MSCS 405- E3	Any Course from Massive Open Online Courses (MOOCs)available at SWAYAM	60	40	100	6	4	2	
5		MSCS-406	Comprehensive Viva Voce	50	-	50	04 Virtual (VR)			
			Total			550	30+04	20	06	04

C=Credit Per Week) / (L = Lectures Per Week)/ (T & PW =Tutorials & Practical Work per week)



PART A: Introduction				
Program: M.Sc.		Class: I SEM	Year: I Year	Session: 2018-19
Subject: Computer Science				
1.	Course Code	MSCS 101		
2.	Course Title	**Discrete Mathematical Structure**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core course**		
4.	Pre-Requisite (if any)	To study this course, students must have the basic knowledge of Mathematics.		
5.	Course Learning Outcomes(CLO)	• Students will learn the basic concepts of sets, permutations, relations, graphs, trees. • Students will represent discrete objects and relationships using abstract mathematical structures. • Apply the Operations of Sets and use Venn Diagrams to Solve Applied Problems; • Understand, Explain and Apply the Basic Principles of Sets and Operations in Sets to Solve the Problems • Analyze Modern Problems in Computer Science and solve them Using Graphs and Trees.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Set Theory: Introduction, Sets and Elements, Universal Set and Empty Set, Subsets, Venn Diagrams. Relations: Introduction, Product Sets, Relations, Pictorial Representation of Relations, Composition of Relations, Types of Relations, Partial Ordering Relations.	18
II	Functions: Introduction, One-to-One, Onto, and Invertible Functions, Cardinality. Logic and Propositional Calculus: Introduction, Propositions and Compound Propositions, Basic Logical Operations, Propositions and Truth Tables, Tautologies and Contradictions.	18
III	Counting: Introduction, Basic Counting Principles, Factorial Notation, Binomial Coefficients, Permutations and Combinations. Pigeon hole Principle.	18
IV	Graph Theory: Introduction, Graphs and Multigraphs, Subgraphs, Paths, Connectivity, Weighted Graphs, Complete, Regular and Bipartite Graphs. Directed Graphs: Introduction, Rooted Trees, Graph Algorithms: Depth first	18

	and Breadth-First Searches.	
V	TREES AND CUT - SETS : Paths and Circuits, Shortest Paths, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits. Rooted Trees, Path Lengths in Rooted Trees, Binary Search Trees. Spanning Trees, Minimum Spanning Trees.	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: **1.** Elements of Discrete Mathematics, C.L.Liu, Second Edition, TMH **2.** Discrete Mathematics and its applications, Kenneth H. Rosen, (Fifth Edition), Tata McGraw Hill Publishing Company. **3.** Theory and Problems of Discrete Mathematics, Semmour Lipschutz, Marc Lipson, Second Edition, Schaum's Outline, T.M.H.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: I Semester	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 102**	
2.	Course Title	**Operating Systems and System Software**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core**	
4.	Pre-Requisite (if any)	Students must have the basic knowledge of Computer basics.	
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: • Identify and describe the Services Provided by Operating Systems. • Understand and Solve Problems Involving Process Control, Mutual Exclusion, Synchronization and Deadlock. • Apply Various Approaches of Memory Management Techniques • Understand the Structure and Organization of the File System. • Implement Processor Scheduling, Synchronization and Disk Allocation Algorithms for a Given Scenario.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks:40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures:90 Hours		
Unit	Topics	No. of Lectures

I	Introduction to System Programs & Operating Systems, Evolution of Operating System (mainframe, desktop, multiprocessor, Distributed, Network Operating System, Clustered & Handheld System), Operating system services, operating system structure, System Call & System Boots, Operating system design & Implementations, System protection, Buffering & Spooling. Types of Operating System: Bare machine, Batch Processing, Real Time, Multitasking & Multiprogramming, timesharing system.File: concepts, access methods, free space managements, allocation methods, directory systems, protection, organization,sharing & implementation issues.	18
II	Process: Concept, Process Control Blocks(PCB), Scheduling criteria Preemptive & non Preemptive process scheduling, Scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling, operations on processes, threads, inter process communication, precedence graphs, critical section problem, semaphores, classical problems of synchronization. Deadlock: Characterization, Methods for deadlock handling, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock Process Management in Linux.	18
III	Memory Hierarchy, Concepts of memory management, MFT & MVT, logical and physical address space, swapping, contiguous and non-contiguous allocation, paging, segmentation, and paging combined with segmentation. Structure & implementation of Page table.Concepts of virtual memory, Cache Memory Organization, demand paging, page replacement algorithms, allocation of frames, thrashing, demand segmentatin	18
IV	Mass Storage Structure: Disk Structure, Disk Scheduling- FCFS, SSTF, SCAN Scheduling, Disk Management, Swap-Space Management. Distributed operating system:-Types, Design issues, File system, Remote file access, RPC, RMI, Distributed Shared Memory(DSM), Basic Concept of Parallel Processing & Concurent Programming.	18
V	System software and application software, layered organization of system software. Assemblers, Macros, Compilers, Cross compilers, Linking and loading, Relocation. Case study of Unix, Linux & Windows	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Operating System by Silberschatz.
2. Operating System by Deitel
3. Modern operating system by Tanneubacem.
4. Donovan, J.J. : System programming, Mcgraw Hill,1972.
5. Dhamdhere. D.M.: Introduction to system software, Tata Mcgraw Hill Publ.comp. 1986.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: I SEM	Year: I Year	Session: 2018-19
Subject: Computer Science				
1.	Course Code	**MSCS-103**		
2.	Course Title	**Entrepreneurship Development**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Course for Ability Enhancement & skill Development (AE & SD)**		
4.	Pre-Requisite (if any)	Students must have basic knowledge of business trends.		
5.	Course Learning Outcomes(CLO)	• Engage with a range stakeholder to deliver creative and sustainable solution to specific problem. • Whenever Stakeholder get opportunities they can captures. • To develop the ability of analysing and understanding business situation.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	**Introduction:** Entrepreneurship - meaning, nature, importance, specific traits of Entrepreneurs, Role of entrepreneurs in Indian Economy.	18
II	**Analysis of Entrepreneur opportunities :** Defining, objectives, identification, process of sensing, accessing the impact of opportunities and threats.	18
III	**Search of Business Idea:** Preparing for business plan, legal requirements for establishing of a new unit- procedure for registering business, starting of new venture, product designing / branding, research and development,	18

	selection of forms of business organization.	
IV	**Role of Supportive Organizations:** D.I.C and various government policies for the development of entrepreneurship, Government schemes and business assistance; subsidies, Role of Banks.	18
V	**Market Assessment :**Meaning of market assessment, components and dimensions of market assessment, Questionnaire preparations, survey of local market, Visit to industrial unit, business houses, service sector etc. Submission of Survey based report on one successful / one unsuccessful entrepreneur.	18

PART C: Learning Resources	
Textbooks, Reference Books, Other Resources	
Suggested Readings:	
1 Entrepreneurship Development	Dr.C.B.Gupta
2 Dynamics of Entrepreneurial Development and Management	Vasant Desai
3 Innovation and Entrepreneurship	Peter F.Drucker
4 Entrepreneurship Development	G.A.Kaulgud
5 Entrepreneurship-Need of the Hour	Dr.Vidya Hattangadi
6 Entrepreneurship Development	Dipesh D. Uike

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions (50 Words Each)	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

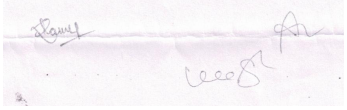
PART A: Introduction			
Program: M.Sc.	Class: I SEM	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS-104 E1**	
2.	Course Title	**Computer organization and Architecture**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	Students must have the basic knowledge of Computer basics.	
5.	Course Learning Outcomes(CLO)	• Understand and Represent Data in Different Binary Formats • Design, Simplify and evaluate Boolean Equations and Circuits • Explain and Analyze Basic Building Blocks of Digital Electronics and Computer • Design and Analyze Simple Combination & Sequential Circuits • Analyze the Basic Computer Organisation and Programming • Understand the Organisation of I/O Devices and Computer Memory Mapping:	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Binary Systems: Digital Computers and Digital Systems, Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers, Complements, Binary Codes. Boolean Algebra and Logic Gates: Boolean Functions, Digital Logic Gates.Simplification of Boolean Functions: The Map Method, Two and Three Variable Maps, Four Variable Map, Product of Sums Simplification, NAND and NOR Implementation, Don't-Care Conditions.	18
II	Combinational Logic: Introduction, Design Procedure, Adders, Subtractors, Code Conversion, Analysis Procedure. Combinational Logic with MSI and LSI: Binary Parallel Adder, Decoders, Multiplexers. Sequential Logic: Introduction, Flip-Flops, Triggering of Flip-Flops.	18
	Analysis of Clocked Sequential Circuits, State Reduction and Assignment,	

III	Flip-Flop Excitation Tables, Design Procedure, Design of Counters. Processor Logic Design: Introduction, Processor Organization, Arithmetic Logic Unit, Design of Arithmetic Circuit, Design of Logic Circuit, Design of Arithmetic Logic Unit, Status Register, Design of Shifter, Processor Unit.	18
IV	Microcomputer System Design: Introduction, Microprocessor Organization, Basic Concept of Instruction, Instruction Types, Micro Instruction Formats and Addressing Modes, Subroutines Interrupt, Fetch and Execution cycle, Hardwired control unit, Micro-programmed Control unit- microprogram sequencer Control Memory, Sequencing and Execution of Micro Instruction.	18
V	Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory. Input Output Organization: Peripheral Devices, Input-Output Interface, Direct Memory Access (DMA), Input-Output Processors (IOP), Structure of Multiprocessor- Inter-processor Arbitration, InterProcessor Communication and Synchronization. Memory in Multiprocessor System, Concept of Pipelining, Vector Processing, Array Processing, RISC And CISC,Study of Multicore Processor – Intel, AMD.	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. 1 Digital Logic and Computer Design, M. Morris Mano, P.H.I., Eastern Economy Edition. 2. Computer System Architecture (3rd ed..), M.Morris Mano, P.H.I., Eastern Economy Edition. 3. Computer Architecture and Organization, J.P. Hays, McGraw Hill. 4. Digital Principle and Applications, Malvino and Leach 5. Digital Computer Fundamentals, Thomas C. Bartee



Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
M.Sc.	Class: I Semester	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 104 E2**	
2.	Course Title	**Techniques Of Operation Research**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	Fundamentals of Computing and Programming.	
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: • Distinguish different computer aided optimization techniques. • Understand the concept of optimization and classification of optimization problems. • Create simple architecture for evaluationary algorithms. • Have the knowledge of applying evaluation optimization technique ti engineering applications. • Learn efficient computational procedures to solve optimization problems.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
	Introduction: nature and meaning of O.R. Modelling in operations research,	

I	features of operation research, scope of operations research. Linear Programming Problem: formulation of L.P.P. solution of L.P.P. graphical method, simplex methods, duality.	18
II	Assignment problems: Mathematical formulation, Reduction theorem, methods of solving the assignments problems, Unbalanced assignment problem, Transportation problem: formulation, basic feasible solution: North-West-Corner method, least cost method, Vogel's approximation method, Optimum solution: Modi method.	18
III	Project management: introduction, network diagram representation, time estimates and critical path in network analysis, project evaluation and review techniques. Job sequencing: processing n jobs through 2 machines, processing n jobs through 3 machines, processing 2 jobs through m machines.	18
IV	Queuing Theory: introduction, queuing system Transient and steady traffic inlets, Distribution of arrival distribution of departure, M/M/I: ∞/ FCFS model. Replacement problems: replacement policy for items whose maintenance cost increases with time and money value is constant.	18
V	Deterministic Inventory Models, what is inventory, types of inventory, inventory decisions, how to develop n variables model, costs involved in inventory problems, variables in inventory problem, classification of characteristics of inventory systems, EOQ model without shortage.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Operations Research by Taha.
2. Operations Research by S D Sharma.
3. Introduction to Operations Research (Sixth Edition) by F.S. Hillier and G.J. Lieberman, Mc Graw Hill International Edition, Industrial Engineering Series, 1995.

Linear Programming by G. Hadley, Narosa Publishing House, 1995.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: I Sem	Year: I Year	Session: 2018-19
Subject: Computer Science				
1.	Course Code	**MCA 105 E1**		
2.	Course Title	**Object Oriented Programming Using C++**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**		
4.	Pre-Requisite (if any)	Basic knowledge of computer and C language.		
5.	Course Learning Outcomes(CLO)	• Creating simple programs using classes and objects in C++. • Implement Object Oriented Programming Concepts in C++. • Develop applications using stream I/O and file I/O. • Implement simple graphical user interfaces. • Implement Object Oriented Programs using templates and exceptional handling concepts		
6.	Credit Value	6 Credits.		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures:90 Hours		
Unit	Topics	No. of Lectures
I	**Object Oriented Systems Development :** Introduction to traditional programming with C. Objectives of OOP, Object Oriented Analysis, Object Oriented Programming in C++: Concepts of Objects, Classes, Data Abstraction, Encapsulation, Inheritance, Polymorphism, Dynamic Binding and Message passing.	18
II	Object modeling, Dynamic modeling, Events, Status, Scenarios, Event hate diagrams, Operations, State diagrams, Functional Models, Dataflow diagrams, Constraints specification, Relation of object, Functional and	18

	Dynamic models.	
III	Tokens, Expressions and Control Structures, Classes and Objects, Overloading and information hiding, Function overloading, Operator overloading in C++, Memory Management: Constructors, Overloading of constructors, copy constructors, destructors.	18
IV	**Inheritance :** Inheritance, Derived and base classes, Single, Multilevel, Hierarchical, Hybrid Inheritance, Protected member, overriding member function, class hierarchies, multiple inheritance, Containership	18
V	**Polymorphism :** virtual functions, late binding, pure virtual functions, abstract classes, friend functions, friend classes, static functions, this pointer, templates, function templates, Class templates.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Object-Oriented Programming with C++: E. Balagurusamy, TMH, 2005
2. Object Oriented Programming in C++, Robert Lafore, Galgotia Publication.
3. Object Oriented Programming, Tomothy Budd, Pearson education.
4. Object Oriented Modelling and Design, J. Rambaugh, M. Blaha, W. Premerlani, F. Eddy, W. Lorensen, P.H.I.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (B): Five Short Questions Section (C): Five Long Questions	04 × 05 = 20 08 × 05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: I Sem	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 105 E2**	
2.	Course Title	**Data Communication and Computer Network**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core**	
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Computers.	
5.	Course Learning Outcomes(CLO)	• Demonstrate the Basic Concepts of Networking, Networking Principles, Routing Algorithms, IP • Addressing and Working of Networking Devices. • Demonstrate the Significance, Purpose and application of Networking Protocols and Standards. • Describe, compare and contrast LAN, WAN, MAN, Intranet, Internet, AM, FM, PM and Various Switching Techniques. • Explain the working of Layers and apply the various protocols of OSI & TCP/IP model. • Analyze the Requirements for a Given Organizational Structure and Select the Most Appropriate Networking Architecture and Technologies. • Design the Network Diagram and Solve the Networking Problems of the Organizations with Consideration of Human and Environment. Install and Configure the Networking Devices.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Network goals and application, Network structure, Network services, Example of networks and Network Standardization, Networking models: centralized, distributed and collaborative. Network Topologies: Bus, Star, Ring, Tree, Hybrid: Selection and Evaluation factors.	18
II	Theoretical Basis for Data communication, Transmission media, Twisted pair (UTP, STP), Coaxial Cable, Fiber optics: Selection and Evaluation factors. Line of Sight Transmission, Communication Satellites. Analog and Digital transmission. Transmission and switching, frequency division and time division multiplexing, STDM, Circuit switching, packet switching and message switching,	18
III	Brief Overview of LAN (Local Area Network) : Classification. Brief overview of Wide Area Network (WAN). Salient features and differences of LAN with emphasis on: Media, Topology, Speed of Transmission, Distance, Cost. Terminal Handling, Polling, Token passing, Contention. IEEE Standards: their need and developments.	18
IV	Open System: What is an Open System? Network Architectures, ISO-OSI Reference Model, Layers: Application, Presentation, Session, Transport, Network, Data Link & Physical. Physical Layer - Transmission, Bandwidth, Signaling devices used, media type. Data Link Layer - : Addressing, Media Access Methods, Logical link Control, Basic algorithms/protocols.	18
V	Network Layer: Routing: Fewest-Hops routing, Type of Service routing, Updating Gateway routing information. Brief overview of Gateways, Bridges and Routers, Gateway protocols, routing daemons. OSI and TCP/IP model. TCP/IP and Ethernet. The Internet: The structure of the Internet, the internet layers, Internetwork problems. Internet Standards.	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. Tannanbaum, A.S.: Computer Networks, Prentice Hall, 1985.processing, Prentice Hall,1983. 2. Black : Computer Networks : Protocols, standords and Interfaces, Prentice Hall International 1. Tannanbaum, A.S.: Computer Networks, Prentice Hall, 1985.processing, Prentice Hall,1983.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04 × 05 = 20 08 × 05= 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: II SEM	Year: I Year	Session: 2018-19
Subject: Computer Science				
1.	Course Code	**MSCS 201**		
2.	Course Title	**Data Structures Using C++**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core course**		
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of C and C++ . .		
5.	Course Learning Outcomes(CLO)	• Outline basic object-oriented design concepts. i.e., Inheritance, Polymorphism, Dynamic Method Binding etc. • Understand and implement the various data structures such as Lists, Queues. • Understand and implement various hierarchical data structures: Binary search trees, Graphs etc. • Analyses sorting and searching algorithms, and explain their relationship to data structures. • Analyses time and space complexity of algorithms. • Choose and implement appropriate data structures to solve an application problem.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	**Stacks and Queues:** Introduction to Data Structures, ADT Stack and its implementation in C++, Evaluation of postfix expressions, ADT Queue and its implementation in C++.	18
II	**Searching algorithms:** Linked Lists: Defining & implementing linked lists with creation, insertion and deletion operations in C++, Sequential search & Binary search algorithms, Implementation in C++.	18
	Sorting Algorithms: Implementation and Algorithm Analysis of Insertion sort, Selection sort, Merge Sort and Quick Sort.	

III		18
IV	**Trees and Graphs**: Definition and Implementation of ADT Binary tree, AVL Trees. Definition of Graph, Representation of Graphs, Graph Traversal methods.	18
V	Hash Tables, Hashing Functions, Overflow Handing, Chaining. Fields, records, files, index techniques, cylinder-surface indexing, tree indexing-B-trees, trie indexing, file organizations.	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. Introduction to Data Structures and Algorithms with C ++, GLENN W.ROWE, Prentice Hall India, 2003 2. Data Structures and Algorithms, Alfred V. Aho, John E. Hopecraft, Jaffrey D. Ullman, Pearson education

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: II Semester	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 202**	
2.	Course Title	**Database Management System**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core**	
4.	Pre-Requisite (if any)	Students must have the basic knowledge of computer systems and database.	
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: 1. Understand and describe the basic concepts and terminology of Database Management System. 2. Analyze and Design the database of applications using ER modelling and Normalization. 3. Evaluate business information problem and find out the data requirements of organization. 4. Demonstrate the database schema, data modelling and normalization process with the help of example. 5. Implement the database design using appropriate database tools.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	DBMS Concepts and architecture Introduction, Database approach v/s Traditional file accessing approach, Advantages, of database systems, Data models, Schemas and instances, Data independence, Data Base Language and interfaces, Overall Database Structure, Functions of DBA and designer, ER data model:Entitles and attributes, Entity types, Defining the E-R diagram,Concept of Generalization, Aggregation and Specialization. transforming ER diagram into the tables. Various other data models object oriented data Model, Network data model, and Relational data model, Comparison between the three types of models.	18
II	Relational Data models: Domains, Tuples, Attributes, Relations, Characteristics of relations, Keys, Key attributes of relation, Relational database, Schemas, Integrity constraints. Referential integrity, Intension and Extension, Relational Query languages: SQL-DDL, DML, integrity constraints, Complex queries, various joins, indexing, triggers, ssertions, Relational algebra and relational calculus, Relational algebra operations like select, Project, Join, Division, outer union. Types of relational calculus i.e. Tuple oriented and domain oriented relational calculus and its operations.	18
III	Data Base Design: Introduction to normalization, Normal forms, Functional dependency, Decomposition, Dependency preservation and losless join, problems with null valued and dangling tuples, multivalued dependencies. Query Optimization: Introduction, steps of optimization, various algorithms to implement select, project and join operations of relational algebra, optimization methods: heuristic based, cost estimation based.	18
IV	Transaction Processing Concepts: - Transaction System, Testing of Serilizability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures. Log based recovery. Checkpoints deadlock handling. Concurrency Control Techniques: - Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity. Multi version schemes, Recovery with concurrent transaction. Introduction to Distributed databases, data mining, data warehousing, Object Technology and DBMS, Comparative study of	18

	OODBMS Vs DBMS. Temporal, Deductive, Multimedia, Web & Mobile database.	
V	Study of Relational Database Management Systems through Oracle/Postgres SQL/MySQL: Architecture, physical files, memory structures, background process. Concept of table spaces, segments, extents and block. Dedicated server, multi threaded server. Distributed database, database links, and snapshot. Data dictionary, dynamic performance view.Security, role management, privilege management, profiles, invoker defined security model. SQL queries, Data extraction from single, multiple tables equi-join, non equi-join, self-join, outer join. Usage of like, any, all, exists, in Special operators. Hierarchical queries, inline queries, flashback queries. Introduction of ANSI SQL, anonymous block, nested anonymous block, branching and looping constructs in ANSI SQL. Cursor management: nested and parameterized cursors, Oracle exception handling mechanism. Stored procedures, in, out, in out type parameters, usage of parameters in procedures. User defined functions their limitations. Triggers, mutating errors, instead of triggers	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Data Base Management System by C.J. Date
2. Data Base Management System by Ullman
3. Fundamental of database system byElmasri/Navathe the Benjamin / Cunnings Publishing company inc.
4. Data base design by GioWiederhold, McGraw Hill
5. Fundamental of Data Base Management System by Leon & Leon, Vikas Publishing House Pvt. Ltd.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: II SEM	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 203**	
2.	Course Title	**Communication Skills**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Course for Ability Enhancement & skill Development (AE & SD)**	
4.	Pre-Requisite (if any)	To study this paper student must have basic knowledge of English.	
5.	Course Learning Outcomes(CLO)	• Students will develop knowledge, skills, and judgement about human communication that facilitate their ability to work. • In communication skill competencies such as managing conflict, understanding small group processes, active listening, appropriate self- disclosure etc.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures:90 Hours		
Unit	Topics	No. of Lectures
I	Definition, nature, objects, elements and importance of communication, principles and practices, models of communication, types of communication,.	18
II	**Communication Skills and Soft Skills** Interviewing and group discussion, resume preparation , etiquette and manners, self-management, body and sign language, presentation skills, feedback & questioning technique: objectiveness in argument (Both one on one and in groups).	18
III	**Concept to Effective Communication** Dimensions and directions of communication**,** means of communication, 7C's for effective communication	18
	Listening Skills Importance of listening skills, good & bad listening ,	

IV	communication channels, types of communication medium- audio, video, digital, barriers of communication.	18
V	**Public Speaking and Reporting** Effective Public Speaking and its principles, interpretation and techniques of report writing, letter writing, negotiation skills	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Reading: Business Communication- Royan and V.lesikar, John D. Pettit, JR.Richard D.Irwin, INC Business communication- K.K. Sinha Business Etiquettes – David Robinson Business communication – Dr. Nageshwar Rao and Dr. R.P. Das Effective business communication- Morphy Richards

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: II SEM	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 204 E1**	
2.	Course Title	**Theory of Computation**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of algebra. .	
5.	Course Learning Outcomes(CLO)	• Demonstrates Models, Turing Machine, Regular Expression, Push Down Automata. • Model, Compare and analyze different Computational Models. • Apply and Prove properties of Languages, Grammars and Automata. • Apply Knowledge of Computing and Mathematics to Solve Problem • Apply Mathematical Foundations, Algorithmic Principles and Computer Science Theory to the Modeling	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Automata: Basic machine, FSM , Transition graph, Transition matrix, Deterministic and nondeterministic FSM'S, Equivalence of DFA and NDFA, Mealy & Moore machines, minimization of finite automata, Two-way finite automata. Regular Sets and Regular Grammars: Alphabet, words, Operations, Regular sets, Finite automata and regular expression, Myhill-Nerode theorem Pumping lemma and regular sets, Application of pumping lemma, closure properties of regular sets.	18
II	Regular Expressions, Two-way Finite Automata, Crossing Sequence of Two way Finite Automata Finite Automata with Output, Applications of Finite Automata, Closure Properties of Regular Sets.	18
	Context Free Grammars: Motivation and Introduction, Context-free Grammars, Derivation trees and Ambiguity, Normal Forms (Chomsky Normal Form and Greibach Normal forms), Unit Production Chomsky Normal Forms, The existence of inherently ambiguous context-free	

III	languages, Closure properties of Context Free Languages, Construction of Reduced Grammars, Elimination of null production.	18
IV	Pushdown Automata: Definition of PDA, Deterministic Pushdown Automata, PDA corresponding to given CFG, CFG corresponding to a given PDA. Context Free Languages: The pumping lemma for CFL's, Closure properties of CFL's, Decision problems involving CFL's.	18
V	Turing Machines: Introduction, TM model, representation and languages acceptability of TM Design of TM, Universal TM & Other modification, Church's hypothesis, composite & iterated TM. Turing machine as enumerators. Properties of recursive & recursively enumerable languages, Universal Turing Machine.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Introduction to Automata Theory, Languages & Computation, J E Hopcraft & JD Ullman, Narosa Publications.
2. Theory of Computer Science, KLP Mishra & N Chandra Sekhar, PHI
3. Mathematical Foundations of Computer Science, Beckman
4. John C Martin, "Introdution to languages and theory of computation", McGraw Hill
5. Anami & Aribasappa , " Formal Languages and Automata Theory",Wiley India

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **40** Marks
University Exam (UE): **60** Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: II Semester	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 204-E2**	
2.	Course Title	**Internet Programming**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	Students must have the basic knowledge of Computer fundamentals.	
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: • Be able to analyze the requirements for and create and implement the principles of web page development. • Demonstrate knowledge of DOM objects that interacts with server-based programs • Be able to create and use cascading style sheets (CSS) • write well-structured, easily maintained, standards-compliant, accessible HTML code. • Be able to create and use JavaScript programs	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures

I	Introduction to Internet Programming- Client-Server model, Browsers-Graphical and Hypertext Access to the Internet, HTTP–Hyper Text Transfer Protocol (how it actually works), The Phases of Web Site Development	18
II	Creating Internet World Wide Web pages- HTML - Hypertext Markup Language , Basic HTML Concepts, HTML: Structured Language ,headers, body, html tags, tables , Text, graphics, sounds, video clips, multi- media ,Client side image mapping.	18
III	HTML forms programming: Building a form, Text fields and value, size, max length html buttons, radio, checkboxes, Selection lists. CSS: Introduction To Style sheet, types of style sheets- Inline, External, Embedded CSS, text formatting properties, CSS Border, margin properties, Positioning Use of classes in CSS, color properties, use of &	18
IV	Intro to script, types, intro of JavaScript, JavaScript identifiers, operators, control & Looping structure, Intro of Array, Array with methods, Math, String, Date Objects with methods User defined & Predefined functions, DOM objects, Window Navigator, History, Location, Event handling, Validations On Forms	18
V	Intro & features of XML, XML writing elements, attributes etc. XML with CSS, DSO, XML Namespaces XML, DTD, XML Schemas, Writing Simple sheets using XSLT, SAX & DOM Parsers, SOAP Introduction.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Joe Fawcett,Danny Ayers,Liam R.E. Quin, “Beginning XML” Wrox Press, 5th Ed., 2012
2. Deitel & Deitel, “XML how to program”, Pearson, 2000
3. Hofstetter fred , “Internet Technology at work”, Osborne pub. , ISBN : 9780072229998, 2004
4. Ivan Bayross , “HTML, DHTML, JavaScript, Perl & CGI” ,BPB pub. 3rd Ed.,2004
5. Ivan Bayross, “Web enabled commercial application development using HTML, DHTML, JavaScript, PERL-CGI”, BPB pub., 2nd Ed., 2000

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: II Sem	Year: 2018	Session: 2018-19
Subject: Computer Science				
1.	Course Code	**MSCS 205 E1**		
2.	Course Title	**Programming with Visula Basic .Net**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**		
4.	Pre-Requisite (if any)	Basic knowledge of computer and basics of any programming language.		
5.	Course Learning Outcomes(CLO)	• Design, formulate, and construct applications with VB.NET. • Integrate variables and constants into calculations applying VB.NET. • Determine logical alternatives with VB.NET decision structures. • Implement lists and loops with VB.NET controls and iteration. • Separate operations into appropriate VB.NET procedures and functions.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks:40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures:90 Hours		
Unit	Topics	No. of Lectures
I	Introduction to .NET, .NET Framework features & architecture, CLR, Common Type System, MSIL, Assemblies and class libraries. Introduction to visual studio, Project basics, types of project in .Net, IDE of VB.NET- Menu bar, Toolbar, Solution Explorer, Toolbox, Properties Window, Form	18

	Designer, Output Window, Object Browser.	
II	The VB.NET Language- Variables -Declaring variables, Data Type of variables, Forcing variables declarations, Scope & lifetime of a variable, Constants, Arrays, types of array, control array, Collections, Subroutines, Functions, Passing variable, Number of Argument, Optional Argument, Returning value from function. Control flow statements: conditional statement, loop statement. Msgbox & Inputbox.	18
III	Working with Forms : Loading, showing and hiding forms, controlling One form within another. Using MDI form. Windows Form Control (with Properties, Methods and events): Textbox, Rich Text Boxes, Label, Link Label, Button, Checkbox, Radio Button, Panel, Group Box, Picture Box, Listbox, Combobox, Check Listbox, scroll bar, Timer. Advance Controls: Menus, Context Menus , Built-in Dialog Box: OpenFileDilog, SaveFileDialog, FontDialog, ColorDialog, PrintDialog, Printing. ListView, TreeView, toolbar, StatusBar.	18
IV	Object oriented Programming: Classes & objects, constructor, destructor, inheritance. Access Specifiers, Interfaces, Polymorphism. Exception Handling: using Try, Catch, Finally, Throw Keywords. Graphics Handling: Using Graphics & Pen classes for drawing colors and figures. File Handling: Opening or Creating a File, Writing & Reading Text.	18
V	Database programming with ADO.NET – Overview of ADO, from ADO to ADO.NET, Accessing Data using Server Explorer. Creating Connection, Command, Data Adapter and Data Set with OLEDB and SQLDB. Display Data on data bound controls, display data on data grid. Generate Reports Using CrystalReportViwer.	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: **1.** VB.NET Programming Black Book by steven holzner –dreamtech publications **2.** Mastering VB.NET by Evangelos petroutsos- BPB publications **3.** Introduction to .NET framework-Worx publication

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: II Semester	Year: I Year	Session: 2018-19
Subject: Computer Science			

1.	Course Code	**MSCS 205 E2**	
2.	Course Title	**Computer System Architecture and Parallel Processing**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	Basic knowledge of functional units of a computer system.	
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: • Be familiar with various measuring tools and functional units of CPU. • Be aware about architecture of microprocessor family. • Acquire knowledge of assembly language programming. • Be aware about computer arithmetic. • Understand about various types of instruction formats and addressing modes.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100(60+40)	Min. Passing Marks:

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures:90 Hours		
Unit	Topics	No. of Lectures
I	Flynn's Classification, System Attributes to Performance, Parallel computer models Multiprocessors and multicomputer, Multivector and SIMD Computers. Data and resource dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Control flow, data flow and Demand driven mechanisms. Static interconnection networks, Dynamic interconnection Networks: Bus Systems, Crossbar Switch, Multiport Memory, Multistage and Combining Networks	18
II	Instruction set architecture, CISC Scalar Processors , RISC Scalar Processors, VLIW architecture, Memory Hierarchy, Inclusion, Coherence and Locality, Memory capacity planning. Interleaved memory organization-memory interleaving, pipelined memory access, Bandwidth and Fault Tolerance. Backplane Bus System :Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt.	18
III	Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, pipeline hazards, Dynamic instruction scheduling – score boarding and Tomosulo's algorithm, Branch handling techniques, Arithmetic Pipeline Design, Static arithmetic pipeline, Multifunctional arithmetic pipelines. Superscalar pipeline design, Super pipeline processor design.	18
IV	Cache coherence, Snoopy protocols, Directory based protocols. Message routing schemes in multicomputer network, deadlock and virtual channel. Vector Processing Principles, Vector Instruction types, Vector-access memory schemes. Vector supercomputer architecture, SIMD organization: distributed memory model and shared memory model. Principles of Multithreading: Multithreading Issues and Solutions, Multiple-Context Processors	18
V	Parallel Programming Models, Shared-Variable Model, Message-Passing Model, Data-Parallel Model, Object-Oriented Model, Functional and Logic Models, Parallel Languages and Compilers, Language Features for Parallelism, Parallel Programming Environment, Software Tools and Environments	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
1. Kai Hwang, "Advanced computer architecture", TMH. 2013 - 14 2. J.P.Hayes, "computer Architecture and organization"; MGH. 3. V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI Learning. 4. Kain,"Advance Computer Architecture: - A System Design Approach", PHI Learning 5. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing. 6. Hwang and Briggs, "Computer Architecture and Parallel Processing"; MGH.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: III SEM	Year: II Year	Session: 2019-20
Subject: Computer Science				
1.	Course Code	MSCS 301		
2.	Course Title	**Theory of Compiler Design**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core**		
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Discrete Mathematics .		
5.	Course Learning Outcomes(CLO)	• Basic knowledge of structure of compiler. • Ability to design cross compiler, finite automata and lexical analysis. • Ability to solve the derivation. • Knowledge and ability to devise, select, and use modern techniques and tools needed to design and implement compilers.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Introduction of Compiler, Major data Structure in compiler, BOOT Strapping & Porting, Compiler structure: analysis-synthesis model of compilation, various phases of a compiler, Lexical analysis: Input buffering , Specification & Recognition of Tokens, LEX. The roll of lexical analyzer, design of lexical analyzer.	18
II	Syntax analysis: CFGs, Top down parsing, Brute force approach, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, operator precedence parsing, LR parsers (SLR,LALR, LR),Parser generation.Syntax directed definitions: Construction of Syntax trees, Bottom up evaluation of S-attributed definition, L-attribute definition, Top down translation, Bottom Up evaluation of inherited attributes Recursive Evaluation, Analysis of Syntax directed definition.	18
III	Type checking: type system, specification of simple type checker, equivalence of expression, types, type conversion, overloading of functions	18

	and operations, polymorphic functions. Run time Environment: storage organization, Storage allocation strategies, parameter passing, dynamic storage allocation , Symbol table.	
IV	Intermediate code generation: Declarations, Assignment statements, Boolean expressions, Case statements, Back patching, Procedure calls Code Generation: Issues in the design of code generator, Basic block and flow graphs, Register allocation and assignment, DAG representation of basic blocks, peephole optimization, generating code from DAG.	18
V	Introduction to Code optimization: sources of optimization of basic blocks, loops in flow graphs, dead code elimination, loop optimization, Introduction to global data flow analysis, Code Improving transformations ,Data flow analysis of structure flow graph Symbolic debugging of optimized code.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

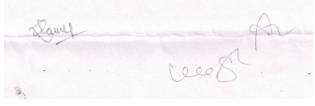
Suggested Readings:

1. Aho, ullman : Principles of compiler design.
2. Raghavan, Compiler Design, TMH Pub.
3. Louden. Compiler Construction: Principles and Practice, Cengage Learning
4. A. C. Holub. Compiler Design in C , Prentice-Hall Inc., 1993.
5. Mak, writing compiler & Interpreters, Willey Pub.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **40** Marks
University Exam (UE): **60** Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

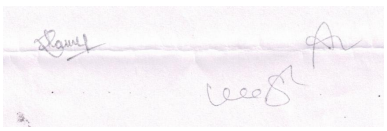


PART A: Introduction				
Program: M.Sc.		Class: III SEM	Year: II Year	Session: 2019-20
Subject: Computer Science				
1.	Course Code	**MSCS 302**		
2.	Course Title	**Data Mining and Data Warehousing**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core**		
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Data Base Management System .		
5.	Course Learning Outcomes(CLO)	• Demonstrate an Understanding and knowledge of the Data Warehousing, Data Mining and Business Intelligence • Explain the Data Analysis and Knowledge Delivery Stages. • Organize and Prepare the Data Needed for Data Mining Using Pre processing Techniques • Implement the Appropriate Data Mining Methods Like Association, Classification, Clustering • Apply Data Mining Methods to Solve Practical Problems. (Analyze the Problem Domain, Data Collection, Pre processing, Apply Suitable Data Mining Method, Interpret and Visualize the Results and Provide Decision Support.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Introduction : Data Mining: Definitions, KDD v/s Data Mining, DBMS v/s Data Mining , DM techniques, Mining problems, Issues and Challenges in DM, DM Application areas. Association Rules & Clustering Techniques: Introduction, Various association algorithms like A Priori, Partition, Pincer search etc., Generalized association rules.	18
II	Clustering paradigms; Partitioning algorithms like K-Medioid, CLARA,CLARANS; Hierarchical clustering, DBSCAN, BIRCH, CURE; categorical clustering algorithms, STIRR, ROCK, CACTUS. Other DM	18

	techniques & Web Mining: Application of Neural Network, AI, Fuzzy logic and Genetic algorithm, Decision tree in DM. Web Mining, Web content mining, Web structure Mining, Web Usage Mining.	
III	Temporal and spatial DM: Temporal association rules, Sequence Mining, GSP, SPADE, SPIRIT, and WUM algorithms, Episode Discovery, Event prediction, Time series analysis. Spatial Mining, Spatial Mining tasks, Spatial clustering, Spatial Trends.	18
IV	Data Mining of Image and Video : A case study. Image and Video representation techniques, feature extraction, motion analysis, content based image and video retrieval, clustering and association paradigm, knowledge discovery.	18
V	The vicious cycle of Data mining, data mining methodology, measuring the effectiveness of data mining data mining techniques. Market baskets analysis, memory based reasoning, automatic cluster detection, link analysis, artificial neural networks, generic algorithms, data mining and corporate data warehouse, OLA	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. Data Mining Techniques ; Arun K.Pujari ; University Press. 2. Data Mining; Adriaans & Zantinge; Pearson education. 3. Mastering Data Mining; Berry Linoff; Wiley. 4. Data Mining; Dunham; Pearson education.



Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: III SEM	Year: II Year	Session: 2019-20
Subject: Computer Science				
1.	Course Code	**MSCS 303**		
2.	Course Title	**Personality Development**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Course for Ability Enhancement & skill Development (AE & SD)**		
4.	Pre-Requisite (if any)	Students should have basic communication skills.		
5.	Course Learning Outcomes(CLO)	• To develop and exhibit and accurate sense of self. • To develop and nurture a deep understanding of personal motivation. • An understanding of and practice personal and professional responsibility. • Demonstrate knowledge of personal belief and values and a commitment to continuing personal reflection and reassessment.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	**Introduction:** Personality development- concept, types, role and impact, developing self-awareness, projecting a winning personality.	18
II	**Personality Assessment** Personality assessment and testing- resume writing- types, contents, formats, interviewing skill , group discussion, JAM sessions, persuasive communication .	18
III	**Communication Skill** Practice on oral/spoken communication skill and testing-voice and accent, feedback and questioning techniques, objectives in an argument.	18

IV	**Presentation Skills** Skills and techniques, etiquette, project/assignment presentation, role play and body language, impression management.	18
V	**Personality Development Activities** Leadership activities, motivation activities, team building activities, stress and time management techniques, creativity and ideation.	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Reading: Business Communication- Royan and V.lesikar, John D. Pettit, JR.Richard D.Irwin, INC. Personality Development and soft skills- Barun K. Mitra, Oxford Publisher. Personality Development –Rajiv K.Mishra, Rupa Publisher

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: III SEM	Year: II year	Session: 2019-20
Subject: Computer Science				
1.	Course Code	**MSCS 304 E1**		
2.	Course Title	**Object-Oriented Programming with Java**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**		
4.	Pre-Requisite (if any)	Basic knowledge of computer and C, C++ language.		
5.	Course Learning Outcomes(CLO)	• To learn why Java is useful for the design of desktop and web applications. • To learn how to implement object-oriented designs with Java. • To identify Java language components and how they work together in applications. • To design and program stand-alone Java applications. • To learn how to design a graphical user interface (GUI) with Java Swing.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Java Evolution, Overview of Java Language : Java Program Structure, Java Tokens, Java Statements, Java Virtual Machine, Command Line Arguments. Constants, Variables and Data Types : Constants, Variables, Data Types, Scope of Variables, Symbolic Constants, Type Casting. Operators : Arithmetic, Relational, Logical, Assignment, Increment & Decrement, Conditional, Bitwise, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Type Conversions in Expressions, Operator Precedence and Associativity, Mathematical Functions.	18

II	Control Statements : Java's Selection Statements : If, Switch. Iterative Statements : While, Do-while, For, Some for loop variations, Nested Loops. Jump Statements : Using breaks, Using continue, return. Classes, Objects and Methods : Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, Visibility Control, The *this* Keyword, Garbage Collection, Overloading Methods, Recursion. Arrays, Strings and Vectors.	18
III	Inheritance : Inheritance basics, Using super, Creating Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using *final* with Inheritance, The Object Class. Packages and Interfaces : Java API Packages, Using System Packages, Creating & Accessing Packages, Hiding Classes, Access Protection, Importing Packages, Interfaces : Defining, Implementing, Applying Interfaces, Variables in Interfaces. Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exception, Using try and catch, Multiple catch Clause, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions. Multithreaded Programming: Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread.	18
IV	Applet Programming : Preparing to write Applets, Building Applet Code, Applet Life Cycle, Creating and Executable Applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, Passing parameters to Applet, Aligning the Display, Displaying Numerical values, Getting input from the User.	18
V	Introductory Graphics Programming : class, Lines , Rectangle, Circles, Ellipes, Arcs, Polygons, Line Graphs. I/O in Java : Streams, stream classes, Byte and Character stream classes. I/O exceptions, Interactive I/O. JDBC Connection and Implementation, Server side programming using Servlet and JSP.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. 1. JAVA: The Complete Reference, Third Edition, P. Naughton & H. Schildt, Tata McGraw Hill.
2. Programming with Java, Second Edition, E. Balagurusamy, Tata McGraw-Hill
3. Teach Yourself JAVA, Joseph O'Neil & Herb Schildt, McGraw-Hill.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (B): Five Short Questions Section (C): Five Long Questio	04 × 05 = 20 08 × 05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class:III SEM	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS – 304 E2**	
2.	Course Title	**Network Security**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective course**	
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Computer Network.	
5.	Course Learning Outcomes(CLO)	• Explain the Principles of Cryptography and Cryptanalysis Including Symmetric and Asymmetric • Encryption, Hashing, and Digital Signatures. • Explain the Fundamental Notions of Threat, Vulnerability, Attack and Countermeasure. • Be able to Identify the Security Goals of an Information System, Point Out Contradictory Goals and Suggest Compromises. • Identify and Classify Particular Examples of Attacks. • Implement the Various Security Algorithms. • Analyze the Root Causes of Attacks &Suggest Appropriate Solution for Different Types of Security Breach Scenario.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Convention Encryption : Conventional Encryption Model , Stenography , Classical Encryption Techniques, Simplified DES , Block Cipher Principles , The Data Encryption Standard, The Strength of DES , Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of operation, Conventional	18
II	Encryption algorithms: Public Key Encryption And Hash Functions Public Key Cryptography , Principles of Public Key Cryptosystems , The RSA	18

	Algorithm , Key Management , Diffie Hellman Key Exchange , Elliptic Curve Cryptography.	
III	Message Authentication and Hash Functions Authentication Requirements, Authentication Functions, Message Authentication Codes , Hash Functions , Security of Hash Functions	18
IV	Hash And Mac Algorithms MD5 Message Digest Algorithm , Secure Hash Algorithm (SHA-I) , RIPEMD ,HMAC	18
V	Digital Signatures and Authentication Protocols Digital Signatures , Authentication Protocols -Digital Signature Standard Authentication Applications , IP Security , Web Security Intruders, Viruses and Worms Intruders , Viruses and Related Threats Firewalls Firewall Design Principles , Trusted Systems	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. William Stallings, "Cryptography and Network Security", Second edition, Prentice Hall, 1999.

2. Atul Kahate, "Cryptography and Network Security," TMH

3. William Stallings, "Cryptography and Network Security",Third Edition, Pearson Ed

4. Introduction to network security, Krawetz, Cengage

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100**

Continuous Comprehensive Evaluation (CCE): **40** Marks

University Exam (UE): **60** Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class:III SEM	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS-305 E1**	
2.	Course Title	**System Analysis and Design**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	Students must have the basic knowledge of Computer basics.	
5.	Course Learning Outcomes(CLO)	• Understand the application of software engineering approaches in software development. • Ability to plan and estimate projects. • Analyze and design software. • Produce quality software using testing and quality assurance mechanisms. • Understand the importance of software maintenance.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hour per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Overview of system analysis and design, system development life cycle, project selection, feasibility analysis, design, implementation, testing and evaluation.	18
II	Feasibility study- Technical and economical feasibility, cost and benefit analysis	18
III	System requirement specification and analysis: Fact finding techniques, Data flow diagrams, Data dictionaries, process organisation and interactions, decision analysis, decisin trees and tables.	18

IV	Detailed design- Modularisation, module specification, file design, system development involving data bases. System Control and Quality Assurance- reliability and maintenance.	18
V	Software design and documentation tools, top-down ,bottom-up and variants. Units and integration testing, testing practices and plans. System controls , Audit trails.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

1. James,A.S.: Analysis of design of Information systems,Mcgraw Hill 1986.
2. Ludeberg, M., Golkuhl, G. and hilsson,A. : Information systems development, Asystematis approach, Prentice Hall international 1981.
3. lesson,M.: System analysis and design, science research associates,1985
4. Sempriv,P.C.: System analysis-Definition Process and Design,1982
5. Richard,D.: System analysis design,Irwin Inc.1979.
6. Awad,E. Homewood : System analysis and design,Awad,Irwin 1979.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **40** Marks
University Exam (UE): **60** Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: III Semester	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS 305-E2**	
2.	Course Title	**Cloud Computing**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	Students must have the basic Knowledge of computer systems and programming.	
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: • Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing. • Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model. • Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost. • Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing. • Analyze various cloud programming models and apply them to solve problems on the cloud.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Historical development, Vision of Cloud Computing, Characteristic of Cloud Computing As Per NIST, Cloud Computing Reference Model, Cloud computing Environments, Cloud service requirements, cloud and dynamic infrastructure, cloud adaptation and rudiments. **Overview of cloud application:** ECG Analysis in the cloud, Protein Structure prediction, Gene Expression Data Analysis, Satellites Image Processing, CRM and ERP, Social networking.	18
II	**Cloud Computing Architecture:** Cloud Reference model types of cloud, cloud interpretability and standards, scalability and fault tolerance, cloud solutions, cloud eco- system, cloud business process management, cloud service management, cloud offerings, cloud analytics, testing under control, virtual desktop infrastructure.	18
III	Cloud Management and virtualization and technology Resiliency, Provisioning, Asset Management, Concepts of MAP reduce, Cloud governance, High availability and disaster recovery, virtualization, fundamentals concepts of compute storage, networking, desktop and application virtualization, virtualization benefits, sever virtualization, block and file level storage virtualization, hypervisor management software, infrastructure requirements, virtual LAN (VLAN), and virtual SAN (VSAN) and their benefits.	18
IV	**Cloud security:** Cloud information security fundamentals, cloud security services, design principles, Secure cloud software requirements, policy implementations, cloud computing security challenges, virtualization security management, cloud computing security architecture.	18
V	**Market based Management of clouds, federated clouds/ inter cloud:** Characterization and definition, Cloud federation status, third party cloud services. Case study: Google App Engine, Hadoop, Amazon, Aneka.	18

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. Tomar Saurabh, Cloud Computing, Wiley Pub. 2. Selvi : Mastermind Cloud Computing, TMH, Pub. 3. Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010 4. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski: "Cloud Computing: Principles and Paradigms", Wiley, 2011 5. Nikos Antonopoulos, Lee Gillam: "Cloud Computing: Principles, Systems and Applications", Springer, 2012

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Que Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: IV SEM	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS 401**	
2.	Course Title	**Computer Graphics and Multimedia**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core**	
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Computers.	
5.	Course Learning Outcomes(CLO)	• List out and Describe the Basic Concepts and terminologies Used in Computer Graphics • Discuss Issues Related to Emerging Electronic Technologies in concern of Graphic Design • Apply and Analyze different Approaches/ Algorithms for Drawing various graphics objects • Identify and Apply Various Geometrical Transformations Approaches • Implement Various Algorithms to Polygon Fill • Describe the Importance of Viewing and Projections • Identify Various Software systems Used in design, the Creation and Implementation of Multi-Media projects	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Overview of Graphic Systems: Display Devices, Refresh Cathode-Ray Tubes, Random-Scan and Raster-Scan Monitors, Color CRT Monitors, Direct-View Storages Tubes, Plasma-Panel Displays, LED and LCD Monitors. Hard-Copy Devices: Printers, Plotters. Interactive Input Devices.	18
II	Output Primitives: Points and Lines, Line-Drawing Algorithms, DDA Algorithm, Bresenham's Line Algorithm, Antialiasing Lines, Circle-Generating Algorithms, Circle Equations, Bresenham's Circle Algorithm, Character Generation. Attribute of Output Primitives: Line Styles, Line Types, Line Width, Line Color. Color and Intensity: Color Tables, Gray Scale. Area Filling: Scan-Line Algorithm.	18
	Two Dimensional Transformations: Basic Transformations, Translation, Scaling, Rotation. Matrix Representations and Homogeneous Coordinates.	

III	Composite Transformations: Translations, Scalings, Rotations, Scaling Relative to a Fixed Point, Rotation about a Pivot Point, General Transformation Equation. Windowing and Clipping: Windowing Concepts, Cliping Algorithms, Line Clipping, Polygon Clipping, Area Clipping, Text Clipping, Window to Viewport Transformation.	18
IV	Viewing in 3D: Three dimensional transformations, Translation, Scaling, Rotation. Matrix Representations projections: Parallel, prospective, viewpoints . Colour Model.	18
V	Introduction to Multimedia, Multimedia Components, Multimedia Hardware, SCSI, IDE, MCI, Multimedia Data and File Formats, RTF, TIFF, MIDI, JPEG, DIB, MPEG, Multimedia Tools, Presentation Tools, Authoring Tools. Computer Aided Design. Graphs Charts and Models. Computer Art, Computer Animation, Graphical User Interface, Graphics for Home use, Image Processing.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Computer Graphics, Donald Hearn and M.Pauline Baker, PHI 2nd Edition
2. Multimedia Making it Works, Third Edition: Tay Vaughan, Tata-McGraw-Hill
3. Procedural Elements of Computer Graphics, Rogers, McGraw Hill
4. Principles of Interactive Computer Graphics, Newman and Sproull, McGraw Hill
5. Mathematical Elements of Computer Graphics, Rogers, McGraw Hill

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **40** Marks
University Exam (UE): **60** Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: IV Sem	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS 402**	
2.	Course Title	**Artificial Intelligence & Expert System**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Core**	
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Computers.	
5.	Course Learning Outcomes(CLO)	• Understand concept of knowledge representation and predicate logic and transform the real life information in different representation. • Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations. • Understand state space and its searching strategies. • Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning. • Acquire the knowledge of real world Knowledge representation.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Introduction of Artificial Intelligence: What is AI ? The Importance of AI. AI and related fields. Introduction to Natural Language Processing . Basic Problem solving methods: Production systems-state space search, control strategies, Breadth first search, Depth first search, Heuristic search, Hill Climbing techniques: Best First search, forward and backward reasoning.	18
II	Knowledge : General Concepts, Definition and Importance of Knowledge, Knowledge based system, representation of Knowledge, Knowledge Organization , Knowledge Manipulation , Acquisition of Knowledge. Introduction to Expert System: Definition, Characteristics, Importance and Applications of Expert System, structure of Expert System. Case study of MYCIN & DENDRAL.	18
III	LISP AND AI PROGRAMMING LANGUAGES : Introduction to LISP : Syntax and Numeric Functions, Basic List Manipulation Functions in LISP , Functions, Predicates, and Conditionals, Input, Output, and Local Variables, Iteration and Recursion, Property List and arrays, PROGLOG and Other AI Programming Languages.	18
IV	FORMALIZED SYMBOLIC LOGICS : Introduction , Syntax and Semantics for Propositional Logic , Syntax and Semantics for FOPL , Properties of Wffs , Conversion to Clausal Form, Inference Rules , The Resolution Principle , Representations Using Rules.	18
V	Neural Network: Basic structure of neuron, perception, feed forward and back propagation, Hopfield network.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Dan W. Patterson: Introduction to Artificial Intelligence and Expert System, Prentice Hall.
2. Peter Norvig: Artificial Intelligence: A Modern Approach, Pearson New International Edition
3. Elaine Rich and Kevin Knight: Artificial Intelligence
4. Charniak, E. : Introduction of Artificial Intellegence, Narosa publ. House.
5. Winston,P.H. : LISP, NArosa publ. House.
6. clark, K.L. : Micro Prolog , Prentice Hall india.1987.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04 × 05 = 20 08 × 05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: IV SEM	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS 403**	
2.	Course Title	**Tourism Management**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Course for Ability Enhancement & skill Development (AE & SD)**	
4.	Pre-Requisite (if any)	The course is of outmost importance when the industry is poised to take a leap forward and therefore, the cause assumes greater significance for understanding the resources development, modernization syndrome in the field of tourism**.**	
5.	Course Learning Outcomes(CLO)	• The student would be able to understand fundamental of tourism from the management, marketing perspectives. • To understand the concepts of travel and tourism. • The student should understand the impact of tourism.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	**Introduction** Concept of tourism & importance in economy, types of tourism, tourism in Madhya Pradesh history and development ,Geography, Climate, Forest , River and Mountain.	18
II	**Overall Scenario** Present scenario, planning, development and opportunities. Social and Economic impact of tourism, role of public and private sector in the promotion of tourism.	18
	Tourism Resources Physical and Biographical ,Tourist satisfaction and service quality-Transport accommodation, other facilities and	

III	amenities available in Madhya Pradesh. Role of tourist service provider, heritage site in M.P.	18
IV	**Financial aspects of Tourism** Requirements of capital investment, sources of finance, Madhya Pradesh State Tourism Development Corporation Limited - funds, finance, policies, packages and its role for the development of tourism in Madhya Pradesh.	18
V	**Practical training** Case studies of popular tourist places and tourist statistics in Madhya Pradesh, Analytical studies of tourist arrivals trends.	18

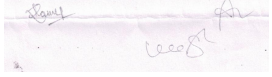
PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Reading: Ancient Geography of M.P-Bhattacharya D.K All district Gazettes of M.P Tourism planning –Gunn. Clare A

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A):Short Answer type questions Section (B): Long Answer Type Questions	04 × 05 = 20 08 × 05 = 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: IV Sem	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS 404 E1**	
2.	Course Title	**Software Engineering**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of System Analysis and Design.	
5.	Course Learning Outcomes(CLO)	Understand how to develop software, Different software designing models, project cost estimation, software testing	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks:40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Introduction to Software Engineering : Software development, and life cycle; Project size and its categories; Planning a software project.	18
II	Project control & Project team standards; Design of solution strategies; Software cost estimation and evaluation techniques.	18
III	Software Design : Various Design concepts and notations; Modern design techniques; Verification and validation methods; Documentation & implementation procedures; Performance of software systems; Software metrics and models. Documentation of Project-systems, manuals and implementation.	18



IV	Software Reliability : Definition and concept of software reliability; software errors, faults, repair and availability; Reavailability & availability models; Use of database as a study tool.	18
V	Modern Programming Language Features Relevant to Software Engineering: data abstraction, exception handling, concurrency mechanism, etc; Software development environments.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Fairley, B.E. : Software Engineering concepts, Mcgraw- Hill 1985.
2. Lewis, T.G. : Software Engineering concepts, Mcgraw Hill,1982.
3. Kernighan,B., Plauger, P. : software tools, Addison Wesley ,1976.
4. Meyers,G. : The Art of software testing, Wiley-inter- science,1979.
5. Gehani,N : Introduction of ADA, Mcgraw Hill, 1983.
6. Chatree : Software engineering concepts.
7. Hiborard : Constructing Quality software.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04 × 05 = 20 08 × 05= 40 **Total Marks: 60**

PART A: Introduction				
Program: M.Sc.		Class: IV Semester	Year: II Year	Session: 2019-20
Subject: Computer Science				
1.	Course Code	**MSCS 404 E2**		
2.	Course Title	**Design and Analysis Of Algorithm**		
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**		
4.	Pre-Requisite (if any)	Fundamentals of discrete mathematics and Programming.		
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: • Argue the correctness of algorithms using inductive proofs and invariants. • Analyze worst-case running times of algorithms using asymptotic analysis. • Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms. • Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them. • Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.		
6.	Credit Value	6 Credits		
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40	

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Introduction and Review: What is an Algorithm, Algorithm's Performance, order architecture:**Θ-Notation, O-Notation, Ω-Notation,** Algorithm Analysis: time space complexities, **Worst-case Complexity, Average-case Complexity.**	18
II	**Divide and conquer**: Structure of divide-and –conquer algorithms: examples, Binary search, quick sort, Analysis of divide and conquer, run time recurrence relations.	18
III	Graph Searching and Traversal: Overview, Traversal methods: depth first and breadth first search. **Greedy Method**: Overview of the greedy method, Minimum spanning trees, Single source shortest paths.	18
IV	**Dynamic programming**: The general method, principle of optimality, difference between dynamic programming and greedy method, Applications: optimal binary search trees, **Back tracking**: The general method, 8-queens problem.	18
V	**Branch and Bound Algorithm**: The **Branch and bound** method, FIFO and LIFO branch and bound, LC (Least Cost) search, Traveling Salesman Problem, LCBB on Traveling Salesman Problem.	18

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings:

1. Fundamentals of Computer Algorithms By Ellis Horowittz and Sartaj Sahni, Galgotia Publications.
2. Ullman "Analysis and Design of Algorithm" TMH
3. Goodman " Introduction to the Design & Analysis of Algorithms, TMH-2002
4. Sara Basse, A.V. Gelder, " Computer Algorithms, " Addison Wesley
5. T.H. Cormen, Leiserson, Rivert and stein, " Introduction of Computer algorithm, " PHI
6. E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms, " Galgotia Publication.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04× 05 = 20 08 ×05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: IV Sem	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS 405 E1**	
2.	Course Title	**Internetwork Application**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	To study this course, a student must have the basic knowledge of Computers Networks	
5.	Course Learning Outcomes(CLO)	• Familiarity with network terminologies, reference model, applications of network, design issues and computer network working. • Knowledge of Data link layer design issues, Framing, Error correction and Detection techniques. • Meaning of flow control and its methods. • Problems associated with broadcast network and multiple access control protocols. • Knowledge of LANs. • Design issues related to Network layer like routing, addressing and their protocols. • Introductory knowledge of Transport layer protocols like TCP and UDP. • Idea about client server architecture and working of DNS, HTTP and E Mail. • Security issues in computer network and Introduction to Cryptographic algorithms and Digital Signature.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	TCP/IP Model : Comparison with ISO -OSI reference model. TCP/IP Protocol Family: Transport : Transmission Control Protocol, TCP Header Format, UDP Routing : IP Addressing , limitations , Brief overview of IPV6 i.e. the next generation IP, IP header format. Network Addresses: ARP, Domain Name System (DNS), RARP.	18
II	User Services /Applications : File Transfer Protocol (FTP) : Channel Connection, Command : internal & Users, Connections, debugging option with FTP, third party transfer, anonymous FTP, FTP Servers, TFTP, Telnet, BOOTP, Gateway Protocols : brief overview of EGP, CGP & IGP, Other protocols : NFS, NIS, RPC, SMTP, SNMP.	18
III	Internet : Uses, Goals/advantages, WWW, Intranet : Goals, benefits, how TCP/IP, bridges, routers, E-mail works in an intranet, Intranet and WWW : IP Networks, HTTP, Commands, Intranet applications : Overview of Web-Servers : essential & desirable features of a web server : authentication , authorization and encryption ; proxy services ; Subnetting an intranet.	18
IV	Overview of an intranet security system : Security and access policies, Server Security, Firewalls, General Security. WAN : overview of DDS, T-1, T-3 , Frame Relay, Sonet, SMDS, ATM Services, WAN implementation, Connecting the LANs : Bridges, routers, Accessing WAN, Message handling system : X.400 & X.500 , Message Transfer Agents (MTA), Mailbox.	18
V	Development of the Socket Programming Interface : Socket Services, Creating a Socket , Binding the Socket , Connecting to the Destination , open Command , Sending Data , Receiving Data , Server Listening , Closing a Connection , Aborting a Connection , UNIX Forks. Network services - file servers, message servers , Directory servers, print servers, application servers.	18

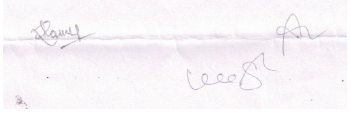
PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: 1. Douglas J. Comer : Internetworking with TCP/IP (Vol I) 2. Richard Stevens : Unix Networking

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
External Assessment: University Exam (UE) Time: 03.00 Hours	Section (A): Five Short Questions Section (B): Five Long Questions	04 × 05 = 20 08 × 05= 40 **Total Marks: 60**

PART A: Introduction			
Program: M.Sc.	Class: IV Semester	Year: II Year	Session: 2019-20
Subject: Computer Science			

1.	Course Code	**MSCS 405-E2**	
2.	Course Title	**Mobile Computing**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Elective**	
4.	Pre-Requisite (if any)	Students must have the basic knowledge of Computer fundamentals and networking.	
5.	Course Learning Outcomes(CLO)	Upon successful completion of this course, students will be able to: • Explain the principles and theories of mobile computing technologies. • Describe infrastructures and technologies of mobile computing technologies. • List applications in different domains that mobile computing offers to the public, employees, and businesses. • Describe the possible future of mobile computing technologies and applications. • Demonstrate a working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities.	
6.	Credit Value	6 Credits	
7.	Total Marks	Max. Marks : 100	Min. Passing Marks: 40

PART B: Content of the Course		
Total No. of Lectures (in hours per week): 06 Hours per week		
Total Lectures: 90 Hours		
Unit	Topics	No. of Lectures
I	Overview of the emerging fields of mobile computing; Historical perspectives (mainly from the perspective of radio), Mobile applications, Limitations, Health Concerns, Cordless phone, Land mobile vs. Satellite vs. In-building communications systems, Frequencies for radio transmission. Characteristics of Cellular Systems, Mobility support in cellular telephone networks, Personal Communications Systems/Personal Communications Networks, Wireless Personal Area Network, Wireless Local Area Network and Internet Access.	18
II	Mobile communication: Fiber or wire based transmission, Wireless Transmission - Frequencies, Signals, Antennas and Signal Propagation, Modulation Techniques, Multiplexing techniques, Coding techniques. Cellular structure, Voice Oriented Data Communication GSM, CDMA. GSM Architecture, Authentication & security, frequency hopping	18
III	Satellite Systems: History, Application, and Basics of Satellite Systems: LEO, MEO, GEO, Routing, Handover, VSAT, installation & Configuration. Cyclic repetition of data, Digital Audio Video Broadcasting, Multimedia object transfer Protocol, Wireless LAN topologies, requirements. Physical layer, MAC sub-layer, IEEE802.11.HIPERLAN: Protocol architecture, layers, Information bases and networking, Bluetooth.	18
IV	Basics of Discrete Event Simulation, Application and Experimentation, Simulation models. Case Study on Performance Evolution of IEEE 802.11 WLAN configuration using Simulation, Mobile IP, goals, assumptions requirements, entities and terminology, IP packet delivery, tunneling and encapsulation, Feature and format of IPv6, DHCP, TCP over Wireless. Characteristic of Ad Hoc networks, Applications, need for routing, routing classification, Wireless sensor networks, classification and Fundamentals of MAC protocol for wireless sensor networks.	18
V	Economical Benefits of Wireless Networks, Wireless Data Forecast, Charging issues, Role of Government, Infrastructure manufacturer, Enabling Applications Mobile operating System, HTTP versus HTML. WML,XML application for wireless handheld devices. UWB systems Characteristics, Current approaches for security.	18



PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings: **1.** Mobile Communications author Jochen Schiller, publication John Willy & Sons, Ltd. **2.** Wireless And Mobile Systems, D. P. Agrawal,Qing-An zeng, Thomson publication **3.** Android Programming (Big Nerd Ranch Guide), by Phillips, Stewart, Hardy and Marsicano. **4.** Android Programming – Pushing the limits by Hellman.

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100** Continuous Comprehensive Evaluation (CCE): **40** Marks University Exam (UE): **60** Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	20 20 **Total Marks: 40**
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