

OBE Template

Department of Computer Science

School of Mathematics and Computer Sciences

A. Vision

Vision Statement of the Department

To develop the department as a global leader in knowledge dissemination and to perform cutting edge research in computer science in compliance with international standards

B. Mission

Mission Statements of the Department

M1	To excel in transforming graduates into software experts with high degree of technical creativity and managerial skills
M2	To excel in imparting quality education using innovative best practices
M3	To train the students to take up various challenges of latest technologies in the field of computer science

C. Program Specific Outcomes (PSO)

After two years of successful completion of the program, the student will be able to achieve

PSO1	Academic competence: (i) Understand a range of programming languages such as Python, Java, R, C#, computing architecture, construction and design underlying in the field of computer science, and related disciplinary areas. (ii) Transfer the knowledge gained in the different computer science fields to solve real world problems.
PSO2	Personal and Professional Competence: (i) Perform laboratory-orientated computer programs to demonstrate different programming language concepts. (ii) Design small executable software, useful mobile application by implementing analytical and critical thinking skills and deliver it on time in the form of report and PowerPoint presentation.
PSO3	Research Competence: Research Competence: (i) Analyse the computer software requirements and design a blueprint as well as executable application. (ii) Integrate the data collected during the software development process which enhances teamwork and leadership skills.

PSO4	Entrepreneurial and Social competence: (i) Apply skills learnt in the field of Artificial Intelligence, Data mining, Machine learning, Cloud Computing, Networking and Security, Software Quality Assurance in specific areas related to health, education, banking, defence etc. (ii) Develop skills required for social interaction.
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D. Graduate Attributes for M.Sc. (Computer Science) Program

1. **Disciplinary Knowledge:** Content and pedagogical knowledge synchronised with the curriculum frameworks and policies
2. **Communication Skills:** Possess clarity in conveying the ideas
3. **Critical Thinking:** Capacity to apply analytical thought in the teaching and learning process
4. **Problem Solving:** Participate in the educational problem solving and applying the knowledge in the day-to-day professional endeavors.
5. **Cooperation:** Appreciate collaboration and cooperation among stakeholders of education.
6. **ICT Skills:** Selecting and integrating appropriate ICT skills for professional development.
7. **Ethics:** Doing what is right to society
8. **Self-Directed Learning:** Developing autonomy and self-regulation in teaching, learning and professional development.
9. **Reasoning:** Ability to interpret and draw the conclusion from qualitative/quantitative data with open-mindedness
10. **Creativity:** Ability to produce new ideas
11. **Societal and Environmental Concern:** Performing an act or solving a problem with respect to societal and environmental concern
12. **Lifelong Learning:** Understands the need for learning and practices it throughout life

E. PSO to Mission Statement Mapping

	PSO1	PSO2	PSO3	PSO4
M1	3	2	3	3
M2	3	3	2	2
M3	2	3	3	3

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

F. Program Outcomes (PO)

On the successful completion of the program, the student will be able to

PO1	Core Knowledge: Ability to apply the knowledge of mathematics, probability and statistics and computer science in real-time applications
PO2	Problem Analysis: Clear understanding of the subject related concepts and contemporary issues and apply them to formulate, design, model, and analyze complex problems.
PO3	Design and Development of Product: Ability to design a component or a product that meet the specific needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations. Demonstrate knowledge and understanding of management skills related to project management.
PO4	Design and Conduct Experiments on Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modelling to complex activities with an understanding of the limitations.
PO6	Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams.
PO7	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

G. PO to PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
PSO1	3	3	3	3	3	2	2
PSO2	3	3	3	3	3	2	2
PSO3	2	3	3	3	2	2	3
PSO4	2	2	3	3	3	3	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

Course Code	Course Name	L	T	P	Credits
MSCT11	Discrete Mathematics	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Apply Mathematical thinking, Mathematical proofs, and algorithmic thinking, in problem-solving	Apply
CO2	Learn the concept of Sets, Relations and Functions and their properties and apply in solving problems	Remember Apply
CO3	Describe mathematical induction and probability	Apply
CO4	Describe basic properties of graphs and related discrete structures, and be able to relate these to practical examples	Apply
CO5	Describe the use of group theory and its applications	Apply

b. Syllabus

Units	Content	Hrs.
I	Mathematical Logic: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.	9
II	Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering. Boolean Algebra: Boolean Functions and its Representation, Simplifications of Boolean Functions.	9
III	Counting, Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion-Exclusion Principle, Mathematical Induction, Probability, Bayes' Theorem.	9
IV	Group Theory: Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory, Polya's theory of counting, Introduction to Error Correcting Codes. Discrete Geometry: Some basic definitions, Ham-Sandwich theorem	9
V	Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs	9
	<p>Tasks and Assignments:</p> <p>✓ Each student is required to submit the assignments in time following the code of honest</p> <p>Text Books and References:</p> <ol style="list-style-type: none"> Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011. Tremblay, J.P. and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007. 	

4. Lipschutz, S. and Mark Lipson., “Discrete Mathematics”, Schaum’s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	1	2	2
CO2	3	2	2	2	0	2	1
CO3	3	3	1	1	0	2	1
CO4	3	3	3	2	1	2	2
CO5	2	2	1	1	0	1	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	2	2	2	2	2
Test	6	6	6	6	6
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Short Answer - 5 x 5= 25 marks)	5	5	5	5	5
Part – C (Essay- 5 x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 70%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO1, CO2, CO3, CO4, CO5

2	Organization 30%	Includes title, introduction, statement of the main idea with illustration and conclusion.	Includes title, introduction, statement of main idea and conclusion.	organizational tools are weak or missing	No organization	Not attended	CO1, CO2, CO3, CO4, CO5
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Course Code	Course Name	L	T	P	Credits
MSCT12	Data Structures and Algorithms	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Understand the concepts of algorithm analysis and solving recurrence relations	Understand Apply Analyze
CO2	Learn linear and non-linear data structures and their usage in applications	Understand Apply Analyze
CO3	Understand and Analyze various searching and sorting algorithms	Understand Analyze
CO4	Applying greedy and dynamic approaches to solve challenging problems	Apply Analyze Create
CO5	Understand computational complexity classes and their importance in designing algorithms	Remember Understand Create Evaluate

b. Syllabus

Units	Content	Hrs.
I	Introduction – linear and non linear data structures – Arrays – Structures – Stack – Queue - Representing Stacks and Queue - Linked lists and its different types – Application of stacks, queues and lists.	9
II	Trees – binary tree - binary search trees - querying a binary search tree – insertion – deletion -union-find operations – AVL trees - Graphs - Undirected and Directed Graphs - Elementary graph algorithms – minimum spanning trees – single source shortest paths – All-pairs shortest paths	9
III	The role of algorithms in computing; algorithm analysis – computational tractability- asymptotic order of growth - survey of common running times - Big O notation; sorting and searching - algorithm analysis techniques –quick sort – heaps - Maintaining the heap property- building a heap – the heap sort algorithm -sorting in linear time – recurrences	9
IV	Divide and conquer- The maximum-subarray problem - Strassen’s algorithm for matrix multiplication; greedy algorithms - An activity-selection problem - Elements of the greedy strategy; dynamic programming - Rod cutting - Matrix-chain multiplication	9
V	Linear Programming - Standard and slack forms - simplex algorithm. NP-Hard And NP-Complete Problems – Basic concepts; NP-HARD GRAPH PROBLEMS – Clique Decision Problem(CDP); NP-HARD SCHEDULING PROBLEMS - Scheduling Identical Processors	9
	Tasks and Assignments: ✓ Each student is required to submit the assignments in time following the code of honest	

	<p>Text Books and References:</p> <ol style="list-style-type: none"> 1. T.H. Cormen, C.E. Leiserson, and R.L. Rivest: Introduction to algorithms, Prentice-Hall (1998). 2. J. Kleinberg and E. Tardos: Algorithm design, Pearson/Addison-Wesley (2006). 3. Jean Paul Tremblay and Paul G. Sorenson, An Introduction to data structures, with applications 2nd edition, Tata McGraw-Hill, 2001 4. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++ (English) 3rd Edition, Addison-wesley, Third Indian Reprint, 2007 5. V. Aho, J. E. Hopcroft, and J. D. Ullman, Data Structures and Algorithms, Addison-Wesley, Reading, Massachusetts, 1983. 6. R. L. Kruse, Data Structures and Program Design in C., Prentice Hall of India, New Delhi, 1994. 7. Ellis Horowitz, Sartaj Sahni and Susan Anderson, Fundamentals of Data Structures using C, Computer Science Press, 1993 	
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c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	1	2	2
CO2	3	3	3	3	2	2	2
CO3	3	3	3	3	2	2	2
CO4	3	3	3	3	2	2	2
CO5	3	3	3	3	3	3	3

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

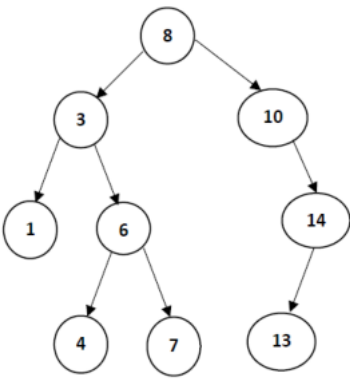
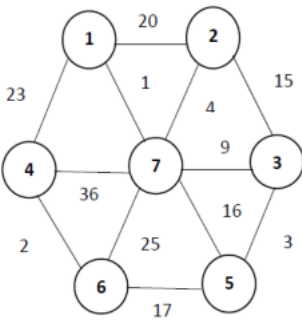
	CO1	CO2	CO3	CO4	CO5
Test	8	8	8	8	8
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (5 * 3 = 15 marks)	3	3	3	3	3
Part – B (5 * 9 = 45 marks)	9	9	9	9	9
Total	12	12	12	12	12

g. Model Question Paper

Sl. No.	Model Questions	Specification	Level		
Part – A (5 * 3 = 15 marks)					
1	(a) Identify suitable data structure for job scheduling problem. (1)	Recall	Remember		
	(b) Define the operations associated with complexity (2)	Recall	Remember		
2	(a) Draw a complete graph with 6 vertices labelled A to F. (1)	Draw	Skill		
	(b) Represent the adjacent matrix and adjacency list for the resultant graph. (2)	Solve	Apply		
3	Solve the following recurrence relation $T(n) = T\left(\frac{n}{4}\right) + T\left(\frac{n}{2}\right) + \theta(n^2)$ using the recurrence tree method and calculate the running time.	Solve	Apply		
4	(a) Dynamic Programming approach is faster than Greedy approach. State True or False and give a valid reason. (1)	Examine	Evaluate		
	(b) When would you select a dynamic programming approach to solve a problem? Give reason. (2)	Distinguish	Analyze		
5	(a) Define Hamiltonian Cycle with an example. (2)	Recall	Remember		
	(b) State whether finding a Hamiltonian cycle in a given graph is NP-Complete or not? (1)	Recall	Remember		
Part – B (5 * 9 = 45 marks)					
6	Convert the following expressions in infix notation to prefix notation in a step-by-step manner. (a) $((P+Q)*(R-S))$ (b) $E * F + G / H$ (c) $(I - J/K) * (I/L-M)$	Solve	Apply		
	OR				
	a) Create a single linked list that has elements in the sequence $1 \rightarrow 3 \rightarrow 5 \rightarrow 7 \rightarrow /$. Write pseudo code for insertion. (5) b) Differentiate between an array and a list. (4)	Apply Compare	Understand Understand		
7	(a) Insert the node 2 in the Binary Search Tree given in Figure – 1. (2) (b) Delete the node 3 from the Binary Search Tree given Figure – 1. (3) (c) Write the Insert procedure and determine the complexity (4)	Solve	Apply		
	OR				
	Determine the minimum spanning tree for the graph given in Figure – 2 using Kruskal's algorithm.	Solve	Apply		
8	For each of the following program fragments, give an analysis of the running time and briefly explain the reason.				
	<table border="0" style="width: 100%;"> <tr> <td style="width: 33%; vertical-align: top;"> a. Sum=0; for(i=0;i<n;i++) for(j=0;j<n*n;j++) sum++; </td> <td style="width: 33%; vertical-align: top;"> b. Sum=0; for(i=0;i<n;i++) for(j=0;j<i*i;j++) if(j%i==0) for(k=0;k<j;k++) sum++; </td> <td style="width: 33%; vertical-align: top;"> c. int count = 0; for(i=n/2; i<=n; i++) for(j=1;j<=n;j=2*j) for(k=1;k<=n;k=k*2) count++; </td> </tr> </table>	a. Sum=0; for(i=0;i<n;i++) for(j=0;j<n*n;j++) sum++;	b. Sum=0; for(i=0;i<n;i++) for(j=0;j<i*i;j++) if(j%i==0) for(k=0;k<j;k++) sum++;	c. int count = 0; for(i=n/2; i<=n; i++) for(j=1;j<=n;j=2*j) for(k=1;k<=n;k=k*2) count++;	Examine
a. Sum=0; for(i=0;i<n;i++) for(j=0;j<n*n;j++) sum++;	b. Sum=0; for(i=0;i<n;i++) for(j=0;j<i*i;j++) if(j%i==0) for(k=0;k<j;k++) sum++;	c. int count = 0; for(i=n/2; i<=n; i++) for(j=1;j<=n;j=2*j) for(k=1;k<=n;k=k*2) count++;			

	OR		
	Solve the recurrences given for the worst-case running time. a. $T(1) = 1$ for all $n \geq 2$ $T(n) = 3T(n-1) + 2$ b. $T(1) = 1$ for all $n \geq 2$ (n is a power of 2) $T(n) = 3T(n/2) + n^2 - n$ c. $T(1) = 1$ for all $n \geq 2$ (n is a power of 2) $T(n) = 2T(n/2) + 6n - 1$	Solve	Apply
	Determine the product of two matrices given using Strassen's Matrix Multiplication Algorithm. $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$	Recall	Remember
	OR		
9	Given value vector as $[60 \ 100 \ 220]^T$ and weight vector $[10 \ 20 \ 30]^T$ and total knapsack capacity as 50, place the items in the knapsack in such a way that the maximum valuable items are placed. Determine the solution using Dynamic Programming and Greedy approach and comment on the result.	Determine	Apply
	(a) Differentiate between Decision Problems and Optimization Problems. (5) (b) How do you determine the solution of a decision problem A if you do not know the procedure for determining its solution?	Compare Predict	Understand Evaluate
10	OR		
	Define any three pairs of related problems where one is solvable in polynomial time and the other is NP-Complete.	Recall	Remember
	 <p style="text-align: center;">Figure – 1 Binary Search Tree</p>  <p style="text-align: center;">Figure – 2 Graph</p>		

Course Code	Course Name	L	T	P	Credits
MSCT13	Computer Organization	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Describe the fundamental organization of a computer system	Understand
CO2	Understand the organization of control units, and pipelining operations	Understand
CO3	Understand memory cells, different kinds of memory, address translation, and memory management	Understand
CO4	Learn input and output systems, I/O devices, ports, and bus organization	Remember
CO5	Compare Multi-core processors, and GPUs.	Analyze

b. Syllabus

Units	Content	Hrs.
I	BASIC STRUCTURE OF COMPUTERS Function and structure of a computer, Interconnection of components, Performance of a computer. Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.	9
II	PROCESSING UNIT AND PIPELINING Organization of a processor - Registers, ALU and Control unit, Arithmetic Units - addition, subtraction, multiplication, division, floating point units - Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Micro programmed control unit. Pipelining, Hazards, Overcoming hazards	9
III	MEMORY SUBSYSTEM Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Memory management unit - Concept of virtual memory, Address translation, Hardware support for memory management.	9
IV	INPUT/OUTPUT SUBSYSTEM Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O, Interrupt controlled I/O and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, I/O peripherals - Input devices, Output devices, Secondary storage devices.	9
V	PARALLELISM ILP, Dynamic scheduling, Introduction to Multi-core processors, GPUs.	9
	<p>Tasks and Assignments:</p> <p>✓ Each student is required to submit the assignments in time following the code of honest</p> <p>Text Books and References:</p> <p>1. Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, by David Patterson & John Hennessy, 2013, Morgan-Kaufmann.</p>	

	2. Carl Hamacher, Zvonko Vranesic, Safwa 3. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016. 4. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998. t Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.	
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c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	0	1	1
CO2	3	2	2	1	0	1	1
CO3	3	2	2	2	2	1	2
CO4	2	3	3	2	1	2	1
CO5	3	3	2	2	1	1	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	2	2	2	2	2
Test	6	6	6	6	6
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Short Answer - 5 x 5 = 25 marks)	3	3	3	3	3
Part – C (Essay- 5 x 7 = 35 marks)	9	9	9	9	9
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO1, CO2, CO5
2	Organization 50%	Includes title, introduction, statement of the main idea with illustration and conclusion.	Includes title, introduction, statement of main idea and conclusion.	organizational tools are weak or missing	No organization	Not attended	CO1, CO2, CO5

Course Code	Course Name	L	T	P	Credits
MSCT14	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

a. Course Outcome (CO)

	Course Outcome	Level
CO1	Identify the basic concepts and apply relational database theory and recognize and identify the use of normalization and functional dependency, indexing technique used in database design.	Remember
CO2	Describe relational algebra expression, tuple and domain relation expression for queries and query processing concepts	Understand
CO3	Apply and relate the concept of transaction, concurrency control and recovery in database.	Apply
CO4	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.	Analyze
CO5	Understand various concepts like Parallel, distributed and object-oriented databases.	Understand

b. Syllabus

Units	Content	Hrs.
I	File System versus DBMS – Advantages -Views – Data models – Database languages – Architecture – E-R Model – Conceptual design with E-R – Extended E-R - Relational Model - Codd’s rule - Keys – Constraints – Relational database design – Anomalies - Functional dependencies – 1NF to 5NF – Decomposition – Denormalization.	9
II	Relational Query Languages – Relational Algebra – Tuple and domain Relational Calculus – SQL – Query processing and optimization – Transformation of relational expressions – Evaluation plans	9
III	Transaction – Properties – Concurrent execution – Serializability – Concurrency control – Protocols – Recovery System – Database Security	9
IV	File organization – Organization of records in files – Indexing – B tree and B+ tree index files – Static hashing – Dynamic hashing	9
V	Parallel and distributed databases – Object-based databases - Mobile databases - XML and Web databases – Intelligent databases – Mongo DB – NOSQL – PostgreSQL	9
	References A. Silberchatz, F. Korth, and S. Sudarshan, "Database System Concepts", Fourth Edition, McGraw Hill, 2002. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Third Edition, Pearson Education, 2000.	

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	1	1	2
CO2	3	2	3	2	1	1	2
CO3	3	2	2	2	3	1	3
CO4	3	2	2	2	1	1	1
CO5	1	2	2	2	1	1	1

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	-	2	-	-	-
Seminar	-	-	-	2	-
Test	8	6	8	6	8
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Objective - 10 x 1 = 10 marks)	2	2	2	2	2
Part – B (Short Answer - 5 x 3 = 15 marks)	3	3	3	3	3
Part – C (Essay- 5 x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO2

2	Organization 50%	Includes title, introduction, statement of the main idea with illustration and Conclusion.	Includes title, introduction, statement of main idea and Conclusion.	organizational tools are weak or missing	No organization	Not attended	CO2
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h. Rubric for Seminar

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Knowledge and Understanding 50%	Exceptional knowledge of facts, terms, and concepts	Detailed knowledge of facts, terms, and concepts	Considerable knowledge of facts, terms, and concepts	Minimal knowledge of facts, terms, and concepts	Not Attended	CO4
2	Presentation 50%	Well Communicated with logical sequences, examples, and references	Communicated with sequences	Just Communicated	No coherent communication	Not Attended	CO4

i. Model Question Paper

Sl. No.	Model Questions	Specification	Level
	Part – A: Objective Type Multiple Choice Marks: 10 x 1 = 10		
1	Fields in Relational Database terminology mean: a) Attributes b) Records c) Element d) Data	Recognize	Remember
2	Primary key in a relation should be : a) Not null b) Unique c) Unique and not null d) Unique and null	Recall	Remember
3	Which of the following can be a multi-valued attribute ? a) Phone_number	Recognize	Remember

	b) Name c) Date_of_birth d) All of the mentioned		
4	Which of the following operation is used if we are interested in only certain columns of a table? a) PROJECTION b) SELECTION c) UNION d) JOIN	Recognize	Remember
5	Data integrity constraints are used to: a) Control who is allowed access to the data b) Ensure that duplicate records are not entered into the table c) Improve the quality of data entered for a specific property (i.e., table column) d) Prevent users from changing the values stored in the table	Recognize	Remember
6	Why are certain FD called as trivial FD.	Recognize	Remember
7	Two relations to be joined into a third relation if	Recall	Remember
8	Write note on various types of cardinality mapping	Recall	Remember
9	When not use databases	Identify	Remember
10	Can we have multiple index for the same relation. Explain	Identify	Remember
	PART – B Short Answer The answer should not exceed 200 words Marks:5 x 3 = 15		
11	Explain Entity, attribute and relationship with example.	Explain	Understand
12	What is the difference between a key and a functional dependency?	Difference	understand
13	Which functional dependencies violate 3NF?	Explain	Apply
14	Consider a relation scheme R = (A, B, C, D, E, H) on which the following functional dependencies hold: {A→B, BC→D, E→C, D→A}. What are the candidate keys of R?	Assess	skill
15	Write short notes on object oriented databases	Explain	Understand
	PART – C Essay Answer The answer should not exceed 400 words Marks:5 x 7 = 35		
16	A. Discuss the advantages and dis advantages of DBMS over FILE management systems (OR) B. Explain the Algorithm for converting ER diagram to Relational model	Explain	Understand
17	A. Let R =(A, B, C), and let r1 and r2 both be relations on schema R. Give an expression in the domain relational calculus that is equivalent to each of the following: a) $\Pi_A(r1)$	Assess	Skill

	<p>b) $\sigma_{B=17}(r_1)$ c) $r_1 \cup r_2$ d) $r_1 \cap r_2$ e) $r_1 - r_2$</p> <p>(OR)</p> <p>B. Write short notes on QBE</p>		
18	<p>A. Write in detail about Aggregate operations in SQL (OR) B. Write short notes on Nested queries in SQL</p>	Explain	understand
19	<p>A. Write in detail about various Normal forms (OR) B. Describe the trade-offs that a database designer needs to consider when deciding whether or not to store data in normalized or de-normalised tables</p>	Explain	understand
20	<p>A. Explain about Parallel databases and distributed databases. (OR) B. Suppose you are given a relation R with four attributes $ABCD$. For each of the following sets of FDs, assuming those are the only dependencies that hold for R, do the following: (a) Identify the candidate key(s) for R. (b) Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF).,</p> <ol style="list-style-type: none"> 1. $C \rightarrow D, C \rightarrow A, B \rightarrow C$ 2. $B \rightarrow C, D \rightarrow A$ 3. $ABC \rightarrow D, D \rightarrow A$ 4. $A \rightarrow B, BC \rightarrow D, A \rightarrow C$ 5. $AB \rightarrow C, AB \rightarrow D, C \rightarrow A, D \rightarrow B$ 	Assess	Skill

Course Code	Course Name	L	T	P	Credits
MSCT15	INTRODUCTION TO PROGRAMMING	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO 1	Understand the fundamental concepts of python and its main components.	Understand
CO 2	Develop (Read and Write) python programs using variables, assignments, and conditional statements using functions.	Create
CO 3	Illustrate and implement different data structures.	Analyze
CO 4	Demonstrate Object-oriented concepts and file handling.	Analyze
CO 5	Analyze and plot data using python visualization libraries.	Analyze

b. Syllabus

Units	Content	Hrs.
I	Introduction to an interpreter programming language, with its basic constructions (variables, assignment, control primitives) and its main components (text editor and interpreter, or one EDI)	9
II	Programming concepts · Algorithms – Basics	9
III	Data Structures in Python	9
IV	Exception – Object Orientated Concepts (Basics), File Handling	9
V	Graph Plotting	9
	Text Book: · Python in easy steps, McGraw Hill, 2nd Reprint , 2014 · Python 3 Documentation, https://docs.python.org/3/ . References: · Philips Dusty, Python 3, Object Oriented Programming , 2010	

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	3	1	2
CO2	3	3	2	3	3	1	2
CO3	3	3	2	3	3	1	2
CO4	3	3	3	3	3	1	2
CO5	3	3	3	2	3	2	2

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Seminar	-	-	2	2	-
Test	8	8	6	6	8
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Objective - 10 x 1 = 10 marks)	2	2	2	2	2
Part – B (Short Answer - 5 x 3 = 15 marks)	3	3	3	3	3
Part – C (Essay- 5x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Seminar

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	<u>Content - Knowledge & understanding</u> a)Relevance to the Topic b)Organization and Structure c)Good Conclusions with d)References e) Audio and 50%	Exceptional knowledge of facts, terms, and concepts	Detailed knowledge of facts, terms, and concepts	Considerable knowledge of facts, terms, and concepts	Minimal knowledge of facts, terms, and concepts	Not Attended	CO3, CO4
2	<u>Presentation & Delivery</u> a) Voice b) Confidence c) Viva 50%	Well Communicated with logical sequences, examples, and references	Communicated with sequences	Just Communicated	No coherent communication	Not Attended	CO3, CO4

h. Model Question Paper

Sl. No.	Model Questions	Specification	Level
	Part – A: Objective Type Multiple choice 10 x 1 = 10		
1	Which of the following is not a feature of python? a) Interpreted Language b) Portable c) Case Insensitive d) High-level language	Recall	Remember
2	Find the output of the following code _____ if (1 + 3 == 7): print("Hello") else: print("Hai") Hai	Recognize	Remember
3	What will be the value of the following Python expression? 4 + 3 % 5 a) 7 b) 2 c) 4 d) 1	Recognize	Understand
4	What will be the output of the following code? a = 3 b = 1 print(a, b) a, b = b, a print(a, b) a) 3 1 b) 1 3 c) 1 3 d) 1 3	Recognize	Understand
5	What will be the output of the following code? day = ["Sunday", "Monday", "Tuesday", "Wednesday"]; print(day[-3:-1]) a) ['Monday', 'Tuesday'] b) ['Sunday', 'Monday'] c) [' Tuesday ', 'Wednesday'] d) [' Tuesday ', 'Monday']	Recognize	Remember
6	What will be the output of the following code? l = [None] * 10 print(len(l)) a) 0 b) 10 c) syntax error d) None	Examine	Analyze
7	Tuple is immutable list. a) Yes b) No	Recall	Understand
8	Which of the following are libraries in Python? a) NumPy b. Pandas c) Matplotlib d) All of the above	Recall	Remember

9	_____ is used when data is in Tabular Format. a) NumPy b) Pandas c) Matplotlib d) All of the above	Identify	Understand
10	What will be the output of the following code? def num(): try: print(1) finally: print(2) num() a) 1 2b) 1 c) 2 d) none	Identify	Analyze
PART – B Short Answer Answer any Five questions 5 x 3 = 15			
1	Differentiate break and continue statements in python.	Differentiate	Understand
2	Write a python program using functions to find the maximum among two numbers (value returning function)	Write	Create
3	Use set data structure to determine whether an element is in the set or not.	Use	Remember
4	Interpret Files operations with examples.	Interpret	Apply
5	Discuss the Matplotlib usage in python.	Discuss	Remember
PART – C Essay Answer 5x 7= 35 Answer any Five questions			
1	Illustrate any two looping constructs in python	Illustrate	Analyze
2	Write a python program to generate the first “N” Fibonacci numbers (Each number is the sum of the preceding two numbers).	Write	Create
3	Analyse dictionary in python with examples	Write	Create
4	Examine the use of try and except blocks in python with suitable examples.	Examine	Analyze
5	Explain the operations that can be performed in NumPy.	Explain	Understand

Course Code	Course Name	L	T	P	Credits
MSCT 21	OPERATING SYSTEMS	3	0	0	3

a. Course Outcome (CO)

	Course Outcome	Level
CO 1	Understand the functions, features, and concepts of operating systems.	Remember
CO 2	Learn the concept of process and Analyze the Inter Process Communication methods	Understand
CO 3	Analyze the scheduling algorithms and deadlocks	Apply
CO 4	Understand the concept of memory management	Analyze
CO 5	Evaluate security mechanisms in operating computing systems	Skill

b. Syllabus

Units	Content	Hrs.
I	OVERVIEW Introduction to operating systems – Computer system organization, architecture – Operating system structure, operations – Process, memory, storage management – Protection and security – Distributed systems – Computing Environments – Open-source operating systems – OS services – User operating-system interface – System calls – Types – System programs – OS structure – OS generation – System Boot – Process concept, scheduling – Operations on processes – Cooperating processes – Inter-process communication – Examples – Multithreading models – Thread Libraries – Threading issues – OS examples.	9
II	PROCESS MANAGEMENT Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple processor scheduling – Operating system examples – Algorithm Evaluation – The critical section problem – Peterson’s solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock detection – Recovery from deadlock.	9
III	STORAGE MANAGEMENT Memory Management – Swapping – Contiguous memory allocation – Paging – Segmentation – Example: The Intel Pentium - Virtual Memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing.	9
IV	I/O SYSTEMS File concept – Access methods – Directory structure – File-system mounting –Protection – Directory implementation – Allocation methods – Free-space management – Disk scheduling – Disk management – Swap-space management – Protection.	9
V	CASE STUDY The Linux System – History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication – Network Structure – Security – Windows 7 – History – Design Principles – System Components – Terminal Services and Fast User – File system – Networking.	9

	References: 1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts”, 9th edition John Wiley & Sons Inc., 2012. 2. Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Addison Wesley, 2014. 3. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education”, 1996. 4. D M Dhamdhere, “Operating Systems: A Concept-based Approach”, Second Edition, Tata McGraw-Hill Education, 2007. 5. William Stallings, “Operating Systems: Internals and Design Principles”, Seventh Edition, Prentice Hall, 2011	
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c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	2	1	1	2
CO2	3	2	3	2	1	1	2
CO3	3	3	2	2	3	1	3
CO4	3	2	2	2	1	1	1
CO5	3	2	3	3	1	1	3

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	-	-	2	-	-
Seminar	-	-			2
Test	8	8	6	8	6
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Objective - 10 x 1 = 10 marks)	2	2	2	2	2
Part – B (Short Answer - 5 x 3 = 15 marks)	3	3	3	3	3
Part – C (Essay- 5 x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO3
2	Organization 50%	Includes title, introduction, statement of the main idea with illustration and Conclusion.	Includes title, introduction, statement of main idea and Conclusion.	organizational tools are weak or missing	No organization	Not attended	CO3

h. Rubric for Seminar

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Knowledge and Understanding 50%	Exceptional knowledge of facts, terms, and concepts	Detailed knowledge of facts, terms, and concepts	Considerable knowledge of facts, terms, and concepts	Minimal knowledge of facts, terms, and concepts	Not Attended	CO5
2	Presentation 50%	Well Communicated with logical sequences, examples, and references	Communicated with sequences	Just Communicated	No coherent communication	Not Attended	CO5

i. Model Question Paper

Sl. No.	Model Questions	Specification	Level
	Part – A: Objective Type Multiple Choice Marks: 10 x 1 = 10		
1	In which one of the following page replacement policies, Belady's anomaly may occur? (A) FIFO (B) Optimal (C) LRU (D) MRU	Recognize	Remember
2	Which of the following is NOT a valid deadlock prevention scheme? (A) Release all resources before requesting a new resource (B) Number the resources uniquely and never request a lower numbered resource than the last one requested. (C) Never request a resource after releasing any resource (D) Request and all required resources be allocated before execution.	Recall	Remember
3	The essential content(s) in each entry of a page table is / are (A) Virtual page number (B) Page frame number (C) Both virtual page and page frame number (D) Access right information	Recognize	Remember
4	A critical section is a program segment (A) which should run in a certain specified amount of time (B) which avoids deadlocks (C) where shared resources are accessed (D) which must be enclosed by a pair of semaphore operations, P and V	Recognize	Remember
5	A counting semaphore was initialized to 10. Then 6 P (wait) operations and 4V (Signal) operations were completed on this semaphore. The resulting value of the semaphore is (A) 0 (B) 8 (C) 10 (D) 12	Recognize	Remember
6	System calls are usually invoked by using (A) a software interrupt (B) polling (C) an indirect jump (D) a privileged instruction	Recognize	Remember
7	Which of the following actions is/are typically not performed by the operating system when switching context from process A to process B? (A) Saving current register values and restoring saved register values for process B.	Recall	Remember

	(B) Changing address translation tables. (C) Swapping out the memory image of process A to the disk. (D) Invalidating the translation look-aside buffer.		
8	The first fit, best fit and worst fit are strategies to select a _____. (A) process from a queue to put in memory (B) processor to run the next process (C) free hole from a set of available holes (D) All of these	Recall	Remember
9	Which of the following memory allocation scheme suffers from external fragmentation? (A) Segmentation (B) Pure demand paging (C) Swapping (D) Paging	Identify	Remember
10	Resources are allocated to the process on non-sharable basis is (A) Mutual exclusion (B) Hold and wait (C) no Pre-emption (D) Circular wait	Identify	Remember
PART – B Short Answer The answer should not exceed 200 words Marks: 5 x 3 = 15			
11	What is a process? Explain the context switching process.	Explain	Understand
12	Why is SJF or SRTF scheduling difficult to implement in a real OS? Give an alternative approach <i>with the same goals</i> that can be implemented easily in a real OS.	Difference	understand
13	Consider a memory system with a cache access time of 10ns and memory access of 200ns. for hit rate of 50%., what is the effective access time for the memory?	Explain	Apply
14	Write short note on demand paging	Explain	Understand
15	Explain the security issues in windows 7.	Explain	Understand
PART – C Essay Answer The answer should not exceed 400 words Marks: 5 x 7 = 35			
16	A. Write note on Process, PCB, process state and state transition diagram..	Explain	Understand

	(OR) B. Explain various schedulers and scheduling criteria in detail.																				
17	<p>A. Consider the following set of processes assigned with CPU burst time in milliseconds (ms). Assume that the processes: P1, P2, P3, P4, P5 and P6 have arrived in the same order at time t=0,</p> <table border="1" data-bbox="411 568 901 837"> <thead> <tr> <th>Process</th> <th>Burst time</th> <th>Priority</th> </tr> </thead> <tbody> <tr> <td>P1</td> <td>10</td> <td>3</td> </tr> <tr> <td>P2</td> <td>1</td> <td>1</td> </tr> <tr> <td>P3</td> <td>2</td> <td>3</td> </tr> <tr> <td>P4</td> <td>1</td> <td>4</td> </tr> <tr> <td>P5</td> <td>5</td> <td>2</td> </tr> </tbody> </table> <p>Identify the Turnaround time and Waiting time for each Process for First Come First Served (FCFS), Shortest Job First (SJF), Non Pre-emptive priority, Round Robin (quantum=1). (OR)</p> <p>B. What is a Critical Section? List the requirements (properties) that a solution to this Problem has to satisfy? Discuss in detail Peterson solution to critical section Problem</p>	Process	Burst time	Priority	P1	10	3	P2	1	1	P3	2	3	P4	1	4	P5	5	2	Assess	Skill
Process	Burst time	Priority																			
P1	10	3																			
P2	1	1																			
P3	2	3																			
P4	1	4																			
P5	5	2																			
18	<p>A. Given memory partitions of 100k, 500k, 200k, 300k, and 600k (in order), apply first fit and best fit algorithms to place processes with the space requirement of 212k, 417k, 112k and 426k (in order)? Which algorithm makes the most effective use of memory? (10)</p> <p>(OR)</p> <p>B. Write in detail about any three page replacement algorithms</p>	Explain	understand																		
19	<p>A. Explain various RAID Levels in detail.(10)</p> <p>(OR)</p> <p>B. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from the current head position, what is the total</p>	Assess	Skill																		

	distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling algorithms? FCFS, SSTF, SCAN, LOOK, C-SCAN, C-LOOK		
20	A. Write in detail about design principles of linux systems (OR) B. Write short note on protection in windows	Explain	understand

Course Code	Course Name	L	T	P	Credits
MSCT22	NETWORKS	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO 1	Describe the fundamental concepts of Networking and Physical layer	Remember
CO 2	Understand details and functionality of Data link layer.	Understand
CO 3	Analyze switching protocols and routing algorithms	Analyze
CO 4	Analyze features, services and operations of various protocols of TCP/IP suite	Analyze
CO 5	Identify various application layer protocols and its functions	Skill

b. Syllabus

Units	Content	Hrs.
I	APPLICATION LAYER Network Architecture – Layers - HTTP – DNS – E-Mail (SMTP, MIME, POP3, IMAP, Web Mail), FTP, Telnet - SNMP.	9
II	TRANSPORT LAYER User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Details - Flow Control – Congestion Control – Queuing Discipline - Introduction to Quality of services (QOS).	9
III	NETWORK LAYER Circuit Switching - Packet Switching - Virtual Circuit Switching – IP – ARP – DHCP – ICMP – Routing – RIP – OSPF – Subnetting – CIDR – Interdomain Routing – BGP – IPV6 Basic Features – Multicast – Congestion Avoidance in Network Layer.	9
IV	DATA LINK LAYER Channel access on links – TDMA – FDMA – CDMA – Hybrid Multiple Access Techniques – Issues in the Data Link Layer – Framing - Error correction and detection – Link Level Flow Control – Medium Access – Ethernet – Token Ring – FDDI – Wireless LAN – Bridges and Switches.	9
V	PHYSICAL LAYER Data Transmission – Transmission Media – Signal Encoding Techniques – Multiplexing – Spread Spectrum.	9
	References: 1. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Sixth Edition, Pearson Education, 2012. 2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012. 3. William Stallings, “Data and Computer Communications”, Eighth Edition, Pearson Education, 2011 4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach “, McGraw Hill Publisher, 2011. 5. Behrouz A. Forouzan, “Computer Networks - A top-down approach”, Tata McGraw-Hill, 2012.	

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	1	1	1	3
CO2	3	2	3	1	1	1	3
CO3	3	3	3	2	3	1	1
CO4	3	3	2	1	1	1	3
CO5	3	2	3	1	1	1	3

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	-	-	2	-	-
Seminar	-	-			2
Test	8	8	6	8	6
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Objective - 10 x 1 = 10 marks)	2	2	2	2	2
Part – B (Short Answer - 5 x 3 = 15 marks)	3	3	3	3	3
Part – C (Essay- 5 x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO3

2	Organization 50%	Includes title, introduction, statement of the main idea with illustration and Conclusion.	Includes title, introduction, statement of main idea and Conclusion.	organizational tools are weak or missing	No organization	Not attended	CO3
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h. Rubric for Seminar

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Knowledge and Understanding 50%	Exceptional knowledge of facts, terms, and concepts	Detailed knowledge of facts, terms, and concepts	Considerable knowledge of facts, terms, and concepts	Minimal knowledge of facts, terms, and concepts	Not Attended	CO5
2	Presentation 50%	Well Communicated with logical sequences, examples, and references	Communicated with sequences	Just Communicated	No coherent communication	Not Attended	CO5

i. Model Question Paper

Sl. No.	Model Questions	Specification	Level
	Part – A: Objective Type Multiple Choice Marks: 10 x 1 = 10		
1	The Internet's application layer includes many protocols, such as the _____ protocol (which provides for Web document request and transfer), _____ (which provides for the transfer of e-mail messages), and _____ (which provides for the transfer of files between two end systems).	Recognize	Remember
2	Match the following a. <u>Field</u> A. UDP Header's Port Number B. Ethernet MAC Address C. IPv6 Next Header	<u>Length in bits</u> Recall I. 32 II. 16 III. 48	Remember

	D. TCP Header's Sequence Number	IV. 8	
3	The address resolution protocol (ARP) is used for (A) Finding the IP address from the DNS (B) Finding the IP address of the default gateway (C) Finding the IP address that corresponds to a MAC address (D) Finding the MAC address that corresponds to an IP address.	Recognize	Remember
4	Which one of the following fields of an IP header is NOT modified by a typical IP router? (A) Checksum (B) Source address (C) Time to Live (TTL) (D) Length.	Recognize	Remember
5	Which one of the following is TRUE about the interior gateway routing protocols, Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)? (A) RIP uses distance vector routing and OSPF uses link state routing (B) OSPF uses distance vector routing and RIP uses link state routing (C) Both RIP and OSPF use link state routing (D) Both RIP and OSPF use distance vector routing.	Recognize	Remember
6	Let the size of congestion window of a TCP connection be 32 KB when a timeout occurs. The round trip time of the connection is 100 msec and the maximum segment size used is 2 KB. The time taken (in msec) by the TCP connection to get back to 32 KB congestion window is _____. (A) 1100 to 1300 (B) 800 to 1000 (C) 1400 to 1600 (D) 1500 to 1700	Recognize	Remember
7	The address of a class B host is to be split into subnets with a 5-bit subnet number. _____ is the maximum number of subnets and _____ the maximum number of hosts in each subnet.	Recall	Remember
8	An error correcting code has the following code words: 00000000, 00001111, 01010101, 10101010, 11110000. What is the maximum number of bit errors that can be corrected? (A) 0 (B) 1	Recall	Remember

	(C) (D) 3	2		
9	PCM is an example of _____ conversion (A) Digital to Digital (B) Analog to Digital (C) Digital to Analog (D) Analog to Analog		Identify	Remember
10	_____ cables carry data signals in the form of light.		Identify	Remember
PART – B Short Answer				
The answer should not exceed 200 words Marks: 5 x 3 = 15				
11	Compare and contrast packet switching and circuit switching.		Difference	understand
12	Write short notes on SNMP		Explain	Understand
13	Discuss any two Flow control protocols		Explain	Apply
14	Compare and contrast Bridges and switches		Difference	understand
15	Discuss Advantages and Disadvantages of optical fiber		Explain	Understand
PART – C Essay Answer				
The answer should not exceed 400 words Marks: 5 x 7 = 35				
16	A DNS resolver typically issues a query using UDP but may also use TCP. Is there a problem using TCP for this purpose? If so, what do you suggest is the solution? (OR) Compare and contrast various email protocols (SMTP, POP3 and IMAP)		Understand	Apply
17	Discuss Klark's and Nagle's solution on congestion control in detail. (OR) Discuss in detail TCP and UDP with respect to its header		Assess	Skill
18	Discuss about various routing protocols (inter domain routing). (OR) Compare and contrast Stop and Wait, Go-Back N and Selective Repeat.		Explain	understand
19	Discuss in detail about Error detection and correction techniques (OR) Describe various Multiple Access Protocols		Explain	understand
20	Explain transmission media in detail. (OR) Explain various signal encoding techniques		Explain	understand

Course Code	Course Name	L	T	P	Credits
MSCT23	Software Engineering	2	0	0	2

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Understand the Fundamentals of Software Process Models	
CO2	Acquire knowledge on Principles of Requirement Engineering	
CO3	Learn design concepts with architectural design, component-level design and user interface design	
CO4	Apply software testing strategies on real world problems, testing conventional applications and testing object-oriented applications	
CO5	Familiarize with software configuration management, estimation of software projects, project scheduling and risk management maintenance.	

b. Syllabus

Units	Content	Hrs.
I	Software Process Models The Evolving role of Software – Software – The changing Nature of Software – Legacy software — A generic view of process– A layered Technology – A Process Framework – The Capability Maturity Model Integration (CMMI) – Process Assessment – Personal and Team Process Models – Product and Process – Process Models – The Waterfall Model – Incremental Process Models – Incremental Model – The RAD Model – Evolutionary Process Models – Prototyping – The Spiral Model – The Concurrent Development Model – Specialized Process Models – the Unified Process - Agile development.	9
II	Requirement Engineering Software Engineering Practice – communication Practice – Planning practice Modeling practice– Construction Practice –Deployment. Requirements Engineering – Requirements Engineering tasks – Initiating the requirements Engineering Process- Eliciting Requirements – Developing Use cases – Building the Analysis Models – Elements of the Analysis Model – Analysis pattern – Negotiating Requirements – Validating Requirements.	9
III	Analysis Modelling Requirements Analysis – Analysis Modeling approaches – data modeling concepts – Object oriented Analysis – Scenario based modeling – Flow oriented Modeling – Class based modeling – creating a behaviour model.	9
IV	Design & Testing Design Engineering – Design process -Design Quality-Design model-User interface Design – Testing strategies- Testing Tactics - strategies Issues for conventional and object oriented software-validation testing –system testing –Art of debugging – Project management	9
V	Quality & Maintenance Software evolution - Verification and Validation -Critical Systems Validation – Metrics for Process, Project and Product-Quality Management -Process Improvement –Risk Management Configuration Management – Software Cost Estimation	9

	References: 1. Roger S.Pressman, Bruce R. Maxim, Software Engineering: A Practitioner’s Approach, McGraw Hill International edition, Eighth edition, 2015. 2. Ian Sommerville, Software Engineering, 10th Edition, Pearson Education, 2015. 3. Stephan Schach, Object Oriented and classical Software Engineering, 8th edition, Tata McGraw Hill, 2016	
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c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	1	2	2
CO2	3	2	2	2	0	2	1
CO3	3	3	1	1	0	2	1
CO4	3	3	3	2	1	2	2
CO5	2	2	1	1	0	1	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	2	2	2	2	2
Test	6	6	6	6	6
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Short Answer - 5 x 5= 25 marks)	3	3	3	3	3
Part – C (Essay- 5 x 7 = 35 marks)	9	9	9	9	9
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO1, CO2, CO5
2	Organization 50%	Includes title, introduction, statement of the main idea with illustration and conclusion.	Includes title, introduction, statement of main idea and conclusion.	organizational tools are weak or missing	No organization	Not attended	CO1, CO2, CO5

Course Code	Course Name	L	T	P	Credits
MSCT24	WEB TECHNOLOGY	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO 1	Understand the principles of www and concepts of web clients and web servers	Understand
CO 2	Interpret the key responsibilities and functionalities of different internet technologies	Apply
CO 3	Demonstrate Markup languages and illustrate the working of it	Apply
CO 4	Analyze the different client-side scripting/programming languages	Analyze
CO 5	Explain and demonstrate server-side, presentation and database technologies	Understand

b. Syllabus

Units	Content	Hrs.
I	Internet Principles – basic web concepts – Client/ server model – Retrieving data from Internet –Internet Protocols and applications	9
II	HTML forms – HTML tags emulation – Links and addressing- HTML and Images	9
III	Streaming – Networking Principles – Sockets for Clients – Sockets for Servers – Protocol Handlers – Content Handlers – Multicast sockets – Remote method Invocation.	9
IV	Scripts - Java Script, VB Script, DHTML, XML, CGI, Servlets.	9
V	Server Scripts - Java Sever Pages (JSP), Active Server pages (ASP), Simple applications – On-line databases – Monitoring user events – Plug-ins – Database connectivity.	9
	<p>Text Books:</p> <ol style="list-style-type: none"> 1. Eillotte Rusty Harold, “Java Network Programming”, O’Reilly Publications, 1997. 2. Harvey M. Deitel and Paul J. Deitel, “Internet & World Wide Web How to Program”, 4th edition, 2008. 3. N. P. Gopalan and J. Akilandeswari, “Web Technology – A Developer’s Perspective”, PHIO Pvt Ltd., New Delhi-, 2007. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Jason Hunter and William Crawford, “Java Servlets Programming”, O’Reilly Publications, 1998. 2. Jeff Frantzen and Sobotka, “Java Script” Tata McGraw Hill, 1999. 3. Eric 	

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	0	3	2	2	3	1	1
CO2	1	3	2	2	3	1	2
CO3	0	3	2	3	3	1	2
CO4	1	3	3	3	3	1	2
CO5	1	3	3	2	3	1	2S

(3 – High, 2 – Moderate, 1 – Low , 0- No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Seminar	2	-	2	-	-
Test	6	8	6	8	8
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Objective - 10 x 1 = 10 marks)	2	2	2	2	2
Part – B (Short Answer - 5 x 3 = 15 marks)	3	3	3	3	3
Part – C (Essay- 5x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Seminar

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	<p><u>Content - Knowledge & understanding</u></p> <p>a) Relevance to the Topic b) Organization and Structure c) Good Conclusions with d) References e) Audio and</p> <p>50%</p>	Exceptional knowledge of facts, terms, and concepts	Detailed knowledge of facts, terms, and concepts	Considerable knowledge of facts, terms, and concepts	Minimal knowledge of facts, terms, and concepts	Not Attended	CO3, CO4
2	<p>Presentation & Delivery</p> <p>a) Voice b) Confidence c) Viva</p> <p>50%</p>	Well Communicated with logical sequences, examples, and references	Communicated with sequences	Just Communicated	No coherent communication	Not Attended	CO3, CO4

h. Model Question Paper

Sl. No.	Model Questions	Specification	Level
	<p>Part – A: Objective Type</p> <p>Multiple choice 10 x 1 = 10</p>		
1	<p>HTTP is a network layer protocol.</p> <p>a) True b) False</p>	Recall	Remember
2	<p>Which of the following transport layer protocol used by SMTP for email transmission.</p> <p>a) TCP b) UDP c) Both the above d) None of the above</p>	Recall	Remember
3	<p>Which of the following tag inserts a line horizontally to a webpage?</p> <p>a) <hr> b) <line>c) <line direction=" horizontal"> d) all the above</p>	Recognize	Understand
4	<p>Which of the following used to make a bulleted list?</p> <p>a) b) c) <dl> d)<list></p>	Recognize	Understand
5	<p>Wed sockets support full duplex communication.</p>	Recognize	Remember

	a) True b) False		
6	A network can receive a multicast packet from a particular source only through a designated parent resolver. a) True b) False	Identify	Analyze
7	The relationship of multicast communication is a) one to one b) one to many c) many to one d) many to many	Recall	Understand
8	What XML schema type can be used to contain other elements and attributes? a) Simple Type b) Complex Type c) In built Type d) None of the above	Recall	Remember
9	jspDestroy() method of HttpJspPage class can be overridden. a) True b) False	locate	Understand
10	ASP.NET Core is a new web framework from the Microsoft. a) True b) False	Examine	Analyze
PART – B Short Answer Answer any Five questions 5 x 3 = 15			
1	a) Differentiate FTP and Telnet. or b) Compare and contrast P2P and Client-server architecture..	Differentiate	Analyze
2	a) Illustrate HTML document structure. or b) Explain how to embed an image in a web page.	Illustrate	Understand
3	a) Explain the applications of multicast sockets. or b) Describe URL handlers.	Explain	Understand
4	a) Describe JavaScript Display Possibilities using inner HTML. or b) Differentiate client-server scripting and server-side scripting.	Describe	Remember
5	a) State the advantages of JSP over ASP. or b) Write CGI script in python.	State	Remember
PART – C Essay Answer 5x 7= 35 Answer any Five questions			
1	Explain the protocol format and working principle of UDP in detail.	Explain	Understand
2	Describe HTML form attributes and elements with examples in detail.	Describe	Remember
3	Illustrate the architecture of RMI.	Illustrate	Understand
4	Write JavaScript code to create and read cookies..	Write	Create
5	Explain the lifecycle of JSP in detail..	Explain	Understand

Course Code	Course Name	L	T	P	Credits
MSCT25	Theory of Computation	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Model, compare and analyze different computational models using combinatorial methods	Understand
CO2	Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata	Apply
CO3	Learn the Push Down Automata and apply Pumping Lemma	Understand
CO4	Design Turing Machines for simple problems	Apply
CO5	Understand the theoretical aspects of Polynomial time and Non-Deterministic Polynomial Time	Remember Understand

b. Syllabus

Units	Content	Hrs.
I	FINITE AUTOMATA Introduction- Basic Mathematical Notation and techniques- Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) - Finite Automaton with ϵ - moves- Regular Languages - Regular Expression - Proving languages not to be regular – Closure properties of regular languages - Equivalence of NFA and DFA - Equivalence of NDFA's with and without ϵ -moves - Minimization of DFA - Pumping Lemma for Regular Language- Its use as an adversarial game.	9
II	CONTEXT FREE GRAMMARS (CFG) AND LANGUAGES Notion of Grammars and languages generated by grammars - Parse Trees - Derivations and Languages – Ambiguity - Relationship between derivation and derivation trees - Simplification of CFG - Elimination of Useless symbols - Unit productions - Null productions - Greiback Normal form (GNF) – Chomsky normal form (CNF) - Problems related to CNF and GNF- applications to compilers.	9
III	PUSHDOWN AUTOMATA (PDA) Definition of the Pushdown automata – Languages of a Pushdown Automata – Moves - Instantaneous descriptions - Deterministic and Nondeterministic pushdown automata - Equivalence of Pushdown automata and CFL - pumping lemma for CFL - Closure Properties of CFL - problems based on pumping Lemma.	9
IV	TURING MACHINES Definitions of Turing machines - Models – Universal Turing machine - Deterministic and Nondeterministic Turing machines Computable languages and functions - Techniques for Turing machine construction - Multi head and Multi tape Turing Machines - The Halting problem -Partial Solvability - Problems about Turing machines.	9
V	UNDECIDABILITY AND INTRACTABILITY A language that is not Recursively Enumerable (RE) - An undecidable problem that is RE - Undecidable problems about Turing Machine - Post's Correspondence Problem - Measuring and Classifying complexity:	9

	Tractable and Intractable problems- Tractable and possibly intractable problems – P and NP.	
	<p>Tasks and Assignments:</p> <p>✓ Each student is required to submit the assignments in time following the code of honest</p> <p>Text Books and References:</p> <ol style="list-style-type: none"> 1. Hopcroft J.E., Motwani R. and Ullman J.D, “Introduction to Automata Theory, Languages and Computations”, Second Edition, Pearson Education, 2008. (UNIT 1,2,3) 2. John C Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, Tata McGraw Hill Publishing Company, New Delhi, 2007. (UNIT 4,5) 3. Dexter C. Kozen , “Automata and Computability” ,Springer-Verlag Berlin Heidelberg, 1977. 4. Mishra K L P and Chandrasekaran N, “Theory of Computer Science – Automata, Languages and Computation”, Third Edition, Prentice Hall of India, 2004. 5. Harry R Lewis and Christos H Papadimitriou, “Elements of the Theory of Computation”, Second Edition, Prentice Hall of India, Pearson Education, New Delhi, 2003. 6. Peter Linz, “An Introduction to Formal Language and Automata”, Third Edition, Narosa Publishers, New Delhi, 2002. 7. Micheal Sipser, “Introduction of the Theory and Computation”, Thomson Brokecole, 1997. 8. J. Martin, “Introduction to Languages and the Theory of computation” Third Edition, Tata Mc Graw Hill, 2007. 	

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	0	2	0
CO2	3	3	3	1	1	2	0
CO3	3	3	3	3	1	2	0
CO4	3	3	3	3	2	2	1
CO5	2	2	2	2	1	2	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	2	2	2	2	2
Test	6	6	6	6	6

Total	8	8	8	8	8
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f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (5 * 3 = 15 marks)	3	3	3	3	3
Part – B (5 * 9 = 45 marks)	9	9	9	9	9
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 70%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO1, CO2, CO4
2	Organization 30%	Includes title, introduction, statement of the main idea with illustration and conclusion.	Includes title, introduction, statement of main idea and conclusion.	organizational tools are weak or missing	No organization	Not attended	CO1, CO2, CO4

Course Code	Course Name	L	T	P	Credits
MSCT31	NETWORK AND SYSTEM SECURITY	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO 1	Deploy measures for data protection by ensuring confidentiality, integrity, authentication and non-repudiation and identify the requirements to implement access control mechanisms for the given system scenario.	Understand
CO 2	Appreciate the usage of Number theory in design of cryptographic algorithms and examine the strength of any cryptographic algorithm by crypt analysis	Analyze
CO 3	Use various authentication and security protocols such as SSL, IP Sec etc., at different layers of TCP/IP stack to develop security solutions	Apply
CO 4	Comprehend the usage of firewalls and Intrusion Detection Systems for securing data.	Analyze
CO 5	Illustrate appropriate mechanisms for protecting information systems by addressing security management issues	Understand

b. Syllabus

Units	Content	Hrs.
I	Overview of information security: confidentiality, integrity, and availability Understanding the Threats: Malicious software (Viruses, trojans, rootkits, worms, botnets), Memory exploits (buffer overflow, heap overflow, integer overflow, format string) Formalisms: Access control theory, access control matrix, Information flow Policy: Security policies, Confidentiality policies (BLP model), Integrity policies (Biba, and Clark-Wilson model), Hybrid policies (Chinese Wall model, role-based access control)	9
II	Implementation: Cryptography --- Block and stream ciphers, Cryptographic hash functions, Message Authentication Codes (MAC), Public and private key systems, Authentication, Password system	9
III	Implementation: Systems --- TCB and security kernel construction, UNIX security and Security-Enhanced Linux (SELinux)	9
IV	Network Security: TCP/IP security issues , DNS security issues and defenses, TLS/SSL, Intrusion detection and prevention systems, Firewalls	9
V	Software Security: Sandboxing, Control flow integrity - Web Security: User authentication, authentication-via-secret and session management Legal and Ethical Issues: Hacking and intrusion, Privacy, identity theft.	9
	Reference books: 1. Computer Security Arts and Science by Matt Bishop, (2nd Ed), Addison wesley. 2. William Stallings. Network Security Essentials (2nd edition). Prentice Hall. 2003.	

	3. Saadat Malik. Network Security Principles and Practices Pearson Education.2002.	
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c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	2	2	3	1	1
CO2	3	3	2	3	3	1	2
CO3	2	2	2	2	3	1	2
CO4	1	2	2	2	3	1	2
CO5	2	2	2	2	3	1	2

(3 – High, 2 – Moderate, 1 – Low , 0- No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Seminar	-	-	2	2	-
Test	8	8	6	6	8
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Short Answer - 5 x 5 = 25 marks)	5	5	5	5	5
Part – B (Essay- 5x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Seminar

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
.							

1	Content - Knowledge & understanding a)Relevance to the Topic b)Organization and Structure c)Good Conclusions with d)References e) Audio and 50%	Exceptional knowledge of facts, terms, and concepts	Detailed knowledge of facts, terms, and concepts	Considerable knowledge of facts, terms, and concepts	Minimal knowledge of facts, terms, and concepts	Not Attended	CO3, CO4
	2	Presentation & Delivery a) Voice b) Confidence c) Viva 50%	Well Communicated with logical sequences, examples, and references	Communicated with sequences	Just Communicated	No coherent communication	Not Attended

h. Model Question Paper

Sl. No.	Model Questions	Specification	Level
PART – A Short Answer Answer the questions (5 x 5 = 25)			
1	Brief on security policies in detail.	Brief	Understand
2	Analyze the operation modes of block cipher/	Analyze	Analyze
3	How would you create security kernel using Trusted Computing base?	Use	Remember
4	Discuss in detail about intrusion detection and prevention systems	Discuss	Remember
5	Interpret about different kinds of Web security issues.	Interpret	Apply
PART – B Essay Answer Answer the questions (5x 7= 35)			
1	Explain in detail about Bell-LaPadula and Biba security models.	Explain	Understand
2	A wants to send an encrypted message to B. The message contains English alphabets (a-z) and numeric digits (0-9). Use affine cipher to encrypt message "happy new year 2022".	Write	Create

3	Illustrate the Scmp TCB rings and explain the different ways of handling SELinux Errors.	Illustrate	Apply
4	Examine the operations of Distributed Denial of Service attack	Examine	Analyze
5	How would you explain the main attacks against authentication and session management mechanisms?	Explain	Understand

Course Code	Course Name	L	T	P	Credits
MSCT32	Data science and Analytics	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Understand the concepts of Big Data Analytics	Understand
CO2	Learn the components of Map Reduce and Hadoop Eco-System	Understand
CO3	Ability to use SPARK	Apply
CO4	Ability to use NOSQL	Apply
CO5	Learn to plot data	Apply

b. Syllabus

Units	Content	Hrs.
I	INTRODUCTION TO DATA SCIENCE Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL.	9
II	INTRODUCTION TO R Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.	9
III	MAP REDUCE Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing Hadoop MapReduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.	9
IV	INTRODUCTION TO BIG DATA Introduction to Big Data Platform – Challenges of Conventional Systems - Five Vs - Intelligent data analysis – Nature of Data – Big data analytic processes - Ingesting data into the system - Persisting the data in storage - Computing and Analyzing data - Visualizing the results – Big data tools	9
V	INTRODUCTION TO SPARK Introduction to data analysis with spark - Programming with RDDs – working with key value pairs – loading and saving your data – Spark SQL – Spark Streaming – Apache spark MLIB - Machine Learning with MLib – Development of real time applications using SPARK	9
	REFERENCES 1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014. 2. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014. 3. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc., 2012	

	<p>4. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.</p> <p>5. Chris Eaton, Dirk deRoos et al. , “Understanding Big data ”, McGraw Hill, 2012.</p> <p>6. Tom White, “HADOOP: The definitive Guide” , O Reilly 2012.</p> <p>7. Spark - The Definitive Guide, Bill Chambers and Matei Zaharia, 2018, O’Reilly Media, Inc, USA, ISBN10 1491912219, ISBN13 9781491912218</p> <p>8. Holden Karau, Andy Konwinski, Patrick Wendell & Matei Zaharia, Learning Spark Lightning-Fast Data Analysis, ISBN-13: 978-1449358624, ISBN-10: 1449358624, O’Reilly, 2015</p> <p>9. Josh Wills, Sandy Ryza, Sean Owen, and Uri Laserson, Advanced Analytics with Spark: Patterns for Learning from Data at Scale 2nd Edition, O’Reilly, 2016</p>	
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c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	1	2	2
CO2	3	2	2	2	0	2	1
CO3	3	3	1	1	0	2	1
CO4	3	3	3	2	1	2	2
CO5	2	2	1	1	0	1	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	--	2	--	2	--
Test	8	6	8	6	8
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Short Answer - 5 x 5= 25 marks)	3	3	3	3	3
Part – C (Essay- 5 x 7 = 35 marks)	9	9	9	9	9
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO1, CO2, CO5
2	Organization 50%	Includes title, introduction, statement of the main idea with illustration and conclusion.	Includes title, introduction, statement of main idea and conclusion.	organizational tools are weak or missing	No organization	Not attended	CO1, CO2, CO5

Course Code	Course Name	L	T	P	Credits
MSCT33	Advanced Programming in Java	2	0	0	2

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Understanding Object-Oriented programming concepts using basic syntaxes of control Structures, strings for developing skills of logic building activity using Java	Understand
CO2	Identification of classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem	Remember
CO3	Illustration to achieve reusability using inheritance, interfaces, and packages and describes faster application development can be achieved with exception handling mechanisms	Understand Apply
CO4	Understanding concept of multithreading for robust faster and efficient application development and applications of collection interfaces in Java	Understand Apply
CO5	Learning of various I/O operations, connecting Java with databases using JDBC and implementation of networking with Java	Understand Apply

b. Syllabus

Units	Content	Hrs.
I	Concepts of Object Oriented Programming- Encapsulation, inheritance, polymorphism	9
II	Introduction to Java – Data types, variables, operators, control statements	9
III	Introduction to classes, declaring objects, data fields, methods, Inheritance, packages and interfaces	9
IV	Exception handling, multithreading, generics	9
V	GUI development- Introduction to AWT and Swing Classes, Input/Output, file handling, Applet class. Introduction to Java Collections	9
	Reference Schildt : Java Fundamentals : A comprehensive Introduction	

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	1	2	2
CO2	3	2	2	2	0	2	1
CO3	3	3	1	1	0	2	1
CO4	3	3	3	2	1	2	2
CO5	2	2	1	1	0	1	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	--	2	--	2	--
Test	8	6	8	6	8
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Short Answer - 5 x 5= 25 marks)	5	5	5	5	5
Part – C (Essay- 5 x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO1, CO2, CO5
2	Organization 50%	Includes title, introduction, statement of the main idea with illustration and conclusion.	Includes title, introduction, statement of main idea and conclusion.	organizational tools are weak or missing	No organization	Not attended	CO1, CO2, CO5

Course Code	Course Name	L	T	P	Credits
MSCT41	Web Services	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

	Course Outcome	Level
CO1	Understand web protocols	Understand
CO2	Learn the principles of SOAP and other web services' functionalities	Remember
CO3	Identify the recent technologies and their usage to demonstrate web-based applications	Understand
CO4	Ability to develop web-based transactions	Create
CO5	Ability to develop web applications with possible web service functionalities	Analyze

b. Syllabus

Units	Content	Hrs.
I	Web Technology - Web 2.0 technologies, Introduction to Ajax, Ajax Design Basics, Introduction to WWW, TCP/IP, HTTP, ARP, ICMP FTP, UDP, routing protocols (RIP, OSPF, BGP), Network Management Protocols (SNMP), and Application-level protocols (FTP, TELNET, SMTP), URL, Web Browsers, Web Servers.	9
II	Web services, Evolution and differences with Distributed computing, XML - Name Spaces - Structuring With Schemas and DTD - Transformation - XML Infrastructure WSDL, SOAP, UDDI, ebXML - SOAP And Web Services in E-Com - Overview Of .NET And J2EE.	9
III	Platform for Web Services Development, MVC Design Pattern, Web services - EJB, .NET, J2EE Architecture, J2EE Components & Containers, Specification, Application servers, Struts, Introduction to JSON.	9
IV	Web Transactions, Coordination, Orchestration, and Choreography – tools BPEL, WS-CDL Overview of Web service standards - BPEL4WS. WS-Security and the Web services security specifications, WS-Reliable Messaging, WS-Policy, WS-Attachments..	9
V	Web Service Case Study - Web Service Search Engine, Web Service Discovery, Web Service Composition. Web Service – SOAP vs Web Service – REST.	9
	<p>Text Books:</p> <ol style="list-style-type: none"> Deitel, and Nieto, "Internet and World Wide Web – How to program", Pearson Education Publishers, 2000. Elliott Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2002. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, "Developing Java Web Services", Wiley Publishing Inc., 2004. R. Krishnamoorthy & S. Prabhu, "Internet and Java Programming", New Age International Publishers, 2004. 	

5. Frank. P. Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002.
6. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.
7. McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers, 2005.

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	2	2	3	2	1
CO2	1	2	2	3	2	1	1
CO3	0	1	1	2	2	1	1
CO4	1	1	2	2	3	1	2
CO5	1	2	2	2	2	1	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	2	-	-	-	2
Test	6	8	8	8	6
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Objective - 10 x 1 = 10 marks)	2	2	2	2	2
Part – B (Short Answer - 5 x 3 = 15 marks)	3	3	3	3	3
Part – C (Essay- 5x 7 = 35 marks)	7	7	7	7	7
Total	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Exemplary - Your answer contains rich details - step by step illustration with proper observations and evidences	Fair - The answer has few pieces of observations and evidences	Acceptable – Needs improvement Ideas are presented but not particularly developed or supported.	Poor - The answer does not describe any reflection about the actual usage	Not attended	CO1, CO5
2	Organization 50%	Includes title, introduction, Objectives, Flow diagram, Methodology, Conclusion and References	Includes title, introduction, statement of main idea and conclusion.	Proper structuring are weak or missing	No organization	Not attended	CO1, CO5

h. Model Question Paper

Sl. No.	Model Questions	Specification	Level
	Part – A: Objective Type Multiple choice 10 x 1 = 10		
1	AJAX based on _____ a) JavaScript and XML b) VBScript and XML c) JavaScript and Java d) JavaScript and HTTP requests	Recall	Remember
2	Most famous HTTP response error "Not Found", code is a) 400 b) 404 c) 405 d) 408	Recognize	Remember
3	With DTD, each of your XML files can carry a _____ of its own format with it. a) data b) control c) description d) data and control	Recognize	Understand
4	Elements with only character data are declared with	Recognize	Understand

	a) #CHAR b) #TEXT c)#PCDATA d) #CDATA		
5	Which of the following is correct list of classifications of design patterns. a) Creational, Structural and Behavioral patterns. b) Executional, Structural and Behavioral patterns. c) Creational, Executional and Behavioral patterns. d) None of the above.	Explain	Remember
6	The ASP & JSP technologies are quite similar in the way they support the creation of dynamic pages using HTML templates , scripting code and components for business logic a) True b) False	Examine	Analyze
7	Which of the following messaging protocol is used with XML in BHEL? a) WS coordination b) WS policy c) WS addressing d) All the above	Recall	Understand
8	Which of the following is a security issue with web services? a) Confidentiality b) Authentication c) Network Security d) All of the above.	Recall	Remember
9	Which of the following layer in Web Service Protocol Stack is responsible for centralizing services into a common registry and providing easy publish/find functionality? a) Service Transport b) XML Messaging c) Service Description d) Service Discovery	Memorize	Understand
10	Which of the following is true about caching in RESTful web service?	Identify	Understand

	<p>a) Caching refers to storing server response in client itself so that a client needs not to make server request for same resource again and again.</p> <p>b) A server response should have information about how a caching is to be done so that a client caches response for a period of time or never caches the server response.</p> <p>c) Both of the above.</p> <p>d) None of the above.</p>		
	<p>PART – B Short Answer Answer any Five questions 5 x 3 = 15</p>		
1	Explain the functions of ICMP.	Explain	Understand
2	Compare SOAP and REST web services	Compare	Analyze
3	Differentiate XML and HTML with example script	Compare	Analyze
4	Brief on WS-attachments	Brief	Understand
5	Discuss WS search engine	Discuss	Understand
	<p>PART – C Essay Answer 5x 7= 35 Answer any Five questions</p>		
1	<p>.(a) Analyze Routing Information Protocol (RIP) with suitable example .</p> <p>Or</p> <p>(b) Elicit the features of FTP model.</p>	Elicit /Analyze	Analyze
2	<p>a) Interpret WSDL elements</p> <p>or</p> <p>(b) Demonstrate web service architecture.</p>	Interpret	Apply
3	<p>a) Discuss the pattern which specifies data model, presentation and control information.</p> <p>or</p> <p>(b) Explain lifecycle of Java Applet (J2EE client).</p>	Explain	Understand
4	<p>(a) Appraise BPEL activities in detail.</p> <p>Or</p> <p>b) Investigate on WS-policy model.</p>	Appraise/ Investigate	Evaluate /Create
5	<p>(a) Explain web service composition</p> <p>Or</p> <p>(b) Discuss web service search engine</p>	Explain/Discuss	Understand

Course Code	Course Name	L	T	P	Credits
MSCT42	Distributed Computing	3	0	0	3

a. Course Outcome (CO)

On the successful completion of the course, the student will be able to

CO#	Course Outcome	Level
CO1	Apply knowledge of distributed systems techniques and methodologies.	Understand Apply
CO2	Explain the design and development of distributed systems and distributed systems applications.	Remember
CO3	Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.	Understand Apply
CO4	Design and develop distributed programs using sockets and RPC/RMI.	Understand Apply
CO5	Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems.	Analyze

b. Syllabus

Units	Content	Hrs.
I	Distributed Systems - Goal - Advantages over centralized systems - Organization of multiprocessor systems - Hardware/software concepts - Review of layered protocols.	9
II	Client/Server Model - Microkernel - RMI - Distributed algorithms - Time stamping - Circulating tokens - Diffusing computations.	9
III	Mutual Exclusion Algorithm - Election algorithm - Detecting loss of tokens and regeneration - Distributed deadlock detection algorithms - Distributed termination algorithms.	9
IV	File Replication - Semantics of file sharing - Remote access methods - Fault tolerant issues - Introduction to distributed operating systems.	9
V	Introduction to Distributed Operating Systems - Motivations - Management systems - Levels of distribution transparency - Architecture - Introduction to concurrency control.	9
	Text / Reference Books: 1. George Coulouris and Jean Dollimore, and Tim Kindberg, "Distributed System Concepts and Design", 4th Edition, Addison Wesley, 2005 2. A. S. Tanenbaum, "Distributed Operating Systems", Prentice Hall, 1995. 3. S. Ceri and G.Pelagatti, "Distributed Databases - Principles and Systems", McGraw Hill, 1985.	

c. Mapping of Program Outcomes with Course Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	1	2	2
CO2	3	2	2	2	0	2	1
CO3	3	3	1	1	0	2	1
CO4	3	3	3	2	1	2	2
CO5	2	2	1	1	0	1	2

(3 – High, 2 – Moderate, 1 – Low, 0 – No correlation)

d. Evaluation Scheme

	CO1	CO2	CO3	CO4	CO5	Total
Internal	8	8	8	8	8	40
External	12	12	12	12	12	60
Total	20	20	20	20	20	100

e. Mapping Course Outcome with Internal Assessment (40 Marks)

	CO1	CO2	CO3	CO4	CO5
Assignments	2	-	-	-	2
Test	6	8	8	8	6
Total	8	8	8	8	8

f. Mapping Course Outcome with External Assessment (60 Marks)

Category	CO1	CO2	CO3	CO4	CO5
Part – A (Short Answer - 5 x 5= 25 marks)	2	2	2	2	2
Part – C (Essay- 5 x 7 = 35 marks)	3	3	3	3	3
Total	7	7	7	7	7
	12	12	12	12	12

g. Rubric for Assignments

Sl. No.	Criteria	100%	75%	50%	25%	0%	Relation to COs
1	Content 50%	Ideas are detailed, well developed, supported with specific evidence & facts and examples	Ideas are detailed, Developed and supported with evidence and facts mostly specific.	Ideas are presented but not particularly developed or supported;	Content is not sound	Not attended	CO1, CO2, CO5
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