Hall Ticket No | | | | | | | | | | | Question Paper Code: ACSB04

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

Four Year B.Tech III Semester End Examinations, November-2019

Regulations: R18

DISCRETE MATHEMATICAL STRUCTURES

(Common to CSE/IT)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each module

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

MODULE – I

1. a) Show that $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$ is a Tautology using truth table. **[7M]**

   b) Show that the statement "Every positive integer is the sum of squares of three integers" is false **[7M]**

2. a) Construct the truth table for the formula $(P \vee Q) \vee \neg P$ **[7M]**

   b) Explain about the tautological implications and logical equivalence using theorem. **[7M]**

MODULE – II

3. a) Show that a relation R defined on the set of real numbers as (a, b) R (c, d) if $a^2 + b^2 = c^2 + d^2$. Show that R is an equivalence relation. **[7M]**

   b) Let $X=\{1,2,3,4\}$ and $R=\{\langle x,y\rangle | x>y\}$. Draw the diagram of the graph R and also give its matrix. **[7M]**

4. a) Illustrate the following function definition with graph. Let X and Y be any two sets. A relation f from X to Y is called a function if for every $x \in X$ there is a unique $y \in Y$ such that $(x,y) \in f$. **[7M]**

   b) Let $X=\{1,2,3\}$, $Y=\{p,q\}$, and $Z=\{a,b\}$. Also let $f:X \rightarrow Y$ be $f=\{\langle 1,p\rangle,\langle 2,p\rangle,\langle 3,q\rangle\}$ and $g:Y \rightarrow Z$ be given by $g=\{\langle p,b\rangle,\langle q,b\rangle\}$. Find gof. **[7M]**

MODULE – III

5. a) Show that the intersection of any two congruence relations on a set is also a congruence relation. **[7M]**

   b) Let $(Z_4,+_4)$ and $(B,+)$ be the algebraic system. Show that $(B,+)$ is a homomorphic image of $(Z_4,+_4)$. **[7M]**

6. a) Prove using the theorem by showing that the composition of semi group homomorphism is also a semi group homomorphism. **[7M]**

   b) Let $(N,+)$ be the algebraic system of natural numbers. Define an equivalence relation E on N such that $x_1 E x_2$ iff either x_1-x_2 or x_2-x_1 is divisible by 4. Show that E is a congruence relation and that the homomorphism g defined is the natural homomorphism associated with E. **[7M]**

MODULE – IV

7. a) What is the solution of the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$ for $n \geq 2$ given that $a_0 = 1$, $a_1 = 6$. **[7M]**

   b) Find the recurrence relation for the Fibonacci sequence. **[7M]**

8. a) A computer system considers a string of decimal digits a valid codeword if it contains an even number of 0 digits. For instance, 1230407869 is valid, whereas 120987045608 is not valid. Let an be the number of valid n-digit codeword's. find the recurrence relation for an. **[7M]**

b) Find r recurrence relation for Cn, the number of ways to parenthesize the product of n+1 numbers, x_0, $x_1x_2\ldots x_n$, to specify the order of multiplication. For example, C_3=5 because there are five ways to parenthesize x_0, x_1x_2 x_3 to determine the order of multiplication: $((x_0.x_1)x_2).x_3$ $(x_0.(x_1)x_2).x_3$ $(x_0.x_1)$ $(x_2).(x_3)$ $x_0.((x_1)x_2).x_3)$ $x_0.$ $(x_1$ $(x_2$ $.x_3))$. **[7M]**

MODULE – V

9 a) Prove that if G is connected graph with n vertices and (n-1) edges then G is a tree. **[7M]**

b) Show that the graphs G and H displayed in following Figure 1 are isomorphic. **[7M]**

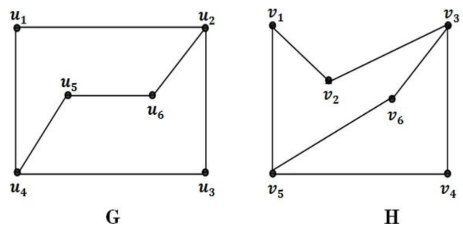

Figure 1

10. a) Prove that the chromatic number of a tree is always 2 & chromatic polynomial is $\lambda(\lambda-1)^{n-1}$. **[7M]**

b) Show that neither graph displayed in following Figure 2 has a Hamilton circuit. **[7M]**

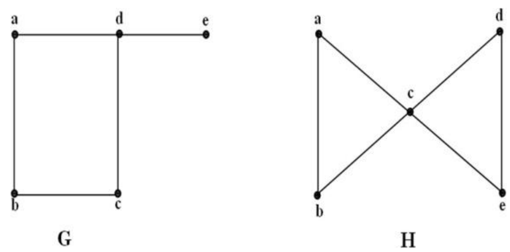

Figure 2

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COURSE OBJECTIVES

The course should enable the students to:

I	Describe the logical and mathematical foundations, and study abstract models of computation.
II	Illustrate the limitations of predicate logic.
III	Define modern algebra for constructing and writing mathematical proofs.
IV	Solve the practical examples of sets, functions, relations and recurrence relations.
V	Recognize the patterns that arise in graph problems and use this knowledge for constructing the trees and spanning trees.

COURSE OUTCOMES (COs):

CO 1	To understand the concepts associated with Mathematical Logic and Predicate calculus
CO 2	Ability to learn the basic concepts about relations, functions and to draw different diagrams like Lattice, Hasse diagrams.
CO 3	To understand the concepts of Algebraic Structures And Combinatorics .
CO 4	To describe various types of recurrence relations and the methods to find out their solutions .
CO 5	To understand the basic concepts associated with Graphs and Trees.

COURSE LEARNING OUTCOMES (CLOs):

ACSB04.01	Understand logical connectives and compound prepositions for building compound statements.
ACSB04.02	Learn the formal symbols and use the preposition logic and predicate logic to solve problems on logical equivalences and implications.
ACSB04.03	Memorize different scientific notations to simplify the logical statements.
ACSB04.04	Prepare valid arguments from the given propositional statements by using rules of inference.
ACSB04.05	Identify ordered pairs to form a binary relation from the given sets.
ACSB04.06	Construct directed graph and a matrix representation using a binary relation on finite order pairs.
ACSB04.07	Identify the properties of relations to check for equivalence relation and partial order relation and compute relations using operations on relations.
ACSB04.08	Construct a hasse diagram to recognize the relevant partial ordered sets from the given binary relation.
ACSB04.09	Describe the types of functions (one to one, on-to, bijective, Identity and constant function).
ACSB04.10	Implement the concept of the inverse and recursive functions to get an optimized solution for an appropriate problem.
ACSB04.11	Use the concept of lattices (Greatest Lower Bound (GLB) and Least Upper Bound (LUB) to represent a defined finite set in multi- dimension applications.
ACSB04.12	Explain about the properties and types of lattices (bounded and distributivelattice).
ACSB04.13	Construct different algebraic structures by using concepts of groups, sub groups, monoids and rings.
ACSB04.14	Understand binomial and multinomial theorems to compute the coefficients for the given expansions.
ACSB04.15	Understand the concept of homomorphism and isomorphism of semi-groups.
ACSB04.16	Analyze the given sets by using inclusion and exclusion principle.

ACSB04.17	Identify the different counting techniques (permutations) related to mathematics and computer science.
ACSB04.18	Solve discrete probability and set problems by using permutations and combinatorics.
ACSB04.19	Identify the series of expansion torepresent the sequence by using generatingfunctions.
ACSB04.20	Identify the general solution for first-order and second-order linear homogeneous recurrence relations.
ACSB04.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.
ACSB04.22	Understand the use of graphs and trees as representation tools in a variety of context.
ACSB04.23	Identify Euler’s and Hamilton rule for a simple connected graph in NP-complete problems.
ACSB04.24	Construct a spanning tree by using search techniques (Depth First Search and Breadth First Search).
ACSB04.25	Construct a minimal spanning tree by using Kruskal’s and Prim’s algorithm in order to obtain a solution for a real time problem.
ACSB04.26	Possess the knowledge and skills for employability and to succeed in national and international level competitive exams.

MAPPING OF SEMESTER END EXAM TO COURSE LEARNINIG OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	ACSB04.02	Learn the formal symbols and use the preposition logic and predicate logic to solve problems on logical equivalences and implications.	CO 1	Understand
	b	ACSB04.04	Prepare valid arguments from the given propositional statements by using rules of inference.	CO 1	Remember
2	a	ACSB04.01	Understand logical connectives and compound prepositions for building compound statements.	CO 1	Understand
	b	ACSB04.02	Learn the formal symbols and use the preposition logic and predicate logic to solve problems on logical equivalences and implications.	CO 1	Understand
3	a	ACSB04.05	Identify ordered pairs to form a binary relation from the given sets.	CO 2	Remember
	b	ACSB04.06	Construct directed graph and a matrix representation using a binary relation on finite order pairs.	CO 2	Remember
4	a	ACSB04.09	Describe the types of functions (one to one, on-to, bijective, Identity and constant function).	CO 2	Understand
	b	ACSB04.09	Describe the types of functions (one to one, on-to, bijective, Identity and constant function).	CO 2	Understand
5	a	ACSB04.13	Construct different algebraic structures by using concepts of groups, sub groups, monoids and rings.	CO 3	Remember
	b	ACSB04.13	Construct different algebraic structures by using concepts of groups, sub groups, monoids and rings.	CO 3	Remember
6	a	ACSB04.15	Understand the concept of homomorphism and isomorphism of semi-groups.	CO 3	Understand
	b	ACSB04.15	Understand the concept of homomorphism and isomorphism of semi-groups.	CO 3	Understand
7	a	ACSB04.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.	CO 4	Remember
	b	ACSB04.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.	CO 4	Remember
8	a	ACSB04.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.	CO 4	Remember
	b	ACSB04.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.	CO 4	Remember

9	a	ACSB04.22	Understand the use of graphs and trees as representation tools in a variety of context.	CO 5	Understand
	b	ACSB04.22	Understand the use of graphs and trees as representation tools in a variety of context.	CO 5	Understand
10	a	ACSB04.23	Identify Euler’s and Hamilton rule for a simple connected graph in NP-complete problems.	CO 5	Remember
	b	ACSB04.23	Identify Euler’s and Hamilton rule for a simple connected graph in NP-complete problems.	CO 5	Remember

Signature of Course Coordinator **HOD, IT**