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) Explain about logical equivalence and tautological implications. Specify the laws of logic. **[7M]**

   b) Determine a valid conclusion from the given premises **[7M]**

   (i) $P \rightarrow (Q \rightarrow S), \sim R \vee P$, and $Q \Leftrightarrow R \rightarrow S$

   (ii) $P \vee Q, Q \rightarrow R, P \rightarrow M$ and $\sim M \Leftrightarrow R \wedge (P \vee Q)$

2. a) Explain about principle conjunctive normal form and principle disjunctive normal form with its procedural steps. Obtain the principal disjunctive normal form of **[7M]**

   $P \rightarrow ((P \rightarrow Q) \wedge \sim (\sim Q \vee \sim P))$.

   b) Prove the following logical equivalences: **[7M]**

   (i) $[(p \leftrightarrow q) \wedge (q \leftrightarrow r) \wedge (r \leftrightarrow p)] \Leftrightarrow [(p \wedge q) \wedge (q \rightarrow r) \wedge (r \rightarrow p)]$

   (ii) $p \rightarrow (q \rightarrow r) \Leftrightarrow p \rightarrow (\sim q \wedge r) \Leftrightarrow (p \wedge q) \rightarrow r \Leftrightarrow (p \rightarrow r) \vee (q \rightarrow r)$

MODULE – II

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

   b) Consider sets $A=\{a,b,c\}$ and $B=\{1,2,3\}$, and relations from A to B are $R=\{(a,1),(b,1),(c,2),(c,3)\}$ and $S=\{(a,1),(a,2),(b,1),(b,2)\}$. Compute the following: **[7M]**

   (i) RUS

   (ii) $R \cap S$

   (iii) R^c

   (iv) S^c

4. a) Describe bounded lattice and distributive lattice. What is a partial order relation? **[7M]**

   b) Construct the hasse diagram for the divisibility relation on following sets. **[7M]**

   (i) $A=\{3,6,12,36,72\}$

   (ii) $A=\{1,2,3,5,6,10,15,30\}$

MODULE – III

5. a) Describe Binomial theorem. Find the coefficient of x^5y^7 in the expansion of $(x+3y)^{12}$. **[7M]**

   b) Recognize the number of ways of forming committee of 5 persons from a group of 5 Indians and 4 Russians such that three are at least 3 Indians in the committee. **[7M]**

6. a) Solve that $(Z,*)$ is an abelian group where Z is a set of integers and the binary operations * is defined as $a*b = a+b-3$. **[7M]**

   b) Construct the co-efficient of $a^2b^3c^3d^5$ in the expansion of $(a+2b-3c+2d+5)^{16}$. **[7M]**

MODULE – IV

7. a) Identify the generating function for the following sequence **[7M]**

(i) $1^2, 2^2, 3^2, \ldots\ldots\ldots\ldots$

(ii) $0^2, 1^2, 2^2, 3^2, \ldots\ldots\ldots$

(iii) $1^3, 2^3, 3^3, \ldots\ldots\ldots\ldots\ldots$

b) he recurrence relation given below **[7M]**

(i) $a_n + a_{n-1} + n^3$, $n >= 1$ where $a_0 = 5$ by using substitution method

(ii) $a_n + 4a_{n-1} + 4a_{n-2} = 8$ for $n \geq 2$, and $a_0 = 1$, $a_1 = 2$ by using non- homogeneous recurrence relation.

8. a) Solve the recurrence relation $a_n - 6a_{n-1} + 12a_{n-2} - 8a_{n-3} = 0$ for $n \geq 3$ using generating functions. **[7M]**

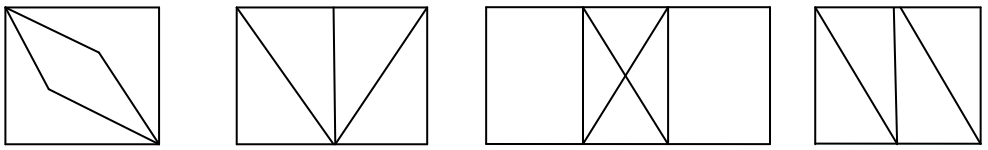
b) Solve the co-efficient of x^{27} of the following functions: **[7M]**

(i) $(x^4 + x^5 + x^6 + \ldots\ldots\ldots)^5$

(ii) $(x^4 + 2x^5 + 3x^6 + \ldots\ldots\ldots)^5$

MODULE – V

9 a) Describe Euler and Hamilton graphs. Which of the following graphs are Euler graphs and Hamilton graphs? **[7M]**



(a) (b) (c) (d)

b) Construct the spanning tree by using (i) Breadth First Search (ii) Depth First Search of graph G shown in Figure 1. **[7M]**

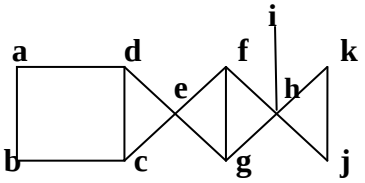


Figure.1

10. a) Find the union, intersection of the graphs G_1 and G_2 given below: **[7M]**

G_1 G2

b) Eight cities A, B, C, D, E, F, G, H are required to be connected by a new railway network. The possible tracks and the cost of involved to lay them (in crores of Rupees) are summarized in the below given table: **[7M]**

Track Between	Cost	Track Between	Cost
A and B	155	D and F	100
A and D	145	E and F	150
A and G	120	F and G	140
B and C	145	F and H	150
C and D	150	G and H	160
C and E	95		

Determine a railway network of minimal cost that connects all these cities.

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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 distributive lattice).
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 to represent the sequence by using generating functions.
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	ACSB04.01	Understand logical connectives and compound prepositions for building compound statements.	CO 1	Understand
	b	ACSB04.04	Prepare valid arguments from the given propositional statements by using rules of inference.	CO 1	Remember
2	a	ACSB04.03	Memorize different scientific notations to simplify the logical statements.	CO 1	Understand
	b	ACSB04.01	Understand logical connectives and compound prepositions for building compound statements.	CO 1	Understand
3	a	ACSB04.06	Construct directed graph and a matrix representation using a binary relation on finite order pairs.	CO 2	Understand
	b	ACSB04.07	Identify the properties of relations to check for equivalence relation and partial order relation and compute relations using operations on relations.	CO 2	Remember
4	a	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.	CO 2	Understand
	b	ACSB04.08	Construct a hasse diagram to recognize the relevant partial ordered sets from the given binary relation.	CO 2	Understand
5	a	ACSB04.14	Understand binomial and multinomial theorems to compute the coefficients for the given expansions.	CO 3	Understand
	b	ACSB04.18	Solve discrete probability and set problems by using permutations and combinatorics.	CO 3	Understand
6	a	ACSB04.13	Construct different algebraic structures by using concepts of groups, sub groups, monoids and rings.	CO 3	Understand
	b	ACSB04.14	Understand binomial and multinomial theorems to compute the coefficients for the given expansions.	CO 3	Understand
7	a	ACSB04.19	Identify the series of expansion torepresent the sequence by using generatingfunctions.	CO 4	Remember
	b	ACSB04.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.	CO 4	Remember
8	a	ACSB04.19	Identify the series of expansion torepresent the sequence by using generatingfunctions.	CO 4	Remember

	b	ACSB04.19	Identify the series of expansion torepresent the sequence by using generatingfunctions.	CO 4	Remember
9	a	ACSB04.23	Identify Euler's and Hamilton rule for a simple connected graph in NP-complete problems.	CO 5	Remember
	b	ACSB04.24	Construct a spanning tree by using search techniques (Depth First Search and Breadth First Search).	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	ACSB04.25	Construct a minimal spanning tree by using Kruskal's and Prim's algorithm in order to obtain a solution for a real time problem.	CO 5	Understand

Signature of Course Coordinator **HOD, IT**