CBCS SCHEME

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16/17MCA15

First Semester MCA Degree Examination, June/July 2019
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Prove that, for any propositions p, q, r the compound proposition $[(p \vee q) \wedge \{(p \rightarrow r) \wedge (q \rightarrow r)\}] \rightarrow r$ is a tautology. **(05 Marks)**

b. Simplify the compound proposition using the laws of logic : $(p \vee q) \wedge [\neg \{(\neg p) \wedge q\}]$. **(05 Marks)**

c. Find whether the following argument is valid. If a triangle is isosceles, then it has two equal angles. The triangle ABC does not have two equal angles. Therefore ABC does not have two equal angles. **(06 Marks)**

OR

2 a. Test the validity of the argument below. I will get grade A in this course or I will not graduate. If I do not graduate, I will join the army. I got grade A. Therefore I will not join the army. **(05 Marks)**

b. Write the statement in symbolic form and find its negation. If k, m, n are any integers where (k-m) and (m-n) are odd, then (k-n) is even. **(06 Marks)**

c. Prove that if m is an even integer, then m + 7 an off integer by direct proof method. **(05 Marks)**

Module-2

3 a. Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9}, A = {1, 2, 4, 6, 8}, B = {2, 4, 5, 9}, C = {x/x is a positive integer and $x^2 < 16$}. Compute the following: i) $A \cup (B - C)$ ii) $(A - B) - C$. **(04 Marks)**

b. The functions $f : R \rightarrow R$ and $g : R \rightarrow R$ are defined by $f(x) = 3x + 7$ for all $x \in R$, $g(x) = x(x^3 - 1)$ for all $x \in R$. Verify that f is one-to-one but g is not one-to-one. **(05 Marks)**

c. For a fixed integer $n > 1$, prove that the relation "Congruent modulo n" is an equivalence relation on the set of all integers Z. **(07 Marks)**

OR

4 a. For any two sets A and B, prove the following:

i) $A - B = A \cap \overline{B}$ ii) $\overline{A - B} = \overline{A} \cup (A \cap B)$. **(05 Marks)**

b. Let A = {1, 2, 3, 4, 6} and R be a relation on A defined by aRb iff 'a is a multiple of b'. Represent the relation R as a matrix and draw its diagraph. Find its indegree and outdegree. **(06 Marks)**

c. Draw the Hasse diagram representing the positive divison of 36. **(05 Marks)**

Module-3

5 a. State Pigeon hole principle. Let ABC is an equilateral triangle whose sides are of length 1cm each. If we select 5 points inside the triangle, prove that at least two of these points are such that the distance between them PS less than 1/2cm. **(05 Marks)**

b. A woman has 11 close relatives and she wishes to invite 5 of them to dinner. In how many ways can she invite them in the following situations
   i) There is no restriction on the choice ;
   ii) Two particular person will not attend separately
   iii) Two particular person will not attend together. **(06 Marks)**

c. A group of friends are comparing their preferences in music. There are five who like country music, four who like classical and seven who like rock music. There are two people who like classical and rock, two people who like country and classical and one person who likes country and rock. Only one person likes all three genres. How many friends are in the group? **(05 Marks)**

OR

6 a. How many positive integers n can we form using the digits 3, 4, 4, 5, 5, 6, 7 if we want n to exceed 5,000,000? **(05 Marks)**

b. Find the coefficient of
   i) $x^9 y^3$ in the expansion $(2x-3y)^{12}$
   ii) x^{12} in the expansion $x^3 (1-2x)^{10}$ **(06 Marks)**

c. The number of virus affected files in a system is 1000 and this increases 250% every two hours. Use a recurrence relation to determine the number of virus affected files in the system after one day. **(05 Marks)**

Module-4

7 a. Define conditional probability. Find the probability that a single toss of a die will result in a number less than 4 if
   i) No other information is given
   ii) It is given that the toss resulted in an odd number. **(06 Marks)**

b. Two cards are drawn from a well-shuffled ordinary deck of 52 cards. Find the probability that they are both aces if the first card is i) replaced ii) not replaced. **(05 Marks)**

c. Out of 30 students in a hostel, 15 study history 8 study economics and 6 study geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these. **(05 Marks)**

OR

8 a. Define probability of an event. Find the probability of a 5 turning up at least once in two tosses of a fair die. **(06 Marks)**

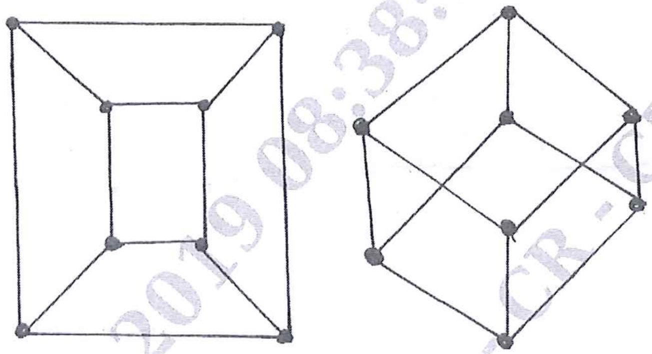
b. A box contains 5 red and 4 white marbles. Two marbles are drawn successively from the box without replacement and it is noted that the second one is white. What is the probability that the first is also white? **(03 Marks)**

c. How many integers between 1 and 300 (inclusive) are
   i) divisible by atleast one of 5, 6, 8?
   ii) divisible by none of 5, 6, 8. **(07 Marks)**

Module-5

9 a. Define complete graph, regular graph and complete bipartite graph with on example each. **(06 Marks)**

b. Define isomorphism of graphs. Verify that the two graphs shown below are isomorphic. **(05 Marks)**



c. Show that the complete graph K_5 is a non-planar graph. **(05 Marks)**

OR

10 a. Define connected graph, complement of a simple graph and Hamilton graph with one example for each. **(06 Marks)**

b. Explain Konigsberg bridge problem. **(05 Marks)**

c. Find the chromatic polynomial for the cycle C_4. Using decomposition theorem. **(05 Marks)**

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