

# MODEL QUESTION PAPER

## (SET-I)

WITH ANSWERS OF MULTIPLE-CHOICE QUESTIONS

For

**P.G. (Mathematics) Semester-3**

**Paper: CCMATH307**

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**Section-I**  
**(Compulsory)**

**Each part of question carries 1 mark.**

1. Choose the correct answer:
- (i) Let  $(P, \leq)$  be a partially ordered set. An element  $a$  in  $P$  is such that there is no element  $b \in P$  satisfying  $a \neq b$  and  $a \leq b$  then  $a$  is called...
- (a) maximal
  - (b) minimal
  - (c) greatest
  - (d) least
- (ii) The statement “Least and greatest elements of a partially ordered set  $(P, \leq)$  always exist” is ...
- (a) true
  - (b) false
- (iii) Which of the following is called idempotent law?
- (a)  $a \wedge (a \vee b) = a$
  - (b)  $a \wedge (b \wedge c) = (a \wedge b) \wedge c$
  - (c)  $a \wedge a = a$
  - (d)  $a \wedge b = b \wedge a$
- (iv) If  $a$  and  $b$  are two elements of a Boolean algebra  $B$ , then  $a + a'.b = \dots$
- (a)  $a$
  - (b)  $b$
  - (c)  $a + b$
  - (d) none of these.
- (v) In a Boolean algebra, which of the following is a conjunctive normal form?
- (a)  $a + bc + a'bc$
  - (b)  $(a + b + c')(a' + b + c)(a + b + c)$
  - (c)  $ab'c + abc' + a'b'c'$
  - (d) none of these.
- (vi) In a graph, the number of vertices with odd degree is...
- (a) always odd.
  - (b) always even.
  - (c) always an integer multiple of 3.
  - (d) none of these.
- (vii) A graph is said to be a simple graph if it has ...

- (a) no circuit in it.
  - (b) no parallel edges.
  - (c) no self-loop.
  - (d) no parallel edges or self-loop.
- (viii) A connected graph  $G$  is a Euler graph if and only if ...
- (a) every vertex of  $G$  is of even degree
  - (b) every vertex of  $G$  is of odd degree.
  - (c) exactly two vertices are of odd degree.
  - (d) exactly two vertices are of even degree.
- (ix) In a connected planar graph with  $n$  vertices and  $e$  edges the number of regions is equal to ...
- (a)  $e - n$
  - (b)  $n - e$
  - (c)  $e - n + 2$
  - (d)  $n - e + 2$
- (x) Among 1000 people, the minimum number of people that were born in the same month is ...
- (a) 81
  - (b) 82
  - (c) 83
  - (d) 84

## Section-II

**Answer any four questions.**

Each question carries 15 marks.

- 2(a). Define distributed lattice and complemented lattice. Prove that in a distributed lattice if complement of an element exists then it is unique.
- (b). Define sub-lattice and complete lattice. Also prove that intersection of two sub-lattices is also a sub-lattice whereas union of sub-lattice may not be a sublattice.

- 3(a). Define Boolean algebra and prove that for every pair of elements in a Boolean algebra
- (i)  $(a + b)' = a' . b'$
  - (ii)  $(a . b)' = a' + b'$
- (b). Write the Boolean function  $f = (xy' + xz)' + x'$  in Conjunctive Normal form.
- 4(a). Define switch. Discuss the connection of switches in parallel and series and also show that algebra of switches is Boolean algebra.
- (b). Draw the circuit diagram represented by the Boolean function  
 $f = (a + b)(cde + (f + g)h)$   
 and hence find a circuit which would be open(closed) if and only if above circuit is closed(open).
5. Define Hamiltonian path and circuit. Prove that if  $G$  is a graph with  $n(\geq 3)$  vertices and if  $\deg(u) + \deg(v) \geq n$  for every pair of non-adjacent vertices  $u$  &  $v$ , then  $G$  is Hamiltonian.
6. Define a tree, spanning tree and minimum spanning tree. Discuss Kruskal's algorithm to find minimum spanning tree with the help of an example,
- 7(a). Define planar graph and show that  $K_5$  &  $K_{3,3}$  are non-planar.
- (b). State and prove five colours theorem.
8. Discuss the principle of Inclusion & Exclusion and hence derive the formula to find number of derangements of  $n$  objects. Also find the number of ways such that no person picks his own hat if 6 persons randomly arrive at a dark room to retrieve their hats.

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## ANSWER TO OBJECTIVE TYPE QUESTIONS

- (i) a
- (ii) b
- (iii) c
- (iv) c
- (v) b
- (vi) b
- (vii) d
- (viii) a
- (ix) c
- (x) d