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Code No. : 31012

**VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**  
**M.C.A. (CBCS) I-Semester Main Examinations, January-2018**

**Discrete Structures**

Time: 3 hours

Max. Marks: 60

Note: Answer ALL questions in Part-A and any FIVE from Part-B

**Part-A (10 × 2 = 20 Marks)**

- Let  $p, q, r$  denote the following statements about a particular triangle  $ABC$ .  
 $p$ : Triangle  $ABC$  is isosceles.  
 $q$ : Triangle  $ABC$  is equilateral.  
 $r$ : Triangle  $ABC$  is equiangular.  
Translate each of the following statements into an English sentence.
  - $q \rightarrow p$
  - $\neg p \rightarrow \neg q$
  - $q \leftrightarrow r$
  - $p \wedge \neg q$
- Verify that  $[\neg(p \rightarrow q) \rightarrow \neg q]$  is a tautology.
- Use mathematical induction to prove that 5 divides  $n^5 - n$  whenever  $n$  is a nonnegative integer.
- Convert the following binary number to base 10 and 16: 11001110
- Find the coefficient of  $x^4$  in  $(1 - 5x)^{-6}$ .
- Solve the recurrence relation  $a_{n+3} - 3a_{n+2} + 3a_{n+1} - a_n = 0$  for  $n \geq 0$
- Define the terms: Group, subgroup and semi-group.
- What is homomorphism of two groups? Give an example.
- Define Hamiltonian path and Hamiltonian cycle.
- What is a spanning tree? Give an example.

**Part-B (5 × 8 = 40 Marks)**

- Construct a truth table for the compound statement  $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$  [6]
  - Draw the venn diagram for commutative law of intersection. [2]
- If  $n$  is a positive integer, prove that [5]  
 $1 \cdot 3 + 2 \cdot 4 + 3 \cdot 5 + \dots + n(n+2) = [n(n+1)(2n+7)] / 6$
  - Give a recursive definition for the set of all nonnegative even integers. [3]
- From a group of 10 professors, how many ways can a committee of 5 members be formed so that at least one of the professor A and professor B will be included? Solve this by using principle of inclusion and exclusion. [8]
- Solve the recurrence relation  $a_{n+3} - 3a_{n+2} + 3a_{n+1} - a_n = 3 + 5n$  for  $n \geq 0$  [8]

15. a) Explain graph, connected graph, complete graph and regular graph with an example. [4]  
b) Find the chromatic number of the complete graph  $K_4$ . [4]
16. a) Define contrapositive, converse and inverse of an open statement and explain each with an example. [4]  
b) Briefly explain about partial order relations and Hasse diagrams. [4]
17. Answer any *two* of the following:
- a) Find the coefficient of  $x^{15}$  in  $(x^2 + x^4 + x^6 + \dots)^4$  [4]  
b) Find the recurrence relation, with initial condition, that uniquely determines the following geometric progression: 6, -8, 54, -162, ... [4]  
c) Write Breadth -First search algorithm. [4]

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