



Reg. No. : .....

Name : .....

**First Semester M.Tech. Degree Examination, March 2014**  
**(2013 Scheme)**  
**Computer Science Engineering and Information Security**  
**RCC 1001 : MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**

Time : 3 Hours

Max. Marks : 60

**Instructions :** Answer **any two** questions from **each** Module. **All** questions carry **equal** marks.

MODULE – I

1. a) Show that  $\sqrt{2}$  is irrational by giving a proof by contradiction. 5  
b) Prove by mathematical induction that  $6^{n+2} + 7^{2n+1}$  is divisible by 43 for each positive integer n. 5

2. a) Solve the recurrence relation  
 $a_n = -3a_{n-1} + 10a_{n-2} + 3 \cdot 2^n$  for  $n \geq 2$   
 $a_0 = 0, a_1 = 6$  using Generating function. 5

- b) What is branching time logic ? Explain. 5

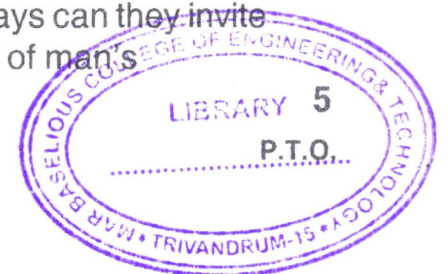
3. a) Solve the recurrence relation using characteristic root method.  
 $a_r - 4a_{r-1} + 4a_{r-2} = (r + 1)^2$  given  $a_0 = 0, a_1 = 1$ . 5

- b) Using mathematical induction, prove that sum of finite terms in a geometric progression,

$$\sum_{j=0}^n ar^j = a + ar + ar^2 + \dots + ar^n = \frac{ar^{n+1} - a}{r - 1}, r \neq 1. \quad 5$$

MODULE – II

4. a) List out the important properties of Poncelet's triangle. 5  
b) A man has 7 relatives, 4 of them are ladies and 3 gents. His wife has 7 relatives, 3 of them are ladies and 4 gents. In how many ways can they invite for dinner party of 3 ladies and 3 gents so that there are 3 of man's relatives and 3 of wife's relatives.





5. a) Tina is getting married tomorrow, at an outdoor ceremony in the desert. In recent years, it has rained only 5 days each year. Unfortunately, the weatherman has predicted rain for tomorrow. When it actually rains, the weatherman correctly forecasts rain 90% of the time. When it doesn't rain, he incorrectly forecasts rain 10% of the time. What is the probability that it will rain on the day of Tina's wedding ? 5
- b) Five friends run a race everyday for 4 months. (excluding February). If no race ends in a tie, show that there are atleast 2 races with identical outcomes. 5
6. a) Explain binominal distribution. A fair coin is tossed 50 times. What is the probability that heads will appear exactly 25 times ? 5
- b) Find the expected value of a uniform random variable. 5

### MODULE – III

7. a) Distinguish between k-coloring and chromatic number of a graph. 5
- b) Prove that if a connected planar graph has  $n$  vertices, ' $e$ ' edges and ' $r$ ' regions, then  $n - e + r = 2$ . 5
8. a) State and prove Lagrange's theorem. 5
- b) Prove that the necessary and sufficient condition that a non empty subset ' $H$ ' of a group  $G$  be a subgroup is  $a \in H, b \in H \Rightarrow ab^{-1} \in H$ . 5
9. a) Discuss about discrete logarithms. 5
- b) Prove that a planar graph is 4-colorable. 5
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