**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(END SEMESTER EXAMINATION)**

**CLASS: BTECH** **SEMESTER : III**
**BRANCH: CS, AIML** **SESSION : MO/2023**

**SUBJECT: DISCRETE MATHEMATICS MA205**

**TIME: 3 Hours** **FULL MARKS: 50**

**INSTRUCTIONS:**
**1. The question paper contains 5 questions each of 10 marks and total 50 marks.**
**2. Attempt all questions.**
**3. The missing data, if any, may be assumed suitably.**
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
**5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

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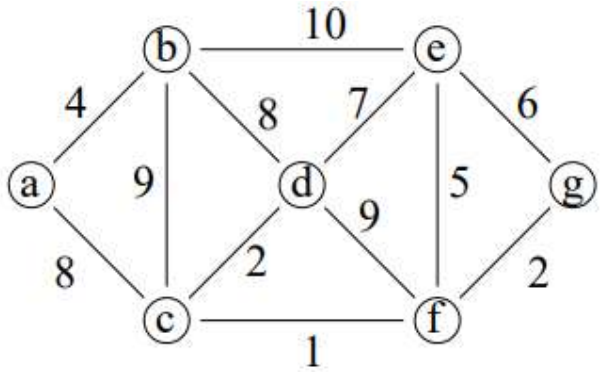
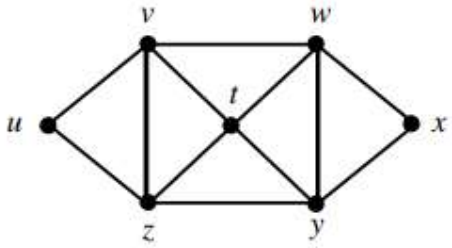
| | | | CO | BL |
|---|---|---|---|---|
| Q.1(a) | Let p, q and r be the three propositions<br>p : You have flu<br>q : You miss the final examination<br>r : You pass the course<br><br>Express the following proposition as an english sentence: $(p \wedge q) \vee (\sim q \wedge r)$ and find truth table of the proposition. | [5] | 1 | 1 |
| Q.1(b) | Prove that $1.1! + 2.2! + \ldots\ldots\ldots + n \,.\, n! = (n+1)! - 1$, whenever n is a positive integer, by mathematical induction. | [5] | 1 | 2 |
| Q.2(a) | Solve the recurrence relation by generating function method : $a_{n+2} - 5a_{n+1} + 6a_n = 2$; $n \geq 0$. $a_0 = 3$ and $a_1 = 7$ | [5] | 2 | 2 |
| Q.2(b) | Solve the recurrence relation by finding homogeneous solution and particular solution ( method of undetermined coefficient ) : $a_r - 6a_{r-1} + 9a_{r-2} = (r+1)3^r$; $a_0 = 1; a_1 = 10$ | [5] | 2 | 2 |
| Q.3(a) | Using Warshall's algorithm compute transitive closure of the relation $R = \{(1,1),(1,4),(2,2),(2,3),(3,2),(3,3),(4,1),(4,4)\}$ on the set A = {1, 2, 3, 4 } | [5] | 3 | 1 |
| Q.3(b) | The function $f(n) = \Theta(g(n))$ if and only if there exists positive constants, $n_0$, $c_1, c_2$ such that $0 \leq c_1 g(n) \leq f(n) \leq c_2 g(n)$; $\forall n \geq n_0$.<br>Prove that $2n^2 + n\log n + 1 = \Theta(n^2)$ by finding corresponding $n_0$, $c_1, c_2$. | [5] | 3 | 1 |
| Q.4(a) | Show that the set $G = \{1,2,3,4,5,6\}$ forms a group with respect to the operation multiplication modulo 7. | [5] | 4 | 2 |
| Q.4(b) | Let $H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ be a parity check matrix. Determine the (3, 6) group code $e_H : B^3 -> B^6$. Find how many error detection and correction is possible? | [5] | 4 | 3 |

Q.5(a) By Kruskal's algorithm find minimum spanning tree ( by showing each step) and find the cost [5] 5 2




Q.5(b) If it is possible then find the Euler Circuit of the following graph [5] 5 3

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