BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO/2022)

CLASS:	**BTECH**	**SEMESTER : III**
BRANCH:	**CSE & IT**	**SESSION : MO2022**

SUBJECT: MA205 DISCRETE MATHEMATICS

TIME:	**03 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. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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Q.1(a) Construct a truth table to determine if the statement $q \vee (\sim q \wedge p)$ is a tautology, a contingency or an absurdity. (CO1, BT3) [2]

Q.1(b) Show that k is odd if and only if k^3 is odd. (CO4, BT3) [3]

Q.1(c) Use mathematical induction to prove that $1+2+3+........n < \frac{(n+1)^2}{2}$ (CO4, BT3) [5]

Q.2(a) Solve the recurrence relation $b_n = -3b_n - 2b_{n-2}$, $b_1 = -2; b_2 = 4$ (CO1, BT3) [2]

Q.2(b) Find the particular solution of the recurrence relation $a_r + 5a_{r-1} + 6a_{r-2} = 3r^2$ (CO1, BT1) [3]

Q.2(c) Solve the recurrence $a_{r+2} - 5a_{r+1} + 6a_r = 2$ by the method of generating function satisfying the initial conditions $a_0 = 1$ and $a_1 = 3$. (CO4, BT1) **[5]**

Q.3(a) Let A = {1,2,3} and R = {(1,2), (2,3), (2,1)}. Find the transitive closure of R. (CO2, BT4) [2]

Q.3(b) Give a big-O estimate of $f(n) = 3n\log n! + (n^2 + 3)$ (CO5, BT2) [3]

Q.3(c) Let $A = \{1,2,3,4\}$ and R is the relation whose matrix is $M_R = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$ [5]

Determine whether R is reflexive, irreflexive, symmetric, asymmetric, antisymmetric or transitive. Give reasons for your answer. (CO5, BT5)

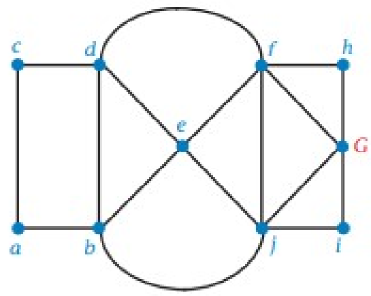
Q.4(a) Let $A = Z^+$ and R be the relation on A defined by aRb iff b = a+1. Give the transitive closure of R. (CO5, BT5) [2]

Q.4(b) Let H= $\begin{bmatrix} 0 & 1 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ & & \end{bmatrix}$ be a parity check matrix. Determine the (3,6) group code $e_H : B^3 -> B^6$. (CO2, BT5) [3]

Q.4(c) $f = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$ $g = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$ $h = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 3 \end{bmatrix}$. Find whether f and g are commutative or not under composition. Find whether f, g and h follow the associative law or not. (CO5, BT1) [5]

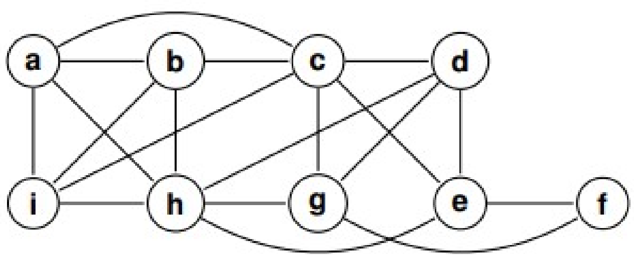
PTO

Q.5(a) If possible find Hamiltonian circuit of following graph. [2]



(CO2, BT4)

Q.5(b) Determine whether the given graph has an Euler circuit and construct such a circuit by Fleury's algorithm when one exists. [3]



(CO5 , BT5)

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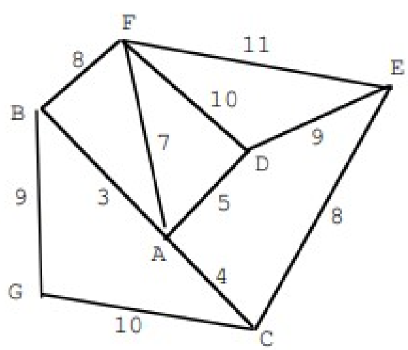
Q.5(c) Find minimum cost spanning tree by Prim's algorithm [5]



(CO2, BT6)