

[Time:2.30 Hrs]

[ Marks:75 ]

Please check whether you have got the right question paper.

- N.B: 1. All questions are compulsory.  
2. Figures to the right indicate full marks.

**Q.1 Attempt any four of the following: (Unit 1)****20**

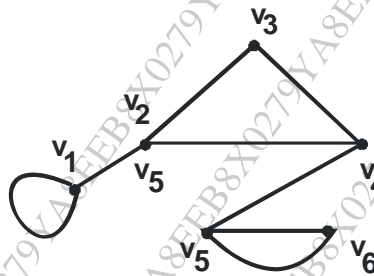
- A Let  $f: A \rightarrow B$  and  $g: B \rightarrow C$  be invertible. Then prove that  $gof$  is invertible and  $(gof)^{-1} = f^{-1}og^{-1}$ .
- B Let  $X = R - \left\{\frac{5}{2}\right\}$  and  $Y = R - \{0\}$  where  $R$  is the set of real numbers. Let the function  $f: X \rightarrow Y$  be defined by  $f(x) = \frac{1}{2x-5}$  is this function is bijective? If yes find inverse of  $f(x)$ .
- C If  $R$  be a relation on  $Z$  defined as  $xRy$  iff  $3x+5y$  is divisible by 8. Show that  $R$  is an equivalence relation.
- D Solve the recurrence relation  $a_n + a_{n-1} - 6a_{n-2} = 0$ , where  $n \geq 2$  and  $a_0 = -1$  and  $a_1 = 8$ .
- E Determine the coefficient  $x^5$  of generating function  $(1 - 2x)^{-7}$ .
- F Draw Hasse diagram of  $D_{30}$  and check whether it is Lattice or not?

**Q.2 Attempt any four of the following: (Unit 2)****20**

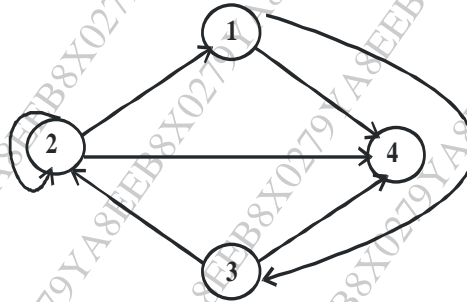
- A In a higher secondary examination, 80% of the examinees have passed in English and 85% in mathematics, while 75% passed in both English and mathematics. If 45 candidates failed in both the subjects, find the total number of candidates.
- B Show that if any eight positive integers are chosen two of them will have the same remainder when divided by 7.
- C A committee of 12 is to be selected from 10 men and 10 women. In how many ways can the selection be carried out if, i) There are no restrictions? ii) There must be six men and six women?
- D Show that  $k \binom{n}{k} = n \binom{n-1}{k-1}$ .
- E Suppose we are now interested in making the 4 couples sit in a round table. Find the number of seating arrangements.
- F Show that "A set is generated by a regular grammar if and only if it is a regular set".

**Q.3 Attempt any four of the following: (Unit 3)****20**

- A State "the Handshaking theorem" for an undirected graph also verify for given graph



B Write down relation  $R$  and the matrix  $M_R$  for given diagram. Also find  $M_{R^2}$ .

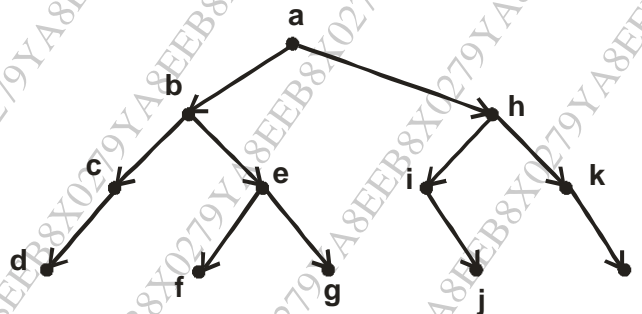


C Build a binary search tree for the sequence  $S = \{35, 24, 45, 12, 8, 55, 39, 18, 15, 42, 22\}$ .

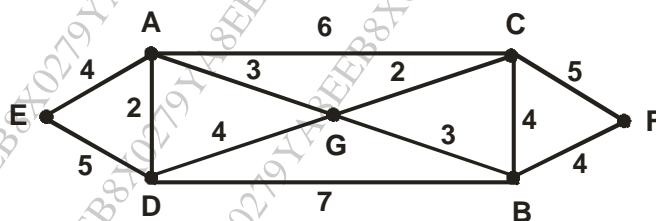
D Define the following terms with one example:

i) isolated vertex ii) pendent vertex

E For the graphs given below perform i) Preorder search ii) Inorder search iii) Post order search and write the result of your search.



F Write Breath first search algorithm to find spanning tree in graph G. beginning at a starting vertex E and end with F.



**Q.4** Attempt any three of the following: (Unit 1,2,3)

A Formulate and solve Tower of Hanoi problem.

B Find  $a_8$  if  $a_{n+1}^2 = 6a_n^2$ , where  $a_n > 0$  for  $n \geq 0$ , and  $a_0 = 2$ .

C How many positive integers not exceeding 100 are divisible by 4 or 6?

- D What is the co-efficient of  $a^3bc^2$  in the expansion of  $(a + b + c)^6$  ?
- E Show that a graph G has a spanning tree if and only if G is connected.
- F Define the following terms with one example:  
i) Adjacent matrix, ii) Incidence matrix,

\*\*\*\*\*END\*\*\*\*\*