Q. P. Code : 541101

(3 Hours)   **[Total Marks: 80]**

N.B.   (1) Question No 1 is compulsory
       (2) Solve any three question out of remaining five questions
       (3) Assumption made should be clearly stated
       (4) Figure to the right indicates full marks

1. (a) Prove using Mathematical Induction   05
         $$2+5+8+ \ldots +(3n-1)=n(3n+ 1)/2$$

    (b) Find the generating function for the following finite sequences   05
            i) 1,2,3,4, ...   ii) 2,2,2,2,2

    (c) Find solution of $a_{r+2}+2a_{r+1}-3a_r=0$ 05

    (d) Find the complement of each element in D_{30}.   05

2. (a) Let A={a,b,c,d,e,f,g,h}. Consider the following subsets of A   04
         A1={a,b,c,d}   A2={a,c,e,g,h}
         A3={a,c1e,g}   A4={b,d}   A5={f,h}
    .   Determine whether following is partition of A or not. Justify your answer.
         i) {A1, A2}   ii) {A3,A4,A5}

    (b) Prove that set G = {1,2,3,4,5,6} is a finite abelian group of order 6 with   08
         respect to multiplication module 7.

    (c) Explain distributive Lattice. Show that following diagrams represent non-   08
   distributive lattice.
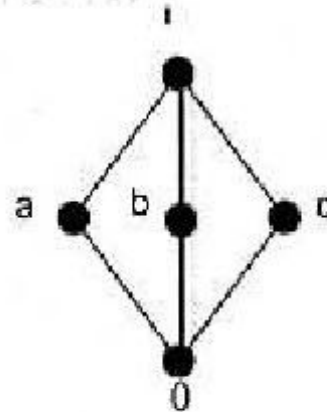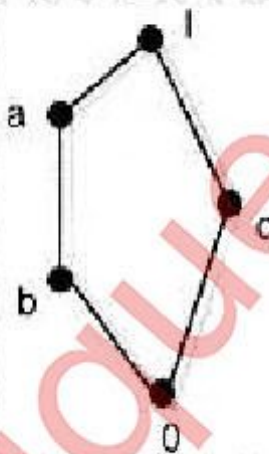
3. (a) Show that $(\sim P \wedge (\sim Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Box R$ 04

    (b) Consider the {3,5} group encoding function defined by   08

            e(000)=00000   e(001)=00110

            e(010)=01001   e(011)=01111

            e(100)=10011   e(101)=10101

            e(110)=11010   e(111)=11000

TURN OVER

Decode the following words relative to a maximum likelyhood decoding function.
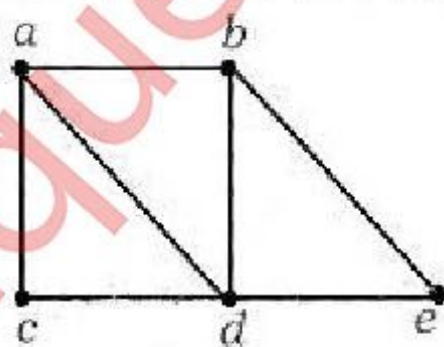
i) 11001   ii) 01010   iii) 00111

(c) Give Prim's algorithm for minimum spanning tree. Use the same to find a   08
minimum tree for the following fig.
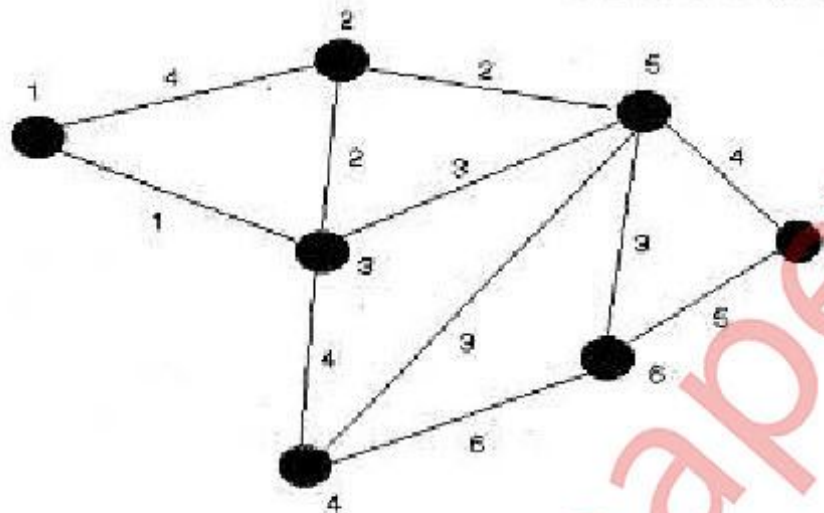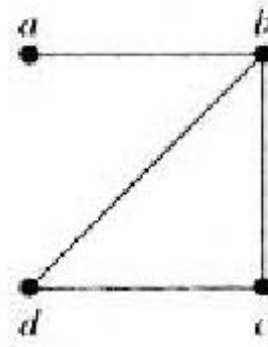

4.   (a) Let the function $f : R \rightarrow R$, $f(x) = 2x-3$ 08
Find $f^2 = fof$, $f^3 = fofof$

(b) Define Euler Path and Hamiltonian Path.   08

   i)   Determine Euler Cycle and path in graph shown in (a)

   ii) Determine Hamiltonian Cycle and path in graph shown in (b)

(a)   (b)

TURN OVER

(c) In a class of students undergoing a computer course the following were observed. **08**

Out of a total of 50 students:

30 know Pascal,

18 know Fortran,

26 know COBOL,

9 know both Pascal and Fortran,

16 know both Pascal and COBOL,

8 know both Fortran and COBOL,

47 know at least one of the three languages.

From this we have to determine
   a. How many students know none of these languages?
   b. How many students know all three languages?
   c. How many students know exactly one language?

5. (a) Define binary tree. Explain various operations on Binary tree. **04**

   (b) Explain Pigeonhole principle and Extended Pigeonhole Principle. Show that if **08**
      7 colors are used to paint 50 bicycles, at least 8 bicycles will be of same
      color.

   (c) Let A be a set of integers, let R be a relation on AXA defined by (a,b) R (c,d) **08**
      if and only if a+d=b+c.
      Prove that R is an equivalence Relation.

6. (a) Define reflexive closure and symmetric closure of a relation. Also find **04**
      reflexive and symmetric closure of R.
      A={1,2,3,4}
      R={(1,1),(1,2),(1,4),(2,4),(3,1),(3,2),(4,2),(4,3),{1,4)}
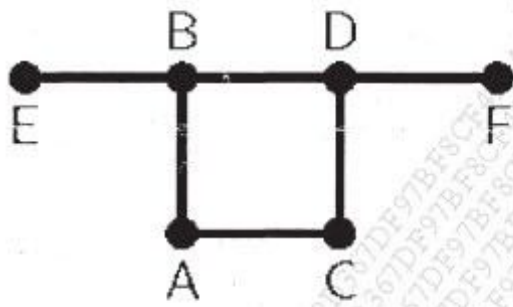
TURN OVER

(b) Let H= $\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$ **08**
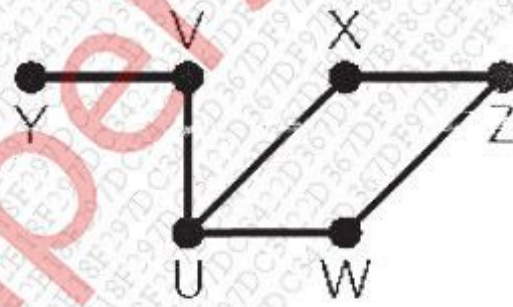
Be a parity check matrix. Determine the group code $e_H : B^3 \rightarrow B^6$

(c) Determine if following graphs G1 and G2 are isomorphic or not.   **08**

G1   G2

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