Time : 3 Hours   **Marks : 80**

Instructions :

1. All Questions are Compulsory.
2. Each Sub-question carry 5 marks.
3. Each Sub-question should be answered between 75 to 100 words. Write every questions answer on separate page.
4. Question paper of 80 Marks, it will be converted in to your programme structure marks.

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1. Solve any **four** sub-questions

   a) i) Draw example of each of the following (give justification):

       1) regular graph

       2) simple graph

       3) tree

   ii) Let $A = \{1, 2, 3, 4\}$ and Z be the set of integers. Define $f : A \to Z$ by $f(x) = 3x + 7$. Show that f is a function from A to Z. Also find the range of f.

   5

   b) Solve the following: 5

   i) Convert $(11001)_2$ to decimal equivalent number.

   ii) Write the converse, inverse and contrapositive of the following conditional statement:

       "If Sachin receives a scholarship then he will study further".

   c) i) Simplify :

       $$17\sqrt{3} - 2\sqrt{32} + 3\sqrt{18} - 4\sqrt{48}$$

   ii) What is the logarithmic form of the following exponential equation:

       1) $7^3 = 343$

       2) $\sqrt{16} = 4$

   5

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d) i) The universal set and A its subset where

U=$\{x:x \in N$ and $x \leq 10\}$, A=$\{y:y$ is a prime number less than 10$\}$. Find :

1) A^c

2) Represent A^c in Venn diagram.

ii) A debating team consists of 4 boys and 3 girls. Find the number of ways they can sit in a? **5**

e) In a school there are 20 teachers who teach Mathematics or Physics. Of these, 12 teach Mathematics and 4 teach both Physics and Mathematics. How many teachers teach Physics? **5**

2. Solve any **four** sub-questions

a) Compute : $(11010)_2 + ((11100)_2 - (10011)_2)$ **5**

b) Let $f: R \rightarrow R$ be a function defined by $f(x) = 5x^3 - 8$ for all $x \in R$, show that this function is a objective function. Hence find f^{-1}. **5**

c) Find the area of the parallelogram whose adjacent sides are represented by the vectors $i + j + k$ and $i - j + k$. **5**

d) If $A = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 2 \\ 3 & -2 \end{bmatrix}$ show that $|AB| = |B||A|$. **5**

e) $p(x)=6x^3+9x^2+\dfrac{1}{2}$ and $q(x)=4x^3+\dfrac{1}{4}x - 4$, are two polynomials, then Find their addition? **5**

3. Solve any **four** sub-questions

a) What is the simplest form of the surd:

i) $\sqrt{\dfrac{343}{45}}$

ii) $3\sqrt{8}+\sqrt{32}-5\sqrt{2}$ **5**

b) Find the roots of the quadratic equation : $3x^2-x-10=0$. **5**

c) i) Subtract the following binary numbers:

    1) $(11001)_2 - (10101)_2$

    2) $(10100)_2 - (1111)_2$

  ii) $\log_5 (25 \times 125) = ?$ 5

d) Find the area A of a triangle with sides 5 cm, 12 cm and 13 cm?   5

e) How many seven-person committees can be formed each containing three female members from an available set of 20 female and four male members from an available set of 30 males?   5

4. Solve any **four** sub-questions

a) Find all roots of $x^3 - 6x^2 + 9x - 4 = 0$.   5

b) If the cost of 2 pens and 3 pencils is 26 Rs. and the cost of 3 pens and 2 pencils is 34 Rs., then what is the cost of one pen and one pencil respectively?   5

c) Find gof and fog, where

  i) $f(x) = x - 2$, $g(x) = x^2 + 3x + 1$

  ii) $f(x) = \dfrac{1}{x}$, $g(x) = \dfrac{x-2}{x+2}$ 5

d) The relation R on $A = \{1, 2, 3, 4\}$ is defined by : $(x, y) \in R$ if $x^2 \geq y$. This relation R can be written as a set of ordered pairs as :

$R = \{(1, 1), (2, 1), (3, 1), (4, 1), (2, 2), (3, 2), (4, 2), (3, 3), (3, 4), (4, 4)\}$. Find the matrix of relation R.   5

e) Find the cross product of the vectors $j - 3k$ and $i - j + 2k$.   5

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