

Instructions :

- i) The question paper has five parts namely A, B, C, D and E. Answer all the parts.
- ii) Use the graph sheet for the question on Linear inequalities in part-D.

Part - A

Answer all the questions.

10x1=10

- 1) Given that the number of subsets of a set A is 16. Find the number of elements in A.
- 2) If $(x-1, y+3) = (2, x+4)$ find the values of x and y.
- 3) Convert $\left(\frac{7\pi}{6}\right)^c$ in to degrees.
- 4) Find the multiplicative inverse of $\sqrt{5} + 3i$
- 5) Find the 20th term of the G.P, $\frac{5}{2}, \frac{5}{4}, \frac{5}{8}, \dots$
- 6) Find 'n' if ${}^nC_9 = {}^nC_8$
- 7) Find the slope of the line $x-y+3=0$.
- 8) Write the negation of the statement " $\sqrt{7}$ is rational".
- 9) Evaluate $\lim_{x \rightarrow 0} \frac{(x+5)^5 - 1}{x}$
- 10) A letter is chosen at random from the word "ASSASSINATION". Find the probability that letter is vowel.

Part - B

Answer any TEN questions.

10x2=20

- 11) If X and Y are two sets such that $X \cup Y$ has 18 elements, X has 8 elements and Y has 15 elements, how many elements does $X \cap Y$ have?
- 12) If $A = \{-1, 1\}$ find $A \times A \times A$.
- 13) Let $f(x) = \sqrt{x}$ and $g(x) = x$ Find (i) $(f+g)x$ (ii) $(fg)x$
- 14) The minute hand of a clock is 2.1 c.m. long. How far does its tip move in 20 minutes? (use $\pi = \frac{22}{7}$)
- 15) Find the general solution of $2 \cos^2 x - 3 \sin x = 0$.
- 16) Evaluate : $\lim_{x \rightarrow 1} \frac{x^{15} - 1}{x^{10} - 1}$
- 17) Find the median for the following data
3, 9, 5, 3, 12, 10, 18, 4, 7, 19, 21
- 18) Write the converse and contrapositive of 'If a parallelogram is a square, then it is a rhombus'.
- 19) On her vacations Veena visits four cities A, B, C and D in random order. What is the probability that she visits A before B?

- 20) In a triangle ABC with vertices A(2, 3) B(4, -1) and C(1, 2) Find the length of altitude, from the vertex A.
- 21) Find the distance between two parallel lines $3x+4y+5=0$ and $6x+8y+2=0$.
- 22) Solve. $4x+3 < 6x+7$
- 23) Show that the points P(-2, 3, 5), Q(1, 2, 3) and R(7, 0, -1) are collinear.
- 24) Express $1 + \sqrt{3}i$ in polar form.

Part - C

10x3=30

Answer any TEN questions.

- 25) In a group of 600 students in a school, 150 students were found to be taking tea 225 taking coffee. 100 were taking both tea and coffee. Find how many students were taking neither tea nor coffee.
- 26) Define a signum function, Draw its graph and find its range.
- 27) Prove that $\tan 4x = \frac{4 \tan x (1 - \tan^2 x)}{1 - 6 \tan^2 x + \tan^4 x}$
- 28) If $x + iy = \sqrt{\frac{a+ib}{c+id}}$ Prove that $x^2 + y^2 = \sqrt{\frac{a^2+b^2}{c^2+d^2}}$
- 29) Convert the complex number $z = \frac{-16}{1+i\sqrt{3}}$ in to polar form.
- 30) Evaluate $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$ using Binomial Theorem.
- 31) How many words with or without meaning can be made from the letters of the word 'MONDAY', assuming that no letter is repeated if
 - (i) Four letters are used at a time.
 - (ii) All letters are used at a time.
 - (iii) All letters are used but first letter is a vowel.
- 32) Find the foci and centricity of ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$
- 33) How many terms of AP $-6, -1\frac{1}{2}, -5, \dots$ are needed to give the sum -25?
- 34) In A.P. if m^{th} term is 'n' and the n^{th} term is 'm' where $m \neq n$ find the p^{th} term.
- 35) Find the derivative of 'Sin x' w. r. t x using first principles.
- 36) Verify by the method of contradiction that $\sqrt{2}$ is irrational.
- 37) A committee of two persons is selected from 2 men and 2 women what is the probability that the committee will have (i) no man (ii) 2 men.
- 38) If E and F are two events such that

$$P(E) = \frac{1}{4} \quad P(F) = \frac{1}{2} \quad \text{and} \quad P(E \text{ and } F) = \frac{1}{8}$$
 Find $P(\text{not } E \text{ and not } F)$

Part - D

Answer any SIX questions :

6x5=30

- 39) Prove that $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right) = 1$ (x being in radians) and hence Show that $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right) = 1$
- 40) Prove by Mathematical Induction $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$; $\forall n \in \mathbb{N}$
- 41) Define a modulus function. Find its domain and range. Also draw its graph.
- 42) A group consists of 7 boys and 5 girls. Find the number of ways in which a team of 5 members can be selected so as to have at least one boy and one girl.
- 43) State and prove Binomial Theorem for any positive integer n.
- 44) Derive an expression for the coordinates of a point that divides the line joining the points $A(x_1, y_1, z_1)$ and $B(x_2, y_2, z_2)$ internally in the ratio m:n Hence find the coordinates of the mid point of AB where $A = (1, 2, 3)$ and $B = (5, 6, 7)$.
- 45) If p is the length of perpendicular from the origin to the line whose intercepts on the axes are 'a' and 'b' then prove that $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$.
- 46) Prove that $\frac{\cos 4x + \cos 3x + \cos 2x}{\sin 4x + \sin 3x + \sin 2x} = \cot 3x$
- 47) Solve the following system of inequalities graphically $2x + y \geq 4$, $x + y \leq 3$, $2x - 3y \leq 6$.
- 48) Find the mean deviation about median for the following data.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of Girls	6	8	14	16	4	2

Part - E

Answer any ONE questions.

1x10=10

- 49) a) Prove geometrically that $\cos(x+y) = \cos x \cos y - \sin x \sin y$. Hence find $\sin 75^\circ$.
b) Find the sum to n terms series $1^2 + (1^2 + 2^2) + (1^2 + 2^2 + 3^2) + \dots$
- 50) a) Define ellipse as a set of points. Derive its equation in the form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$; $a > b$
b) Find the derivative of $\frac{x^5 - \cos x}{\sin x}$ using rules of differentiation.