

**Model Question Paper – 2**  
**I P.U.C MATHEMATICS (35)**

**Time : 3 hours 15 minute**

**Max. Marks : 100**

**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 inequalities in PART E.

**PART-A**

**Answer ALL the questions:**

**10x1=10**

1. Define power set of a set.
2. If the set A has 3 elements and the set  $B=\{3,4,5\}$ . Find the number of elements in  $A \times B$ .
3. Convert  $40^\circ 20'$  into radian measure.
4. Write the multiplicative inverse of  $\frac{\sqrt{3}}{2} - \frac{1}{2}i$
5. Is  $3! + 4! = 7!$  ?
6. What is the 20<sup>th</sup> term of the sequence defined by  $a_n = (n-1)(2-n)(3+n)$ ?
7. Find the slope of a line  $3x-4y+10=0$
8. Find the derivative of  $x$  at  $x=1$ .
9. Write the negation of "Intersection of two disjoint sets is not an empty set".
10. A die is rolled. Describe the event "a number less than 7" occurs.

**PART-B**

**Answer ANY TEN questions:**

**10X2=20**

11. Let A and B be two sets such that  $n(A)=3$  and  $n(B)=2$ . If  $(5,a), (6,b), (7,a)$  are in  $A \times B$  then find the sets A and B, where  $a, b$  are distinct elements.
12. If  $A=\{3,5,7,9,11\}$ ,  $B=\{7,9,11,13\}$  and  $C=\{11,13,15\}$ , then find  $A \cap (B \cup C)$ .
13. If X and Y are two sets such that  $X \cup Y$  has 18 elements, X has 8 elements and Y has 15 elements, then how many elements does  $X \cap Y$  have?
14. Find the value of  $\sin \frac{31\pi}{3}$ .
15. Prove that :  $\cos 3x = 4\cos^3 x - 3\cos x$
16. Show that  $(-1,2,1)$ ,  $(1,-2,5)$ ,  $(4,-7,8)$  and  $(2,-3,4)$  are the vertices of a parallelogram.
17. Express  $\frac{(3+\sqrt{2}i)(3-\sqrt{2}i)}{(5+2i)-(5-2i)}$  in the form of  $a+ib$ .
18. The marks obtained by a student of class XI in first and second terminal examinations are 62 and 48, respectively. Find the minimum marks he should get in the annual examination to have an average of at least 60 marks.
19. Find the equation of line which make intercepts -3 and 2 on x and y axes respectively.
20. Find the equation of the line passing through  $(-3,5)$  and perpendicular to the line through the points  $(2,5)$  and  $(-3,6)$ .

21. Evaluate:  $\lim_{x \rightarrow 0} \frac{ax + x \cos x}{b \sin x}$
22. Write the contrapositive and converse of "If a parallelogram is a square, then it is a rhombus".
23. Two series A and B with equal means have standard deviations 9 and 10 respectively. Which series is more consistent?
24. A coin is tossed 3 times. Events A and B are,  
 A: No head appears  
 B: No tail appears. Show that A and B are mutually exclusive.

**PART-C****Answer ANY TEN questions:****10X3=30**

25. In a survey, it was found that 21 people liked product A, 26 liked product B and 29 liked product C. If 14 liked products A and B, 12 liked products C and A, 14 people liked product B and C and 8 liked all the three products. Find how many liked product C only.
26. If  $A = \{1, 2, 3, 4\}$ ,  $B = \{5, 6\}$ . Define a relation R from A to B by  $R = \{(x, y) : x \in A, y \in B, x - y \text{ is odd}\}$ . Write R in the roster form. Write down its domain and range.
27. If  $\sin x = \frac{3}{5}$ ,  $\cos y = \frac{-12}{13}$  where x and y both lie in the second quadrant, find the value of  $\sin(x+y)$ .
28. Convert  $\frac{1+i\sqrt{3}}{2}$  into polar form.
29. Solve :  $27x^2 - 10x + 1 = 0$
30. Find the number of arrangement of the letters of the word PERMUTATIONS. In how many of these arrangements (1) word start with P and end with S (2) vowels are all together.
31. Expand  $\left(x^2 + \frac{3}{5}\right)^5$ ,  $x \neq 0$
32. How many terms of the G.P  $3, \frac{3}{2}, \frac{3}{4}, \dots$  are needed to give the sum  $\frac{3069}{512}$ .
33. If the  $p^{\text{th}}$ ,  $q^{\text{th}}$ ,  $r^{\text{th}}$  terms of a G.P. are a, b, c respectively. Prove that  $a^{q-r} \cdot b^{r-p} \cdot c^{p-q} = 1$ .
34. Find the equation of circle which passes through (1,0) and (0,-1) and whose centre lies on the line  $x - y + 2 = 0$ .
35. Differentiate  $\cos x$  with respect to x by using first principles.
36. By the method of contradiction, check the validity of the statement: "If  $a, b \in \mathbb{Z}$  such that  $ab$  is odd, then both 'a' and 'b' are odd".
37. A and B are events such that  $P(A) = 0.42$ ,  $P(B) = 0.48$  and  $P(A \text{ and } B) = 0.16$ . Determine (i)  $P(\text{not } A)$ , (ii)  $P(\text{not } B)$  and (iii)  $P(A \text{ or } B)$ .
38. A committee of two persons is selected from two men and two women. What is the probability that the committee will have (i) no man? (ii) two men?

**PART-D****Answer ANY SIX questions:****6X5=30**

39. Define an identity function. Draw the graph of the identity function and write down its range and domain.

40. Prove that  $\frac{\cos 4x + \cos 3x + \cos 2x}{\sin 4x + \sin 3x + \sin 2x} = \cot 3x$
41. Prove that  $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$ ,  $\forall n \in \mathbb{N}$  by the principle of mathematical induction.
42. Derive the section formula in 3-dimensions for the internal division. Also, find the co-ordinates of the mid-point of the line joining the points P(2,3,-4) and Q(4,-7,2).
43. Solve the inequalities :  $2x + 3y < 12, x \geq 2, y \geq 2$  graphically.
44. A committee of seven has to be formed from 9 boys and 4 girls. In how many ways this can be done when the committee consists of (1) exactly 3 girls, (2) at least 3 girls and (3) at most 3 girls.
45. Show that the middle term in the expansion of  $(1+x)^{2n}$  is  $\frac{1.3.5 \dots (2n-1)}{n!}$
46. Derive the equation of a straight line passing through the point  $(x_1, y_1)$  having the slope m. Hence deduce the equation of a line which passes through (2,1) which makes an angle  $45^\circ$  with positive direction of x-axis.
47. Prove that  $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$ , where x is in radian and hence evaluate  $\lim_{x \rightarrow 0} \frac{\sin ax}{x}$ .
48. Find the mean deviation about the mean for the following data:

Marks obtained	0-10	10-20	20-30	30-40	40-50	50-60
Number of girls	6	8	14	16	4	2

### PART-E

Answer ANY ONE questions:

1X10=10

49. (a) Prove geometrically that  $\cos(A+B) = \cos A \cdot \cos B - \sin A \cdot \sin B$  and hence prove that  $\cos 2A = \cos^2 A - \sin^2 A$ . (6)
- (b) Find the sum to n terms of the series  $5+11+19+29+\dots$ . (4)
50. (a) Define hyperbola as a set of all points in the plane and derive its equation as  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$  (6)
- (b) Find the derivative of  $\frac{x + \cos x}{\tan x}$ . (4)