

**Model Question Paper – 5**  
**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**

**10 × 1=10**

1. If A has 4 elements. How many subsets does A has?
2. Convert  $520^\circ$  in to radian measure.
3. Find the conjugate of  $\sqrt{3}i - 1$ .
4. If  $\frac{1}{6!} + \frac{1}{7!} = \frac{x}{8!}$  then find x
5. Find the  $20^{th}$  term of the G.P. :  $\frac{5}{2}, \frac{5}{4}, \frac{5}{8}, \dots$
6. Find the slope of the line making inclination of  $60^\circ$  with positive direction of x-axis.
7. Find the derivative of  $2x - \frac{3}{4}$
8. Write the negation of 'For all a, b ∈ I, a - b ∈ I'.
9. Define mutually exclusive events.
10. If for some non-empty sets A and B containing 3 elements  $A \times B = \{(3,4), (5, -3), (6,1)\}$ . Find the set A.

**PART - B**

**Answer any TEN questions**

**10 × 2 = 20**

11. If  $A = \{1, 2, 3, 4\}$ ,  $B = \{2, 3, 5\}$  and  $C = \{3, 5, 6\}$ , find  $A \cup (B \cap C)$ .
12. If X and Y are the two sets such that  $n(X) = 17$ ,  $n(Y) = 23$  and  $n(X \cup Y) = 38$ . Find  $n(X \cap Y)$ .
13. Find the range and domain of the real function  $f(x) = \sqrt{9 - x^2}$ .

14. The minute hand of a clock is 2.1 cm long. How far does its tip move in 20 minute?  
 (use  $\pi = \frac{22}{7}$ ).
15. Prove that  $\tan(x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$ .
16. Evaluate:  $\lim_{x \rightarrow -1} [1 + x + x^2 + x^3 + \dots + x^{10}]$
17. A die is thrown. Write the sample space. Also find the probability of the event "A number greater than or equal to 3 will appear".
18. Write the converse and contrapositive of 'If a parallelogram is a square, then it is a rhombus'.
19. Two series A and B with equal means have standard deviations 9 and 10 respectively. Which series is more consistent?
20. Find the equation of the line perpendicular to the line  $x+y+2=0$  and passing through the point  $(-1,0)$ .
21. Represent the complex number  $z = -1 + i$  in polar form.
22. Solve  $3x+2y>6$  graphically.
23. Find the distance between the parallel lines  $3x-4y+7=0$  and  $3x-4y+5=0$
24. Show that the points  $A(1,2,3)$ ,  $B(-1,-2,-3)$ ,  $C(2,3,2)$  and  $D(4,7,6)$  are the vertices of a parallelogram.

### PART - C

**Answer any TEN questions**

**10 × 3=30**

25. In a group of 65 people, 40 like cricket, 10 like both cricket and tennis. How many like tennis? How many like tennis only and not cricket?
26. Write the relation  $R$  defined as  $R = \{(x, x + 5) : x \in \{0, 1, 2, 3, 4\}\}$  in roster system. Write down its range and domain.
27. Prove that  $(\cos x + \cos y)^2 + (\sin x - \sin y)^2 = 4\cos^2\left(\frac{x+y}{2}\right)$ .
28. Solve the equation  $x^2 + 3x + 9 = 0$ .
29. Find the real  $\theta$  such that  $\frac{3+2i\sin\theta}{1-2i\sin\theta}$  is purely real

30. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that
- (1) the student has opted for NCC or NSS (2) The student has opted for NCC but not NSS
31. Find the coefficient of  $x^6y^3$  in the expansion of  $(x + 2y)^6$
32. Find the sum of the sequence : 7,77,777,7777,.....
33. In If  $\frac{a^n+b^n}{a^{n-1}+b^{n-1}}$  is the A.M. between  $a$  and  $b$ , then find the value of  $n$ .
34. Find the derivative of the function ' $x$ ' with respect to ' $x$ ' from first principle.
35. Find the centre and radius of the circle  $x^2+y^2+8x+10y-8=0$
36. 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) 4 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.
37. Verify by the method of contradiction that  $\sqrt{2}$  is irrational.
38. Find the probability that when a hand of 7 cards is drawn from a well shuffled deck of 52 cards, it contains (i) 3 kings (ii) At least 3 kings.

### PART D

**Answer any SIX questions**

**6 × 5=30**

39. Define greatest integer function. Draw the graph of greatest integer function, Write the domain and range of the function.
40. Prove that  $\lim_{\theta \rightarrow 0} \left( \frac{\sin \theta}{\theta} \right) = 1$  ( $\theta$  being in radians) and hence show that  $\lim_{\theta \rightarrow 0} \left( \frac{\tan \theta}{\theta} \right) = 1$ .
41. Prove by mathematical induction that
- $$\frac{1}{1.4} + \frac{1}{4.7} + \frac{1}{7.10} + \dots + \frac{1}{(3n-2)(3n+1)} = \frac{n}{(3n+1)}, \quad \forall n \in N.$$
42. How many words with or without meaning each of 3 vowels and 2 consonants can be formed from the letters of the word INVOLUTE?
43. Find "a" if 17<sup>th</sup> and 18<sup>th</sup> terms of the expansion  $(2+a)^{50}$  are equal
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 midpoint of AB where  $A(2, -3, 4)$  and  $B(-1, 2, 1)$ .

45. Derive the equation of the line with slope  $m$  and  $y$ -intercept  $c$ . Also find the equation of the line for which  $\tan\theta = \frac{1}{2}$  and  $y$ -intercept is  $\frac{-3}{2}$
46. Prove that  $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$ .
47. A manufacture has 600 liters of a 12% solution of acid.. How many liters of a 30% acid solution must be added to it so that the acid content in the resulting mixture be more than 15% but less than 18%.
48. Find the mean deviation about the median age for the age distribution of 100 persons given below

|        |       |       |       |       |       |       |       |       |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| Age    | 16-20 | 21-25 | 26-30 | 31-35 | 36-40 | 41-45 | 46-50 | 51-55 |
| Number | 5     | 6     | 12    | 14    | 26    | 12    | 16    | 9     |

### PART-E

**Answer any ONE question**

**1 × 10 = 10**

49. (a) Prove geometrically that  $\cos(x + y) = \cos x \cos y - \sin x \sin y$  using unit circle method and hence find the value of  $\cos\left(\frac{\pi}{2} + x\right) = -\sin x$ . 6
- (b) Find the sum to  $n$  terms of the series : 4
- $$1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + 3 \cdot 4 \cdot 5 \dots \dots \dots$$
50. (a) Define Hyperbola as a set of points. 6
- Derive its equation in the form  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$
- (b) Suppose  $f(x) = \begin{cases} a + bx, & x < 1 \\ 4 & x = 1 \\ b - ax & x > 1 \end{cases}$  and  $\lim_{x \rightarrow 1} f(x) = f(1)$ . 4
- What are the possible values of  $a$  and  $b$ .