

6 – Marks

- Q. 1. The second, third and fourth terms in the binomial expansion $(x + a)^n$ are **240**, **720** and **1080**, respectively. Find 'x', 'a' and 'n'.
- Q. 2. In how many ways can the letters of the word **PERMUTATIONS** be arranged if the
(i) all vowels are not together, (ii) there are always **5** letters between **P** and **S** ?
- Q. 3. Convert the complex number $\frac{i + 1}{\cos(\frac{2\pi}{3}) + i \sin(\frac{2\pi}{3})}$ in the polar form.
- Q. 4. In a triangle **ABC** prove that : $(b - c) \cot\left(\frac{A}{2}\right) + (c - a) \cot\left(\frac{B}{2}\right) + (a - b) \cot\left(\frac{C}{2}\right) = 0$.
- Q. 5. Using Principle of Mathematical Induction prove that,
for all $n \geq 1$, $\cos x + \cos 2x + \cos 3x + \dots + \cos nx = \sin\left(\frac{nx}{2}\right) \cdot \operatorname{cosec}\left(\frac{x}{2}\right) \cdot \cos\left(\frac{(n+1)x}{2}\right)$
- Q. 6. In a survey of **60** people, it was found that **25** people read newspaper **H**, **26** read newspaper **T**, **26** read newspaper **I**, **9** read both **H** and **I**, **11** read both **H** and **T**, **8** read both **T** and **I**, **3** read all three newspapers. Find: (i) the number of people who read exactly one newspaper.
(ii) the number of people who read exactly two newspaper.
(iii) the number of people who read no newspaper.

4 – Marks

- Q. 7. Find the domain and range of the functions $f(x) = \frac{1}{\sqrt{16 - x^2}}$
- Q. 8. Let **R** be a relation from **N** to **N** defined by $R = \{(a, b) : a, b \in N \text{ and } a = b^2\}$. Are the following true?
(i) $(a, a) \in R$, for all $a \in N$ (ii) $(a, b) \in R, \Rightarrow (b, a) \in R$ (iii) $(a, b) \in R, (b, c) \in R \Rightarrow (a, c) \in R$.
- Q. 9. For any sets **A** and **B**, show that $P(A \cap B) = P(A) \cap P(B)$.
- Q. 10. There are **200** individuals with a skin disorder, **120** had been exposed to the chemical **C₁**, **50** to chemical **C₂**, and **30** to both the chemicals **C₁** and **C₂**. Find the number of individuals exposed to
(i) Chemical **C₁** but not chemical **C₂** (ii) No Chemical
- Q. 11. Show that : $\frac{\sec 8x - 1}{\sec 4x - 1} = \frac{\tan 8x}{\tan 2x}$

Q. 12. Show that , $\cos^2 x + \cos^2\left\{x + \frac{\pi}{3}\right\} + \cos^2\left\{x - \frac{\pi}{3}\right\} = \frac{3}{2}$.

- Q. 13. Using Principle of Mathematical Induction prove that,
for all $n \geq 1$, $1^2 + 2^2 + 3^2 + \dots + n^2 > \frac{n^3}{3}$

Q. 14. Using Principle of Mathematical Induction prove that :

$$\text{for all } n \geq 1, \frac{1}{1.2.3} + \frac{1}{2.3.4} + \frac{1}{3.4.5} + \dots + \frac{1}{n(n+1)(n+2)} = \frac{n(n+3)}{4(n+1)(n+2)}$$

Q. 15. Prove that : $\operatorname{Re} \left\{ \frac{1}{1 - \cos x + 2i \sin x} \right\} = \frac{1}{5 + 3 \cos x}$

Q. 16. If ' α ' and ' β ' are two different complex numbers with $|\beta| = 1$, then find $\left| \frac{\beta - \alpha}{1 - \bar{\alpha} \beta} \right|$

Q. 17. A solution of 8% boric acid is to be diluted by adding a 2% boric acid solution to it. The resulting mixture is to be more than 4% but less than 6% boric acid. If we have 640 litres of the 8% solution, how many litres of the 2% solution will have to be added?

Q. 18. Solve the following inequalities graphically : $2x + y \leq 12$; $4x + 5y > 20$; $x + 2y \leq 12$; $x, y \geq 0$

Q. 19. Solve the following inequalities graphically : $x + y \leq 4$; $x + 5y \geq 4$; $6x + 2y \geq 8$; $x \leq 3, y \leq 3$; $x, y \geq 0$

Q. 20. How many natural number not exceeding 4321 can be formed with the digits 1, 2, 3, and 4, if the digits can repeat?

Q. 21. If the letters of the word **FATHER** are arranged according to the dictionary, find the order of **FATHER**.

Q. 22. Find n, if the ratio of the fifth term from the beginning to the fifth term from the end in the expansion of $(2^{\frac{1}{4}} + 3^{-\frac{1}{4}})^n$ is $\sqrt{6} : 1$.
