Answer any **FIVE** of the following questions. $(5 \times 12 = 60M)$

1. a) If $z = 3 - 5i$, then show that $z^3 - 10z^2 + 58z - 136 = 0$.   **4M**

   b) If $z = x + iy$ and point P represents Z in the argand plane and $Arg\left(\frac{z-1}{z+1}\right) = \frac{\pi}{4}$, then find locus of P.   **4M**

   c) If $\cos\alpha + \cos\beta + \cos\gamma = 0 = \sin\alpha + \sin\beta + \sin\gamma$, then show that

      i) $\cos3\alpha + \cos3\beta + \cos3\gamma = 3\cos(\alpha + \beta + \gamma)$.   **3M**

      ii) $\sin3\alpha + \sin3\beta + \sin3\gamma = 3\sin(\alpha + \beta + \gamma)$.   **1M**

2. a) If $1, \omega, \omega^2$ are the cube roots of unity, then prove that

      i) $\frac{1}{2+\omega} + \frac{1}{1+2\omega} = \frac{1}{1+\omega}$.   **2M**

      ii) $(2 - \omega)(2 - \omega^2)(2 - \omega^{10})(2 - \omega^{11}) = 49$.   **2M**

   b) solve $\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = \frac{13}{6}$. when $x \neq 0$ and $x \neq 1$ **4M**

   c) If x is real, then prove that $\frac{x}{x^2-5x+9}$ lies between $-\frac{1}{11}$ and 1.   **4M**

3. a) If α, β, γ are non zero roots of $x^3 + px^2 + qx + r = 0$, then find the following in terms of p, q, r

      i) $\sum \alpha^2$ ii) $\sum \frac{1}{\alpha}$ iii) $\sum \alpha^3$ iv) $\sum \beta^2\gamma^2$ (1M+1M+1M+1M)

   b) Solve $9x^3 - 15x^2 + 7x - 1 = 0$, given that two of its roots are equal.   **4M**

   c) Solve $2x^5 + x^4 - 12x^3 - 12x^2 + x + 2 = 0$.   **4M**

4. a) Find the number of ways of arranging 6 boys and 6 girls around a circular table so that

         i) all the girls sit together ii) No two girls sit together.   **2M+2M**

   b) If the letters of the word **CHAINS** are arranged in all possible ways and the words does formed are arranged in a dictionary order then find the 601th word.   **4M**

   c) Out of 8 gentlemen and 5 ladies a committee of 5 is to be formed .Find the number of ways in which this can be done so as to always include atleast two ladies.   **4M**

5. a) Find the term independent of x in the expansion of $\left(\sqrt{\frac{x}{3}} + \frac{3}{2x^2}\right)^{10}$.   **4M**

   b) Find the coefficient of x^{10} in the expansion of $\frac{1+2x}{(1-2x)^2}$.   **4M**

   c) Resolve $\frac{3x+7}{x^2-3x+2}$ into partial fractions.   **4M**

6. a) Resolve $\dfrac{x+3}{(1-x)^2(1+x^2)}$ into partial fractions. **4M**

   b) Find the probability that a leap year contains

       i) 53 Sundays   ii) 52 Sundays only. **(2M+2M)**

   c) A, B, C are three horses in a race. The probability of A to win the race is twice that of B and probability

       of B is twice that of C. What are the probability of A, B and C to win the race. **4M**

7. a) Find the square root of $-5 + 12i$. **2M**

   b) Find the Maximum or Minimum value of quadratic expression $2x - 7 - 5x^2$. **2M**

   c) If $n_{p_7} = 42 . n_{p_5}$,then find n. **2M**

   d) Find the middle term(s) in $\left(4x + \dfrac{3y}{2}\right)^{11}$. **2M**

   e) Resolve $\dfrac{x^2}{(x-1)(x-2)}$ into partial fractions. **2M**

   f) If 4 fair coins are tossed simultaneously, then find the probability that 2 heads and 2 tails appear. **2M**

End of the Question paper