MATHEMATICS (Subjective)   Group – II

Time: 02:30 Hours   Marks: 80   FSD-2-24

SECTION – I

2. **Attempt any EIGHT parts:**   16

   (i)   Let $z \in C$, show that $\bar{\bar{z}} = z$

   (ii)   Find multiplicative inverse of $1 - 2i$

   (iii)   Simplify: $(2, 6) . (3, 7)$

   (iv)   State and prove Golden Rule of fractions.

   (v)   Find inverse of the given relation $R = \{(x, y) \mid y^2 = 4ax, x \geq 0\}$

   (vi)   If a, b are elements of a group G, then show that $(ab)^{-1} = b^{-1}a^{-1}$

   (vii)   If $A = \begin{bmatrix} i & 0 \\ 1 & -i \end{bmatrix}$, show that $A^4 = I_2$

   (viii)   If $A = \begin{bmatrix} 2 & 3 & -2 \\ -1 & 1 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -3 & 1 \\ 5 & 4 & -1 \end{bmatrix}$ then solve $3X - 2A = B$ for X.

   (ix)   Define minor and cofactor of an element of a matrix.

   (x)   Solve $x^2 + 7x + 12 = 0$ by factorization.

   (xi)   Discuss the nature of the roots of equation $2x^2 + 5x + 1 = 0$

   (xii)   Find two consecutive numbers, whose product is 132.

3. **Attempt any EIGHT parts:**   16

   (i)   Define rational fraction.

   (ii)   Resolve into partial fractions $\dfrac{7x + 25}{(x + 4)(x + 3)}$

   (iii)   Define arithmetic progression.

   (iv)   Find three A.Ms between $\sqrt{2}$ and $3\sqrt{2}$

   (v)   Sum the series: $2 + (1 - i) + \left(\frac{1}{i}\right) + \ldots$ to 8 terms.

   (vi)   Find 9th term of the H.P $\dfrac{1}{3}, \dfrac{1}{5}, \dfrac{1}{7}, \ldots$

   (vii)   Evaluate: $\dfrac{8!}{4!2!}$

   (viii)   Define sample space.

   (ix)   Find the number of diagonals of a 6-sided figure.

   (x)   Show that $5^n - 2^n$ is divisible by 3 for $n = 4$

   (xi)   Find the middle term of $\left(\dfrac{1}{x} - \dfrac{x^2}{2}\right)^{12}$

   (xii)   Expand up to 3 terms $(1 - 2x)^{\frac{1}{3}}$

4. **Attempt any NINE parts:**   18

   (i)   Define radian.

   (ii)   Express the angle $75°6'30''$ in radian measure.

   (iii)   Without using the tables, write the values of $\cos 315°$ and $\sin 540°$

   (iv)   If α, β and γ are the angles of a triangle ABC, then prove that $\tan(\alpha + \beta) + \tan \gamma = 0$

   (v)   Prove that $\sin(\alpha + \beta)\sin(\alpha - \beta) = \sin^2 \alpha - \sin^2 \beta$

   (vi)   Write the domain and range of $\sin \theta$

FSD-2-24

(vii) Find the period of $\tan \frac{x}{3}$

(viii) Draw the graph of $y = \sin x$ from 0 to π

(ix) At the top of a cliff 80m high, the angle of depression of a boat is 12°. How far is the boat from the cliff?

(x) State any two Law of Cosines.

(xi) Find the area of triangle ABC, in which b = 21.6, c = 30.2 and $\alpha = 52°40'$

(xii) Find the value of $\sin\left(\cos^{-1}\frac{\sqrt{3}}{2}\right)$

(xiii) Define trigonometric equation. Give an example.

| SECTION – II | Attempt any THREE questions. Each question carries 10 marks. |

5. (a) Prove that $\begin{vmatrix} a & b+c & a+b \\ b & c+a & b+c \\ c & a+b & a+c \end{vmatrix} = a^3 + b^3 + c^3 - 3abc$ 05

(b) Find the values of a and b if −2 and 2 are the roots of polynomial equation $x^3 - 4x^2 + ax + b = 0$ 05

6. (a) Resolve into partial fractions: $\dfrac{x^4}{1-x^4}$ 05

(b) Find four numbers in A.P whose sum is 32 and sum of whose squares is 276   05

7. (a) A card is drawn from a deck of 52 playing cards. What is the probability that it is a diamond card or an ace?   05

(b) If x is so small that its square and higher powers can be neglected, then show that:

$$\frac{(1+x)^{\frac{1}{2}}(4-3x)^{\frac{3}{2}}}{(8+5x)^{\frac{1}{3}}} \approx 4\left(1 - \frac{5x}{6}\right)$$ 05

8. (a) If α, β, γ are the angles of triangle ABC, prove that $\tan\frac{\alpha}{2}\tan\frac{\beta}{2} + \tan\frac{\beta}{2}\tan\frac{\gamma}{2} + \tan\frac{\gamma}{2}\tan\frac{\alpha}{2} = 1$ 05

(b) Prove that in an equilateral triangle $r : R : r_1 = 1 : 2 : 3$ 05

9. (a) If $\operatorname{cosec}\theta = \dfrac{m^2+1}{2m}$ and $m > 0 \left(0 < \theta < \dfrac{\pi}{2}\right)$, find the values of remaining trigonometric ratios.   05

(b) Prove that $2\tan^{-1}\dfrac{1}{3} + \tan^{-1}\dfrac{1}{7} = \dfrac{\pi}{4}$ 05