

MATHEMATICS (Subjective) Group – I

Time: 02:30 Hours

Marks: 80

FSD-1-24

SECTION – I

2. Attempt any EIGHT parts:

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- (i) State Golden rule of fractions and rule for quotient of fractions.
- (ii) Find multiplicative inverse of $(\sqrt{2}, -\sqrt{5})$
- (iii) Prove that sum as well as product of two conjugate complex numbers is a real.
- (iv) Simplify: $(a + bi)^{-2}$
- (v) Write power set of $A = \{9, 11\}$
- (vi) If a, b are elements of a group G , then show $(ab)^{-1} = b^{-1}a^{-1}$
- (vii) If $A = \begin{bmatrix} i & 1+i \\ 1 & -i \end{bmatrix}$, show that $A - (\bar{A})^t$ is skew-Hermitian.
- (viii) Evaluate: $\begin{vmatrix} 1 & 2 & -3 \\ -1 & 3 & 4 \\ -2 & 5 & 6 \end{vmatrix}$
- (ix) If $A = \begin{bmatrix} 2i & i \\ i & -i \end{bmatrix}$ then find A^{-1}
- (x) Find k if $x^3 + kx^2 - 7x + 6$ has remainder -4 , when divided by $x + 2$.
- (xi) α, β are roots of $5x^2 - x + 2 = 0$, find $\frac{3}{\alpha} + \frac{3}{\beta}$
- (xii) Discuss the nature of roots of $x^2 - 5x + 6 = 0$

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3. Attempt any EIGHT parts:

- (i) Define rational fraction.
- (ii) Resolve into partial fractions $\frac{x^2 + x - 1}{(x + 2)^3}$
- (iii) Define sequence.
- (iv) If the 5th term of an AP is 13 and its 17th term is 49, find its general term.
- (v) Find vulgar fraction equivalent to $1.\dot{5}\dot{3}$ recurring decimal.
- (vi) Find the 12th term of harmonic sequence $\frac{1}{3}, \frac{2}{9}, \frac{1}{6}, \dots$
- (vii) Evaluate: $\frac{10!}{7!}$
- (viii) Define sample space.
- (ix) Find the value of n if ${}^nC_{10} = \frac{12 \times 11}{2!}$
- (x) Show that $5^n - 1$ is divisible by 4 if $n = 5$.
- (xi) Expand $(1 - 2x)^{\frac{1}{3}}$ up to 4 terms.
- (xii) Find the middle term of $\left(\frac{x}{2} + \frac{2}{x^2}\right)^{12}$

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4. Attempt any NINE parts:

- (i) If $\cos \theta = -\frac{\sqrt{3}}{2}$ and the terminal arm of the angle is in III quadrant, find the value of $\sin \theta$ and $\tan \theta$
- (ii) Verify that $\cos 2\theta = 2\cos^2 \theta - 1$ when $\theta = 30^\circ$
- (iii) Show that $\cos(\alpha + \beta)\cos(\alpha - \beta) = \cos^2 \beta - \sin^2 \alpha$
- (iv) Prove that $\cot \alpha - \tan \alpha = 2\cot 2\alpha$
- (v) Prove that $\frac{\sin 3x - \sin x}{\cos x - \cos 3x} = \cot 2x$
- (vi) What is the domain and range of $y = \cos x$?

(Continued P.....2)

- (vii) Find the period of $3\cos \frac{x}{5}$
- (viii) Draw the graph of $y = \sin x$ for $0 \leq x \leq 360^\circ$.
- (ix) Find the measure of the greatest angle if sides of triangle are 16, 20, 33.
- (x) Find the area of the triangle ABC, when $b = 37$, $c = 45$, $\alpha = 30^\circ 50'$
- (xi) Prove that $r_1 r_2 r_3 = rs^2$
- (xii) Prove that $2\tan^{-1} A = \tan^{-1} \frac{2A}{1-A^2}$
- (xiii) Find the solution of equation $\sec x = -2$, $x \in [0, 2\pi]$

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

5. (a) If $A = \begin{bmatrix} 1 & -1 \\ a & b \end{bmatrix}$, $A^2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find the values of a and b .

- (b) Solve the system of equations $x^2 - 5xy + 6y^2 = 0$; $x^2 + y^2 = 45$

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

- (b) If $y = 1 + 2x + 4x^2 + 8x^3 + \dots$ show that $x = \frac{y-1}{2y}$

7. (a) Prove that ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$

- (b) If $2y = \frac{1}{2^2} + \frac{1 \cdot 3}{2!} \cdot \frac{1}{2^4} + \frac{1 \cdot 3 \cdot 5}{3!} \cdot \frac{1}{2^6} + \dots$, then prove that $4y^2 + 4y - 1 = 0$

8. (a) Find $\sin(\alpha + \beta)$ and $\cos(\alpha + \beta)$, given that $\tan \alpha = -\frac{15}{8}$ and $\sin \beta = -\frac{7}{25}$ and neither the terminal side of the angle of measure α nor that of β is in the IV quadrant.

- (b) Prove that $r_1 r_2 + r_2 r_3 + r_3 r_1 = s^2$

9. (a) Prove the identity, state the domain of θ , $\sin^6 \theta + \cos^6 \theta = 1 - 3\sin^2 \theta \cos^2 \theta$

- (b) Prove that $\tan^{-1} \frac{120}{119} = 2 \cos^{-1} \frac{12}{13}$

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