Model Paper Mathematic (HSSG-I)

Board: **F.B.I.S.E.** Time : **03 Hrs** Marks: **100**

Section – A (Marks: 20)

Q. 1. (a) Fill in the blanks. **(5)**

i) The conjugate of $4i+3$ is ....

ii) The sum of all the three cube root of unity is ....

iii) If $b^2 - 4ac$ is a perfect square the roots of equation are ....

iv) The Period of $\sin 2x$ is ....

v) $\cos(\alpha+\beta) - \cos(\alpha-\beta) =$ ....

(b) Mark true or false by ✓ or ✗ . **(5)**

i) If A and B are overlapping then $n(B - A) = n(A) - n(A \cap B)$

ii) The domain of principal $\cot x$ is $0 < x < \pi$

iii) If a and b are any two distinct positive real number then $A < H < G$.

iv) If α and β are roots of the equation $ax^2 + bx + b = 0$ then $\alpha\beta = \frac{b}{a}$.

v) Multiplicative inverse of $(a, 0)$ is $\left(\frac{1}{a}, 0\right)$.

(c) Pick up the right answer. **(5)**

i) The general term of the expansion $(a + b)^n$.

(a) ${}^nC_r\, a^n\, b^r$ (b) ${}^nC_{n-r}\, a^n\, b^r$ (c) ${}^nC_r\, a^{n-r}\, b^r$ (d) ${}^nC_r\, a^n\, b^{n-r}$

ii) $\tan\left(\frac{\pi}{2} - \theta\right) =$ ....

(a) $\cot\theta$ (b) $-\cot\theta$ (c) $\tan\theta$ (d) $-\tan\theta$

iii) The Harmonic Means between a and b is

(a) $\frac{a+b}{2ab}$ (b) $\frac{a-b}{2ab}$ (c) $\frac{2ab}{a+b}$ (d) None of them.

iv) ${}^nC_r \times r! =$..................

(a) ${}^nP_r$ (b) ${}^{n+1}C_r$ (c) ${}^nC_{r+1}$ (d) ${}^{n+1}P_r$

v) A square matrics $A = \left[a_{ij}\right]_{n\times n}$ is called symmetric if $A =$ ....

(a) A^2 (b) $\left(\overline{A}\right)^t$ (c) $|A|$ (d) None of them.

(d) Find correct result from Column-I from Column-II and write in Column-III.

Column-I	Column-II	Column-III
i) r	$A^c \cap B^c$	
ii) $\forall\, a \in \mathbb{R},\ a = a$	171.887°	
iii) $(A \cup B)^c$	$\frac{\Delta}{s}$	
iv) $2\text{Tan}^{-1}A$	Reflexive property.	
v) 3 Radian	$\text{Tan}^{-1}\frac{2A}{1-A^2}$	

Section – B (Marks: 40 (*4 Marks each*))

Q. 2. Find the multiplicative inverse of $1 - 2i$.

OR

Construct truth table for $(p \wedge \sim p) \rightarrow q$.

Q. 3. If A and B are non-singular matrices, then show that $(AB)^{-1} = B^{-1}A^{-1}$

OR

If $\frac{1}{a}, \frac{1}{b}$ and $\frac{1}{c}$ are in A.P, then show that the common difference is $\frac{a-c}{2ac}$.

Q. 4. How many (a) diagonals and (b) triangles can be formed by joining the vertices of polygon having 12 sides?

OR

Insert four G.Ms between 3 and 96.

Q. 5. Prove without using Calculator.

$$\cos 330° \sin 600° + \cos 120° \sin 150° = -1$$

OR

Prove that $\cos^{-1} A - \cos^{-1} B = \cos^{-1}\left(AB + \sqrt{(1-A^2)(1-B^2)}\right)$

Q. 6. If α and β are the roots of the equation $3x^2 - 2x + 4 = 0$, find the value of $\alpha^2 - \beta^2$

Q. 7. Resolve it into partial fraction.

$$\frac{x}{(x-a)(x-b)(x-c)}$$

Q. 8. Prove that $\sin 3\theta = 3\sin\theta - 4\sin^3\theta$

Q. 9. Find the length of the equatorial arc subtending an angle of 1° at the centre of the earth, taking the radius of the earth as 6400 km.

Q. 10 Find the measure of the greatest angle if sides of triangle are 16, 20, 33.

Q. 11 Solve the equation $\cot^2\theta = \frac{1}{3}$

Section – C (Marks: 40)

Attempt any four Questions. (5+5 marks each)

Q. 12. **(a)** Prove that $\bar{z} = z$ if and only if z is real.

(b) Determine whether $(P(S), *)$, where * stands for intersection is a semi-group, a monoid or neither. If it is a monoid, specify its identity.

Q. 13. **(a)** Find the inverse of the matrix by using row operation.

$$\begin{bmatrix} 1 & -3 & 2 \\ 2 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix}$$

(b) Solve the equation $4^x - 3.2^{x+3} + 128 = 0$

Q. 14. **(a)** Resolve $\dfrac{1}{(x+1)^2(x^2-1)}$ into Partial Fraction.

(b) If $y = 1 + \dfrac{x}{2} + \dfrac{x^2}{4} + \cdots\cdots\cdots$

i) Show that $x = 2\left(\dfrac{y-1}{y}\right)$

ii) Find the interval in which the series is convergent.

Q. 15. **(a)** Two dice are thrown. E_1 is the event that the sum of their dots is an odd number and E_2 is the event that one is the dot on the top of the first die. Show that $P(E_1 \cap E_2) = P(E_1).P(E_2)$.

(b) Use Mathematic Induction to prove the following formulae for every positive integer *n*.

$$\frac{1}{3} + \frac{1}{3^2} + \cdots\cdots\cdots + \frac{1}{3^n} = \frac{1}{2}\left[1 - \frac{1}{3^n}\right]$$

Q. 16. **(a)** Prove that $\dfrac{\tan\theta + \sec\theta - 1}{\tan\theta - \sec\theta + 1} = \tan\theta + \sec\theta$

(b) Reduce $\sin^4\theta$ to an expression involving only function of multiple of θ, raised to the first power.

Q. 17. **(a)** Draw the graph of $y = \tan 2x$ in the interval $[-\pi, \pi]$.

(b) Show that $r_1 = 4R \sin\dfrac{\alpha}{2} \cos\dfrac{\beta}{2} \cos\dfrac{\gamma}{2}$

Q. 18. **(a)** Prove that $2\tan^{-1}\dfrac{1}{3} + \tan^{-1}\dfrac{1}{7} = \dfrac{\pi}{4}$

(b) Solve the equation: $\sqrt{3}\tan x - \sec x - 1 = 0$
