GOVERNMENT PUBLIC EXAM QUESTION PAPER – MARCH 2025
HIGHER SECONDARY FIRST YEAR - MATHEMATICS

Time Allowed: 3 hours **Maximum Mark: 90**

Note: (i) Answer all the question.
(ii) choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer.

PART- I **20X1=20**

1. **Subtraction is not a binary operation in:**
   a) N b) R c) Q d) Z

2. **Suppose that X takes on one of the values 0, 1 and 2. If for some constant k, P (X = i) = k P (X = i - 1) for i = 1, 2 and P (X = 0) = 1/7, then the value of k is:**
   a) 3 b) 1 c) 4 d) 2

3. **If A is a non-singular matrix of order 3x3 and |A| = 5 then $|A^{-1}|$ is:**
   a) 5^2 b) 5 c) $\frac{1}{5^2}$ d) $\frac{1}{5}$

4. **A stone is thrown up vertically. The height it reaches at time t seconds is given by x = 80t - 16t ^ 2 The stone reaches the maximum height in time t seconds is given by:**
   a) 3 b) 2 c) 3.5 d) 2.5

5. **The order and degree of the differential equation $\sqrt{\frac{dy}{dx}} - 4\frac{dy}{dx} - 7x = 0$ are respectively:**
   a) 1, 2 b) 2,1 c) 2, 2 d) 1, 1

6. **If A = $\begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be that λA-1 = A, then λ is:**
   a) 19 b) 17 c) 21 d) 14

7. **The slope at any point of a curve y = f(x) is given $\frac{dy}{dx} = 3x^2$ and it passes through (-1, 1). Then the equation of the curve is:**
   a) $y = 3x^3 + 4$ b) $y = x^3 + 2$ c) $y = x^3 + 5$ d) $y = 3x^2 + 4$

8. **The domain of the function defined by f(x) = $\sin^{-1}\sqrt{x-1}$ is:**
   a) [0, 1] b) [1, 2] c) [-1, 0] d) [-1, 1]

9. **If u(x, y) = $e^{x^2+y^2}$,then $\frac{\partial u}{\partial x}$ is equal to:**
   a) x^2u b) $e^{x^2+y^2}$ c) y^2u d) 2xu

10. **The number of real numbers in [0, 2π] satisfying $\sin^4 x - 2\sin^2 x + 1$ is:**
    a) 1 b) 2 c) ∞ d) 4

11. **The square root of i are:**

a) $\pm\frac{1}{2}(1+i)$ b) $\pm\frac{1}{\sqrt{2}}(1+i)$ c) $\pm\frac{1}{2}(1-i)$ d) $\pm\frac{1}{\sqrt{2}}(1-i)$

12. **The value of sum $\sum_{n=1}^{13}(i^n + i^{n-1})$ is:**
a) 1 b) 1+i c) 0 d) i

13. **If in 6 trials, X is a binomial variable which follows the relation 9P (X = 4) = P (X = 2), then the probability of success is:**
a) 0.375 b) 0.125 c) 0.75 d) 0.25

14. **The angle between the lines $\frac{x-2}{3}=\frac{y+1}{-2}$, z=2 and $\frac{x-1}{1}=\frac{2y+3}{3}=\frac{z+5}{2}$ is:**
a) $\frac{\pi}{3}$ b) $\frac{\pi}{6}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

15. **The point of inflection of the curve y = $(x - 1)^3$ is:**
a) (1,0) b) (0,0) c) (1, 1) d) 0, 1)

16. **The value of $\int_0^{\frac{2}{3}}\frac{dx}{\sqrt{4-9x^2}}$ is:**
a) $\frac{\pi}{4}$ b) $\frac{\pi}{6}$ c) π d) $\frac{\pi}{2}$

17. **The volume of solid of revolution of the region bounded by $y^2 = x(a - x)$ about x-axis is:**
a) $\frac{\pi a^3}{5}$ b) πa^3 c) $\frac{\pi a^3}{6}$ d) $\frac{\pi a^3}{4}$

18. **An ellipse has OB as semi minor axes, F and F' its foci and the angle FBF' is a right angle. Then the eccentricity of the ellipse is:**
a) $\frac{1}{4}$ b) $\frac{1}{\sqrt{2}}$ c) $\frac{1}{\sqrt{3}}$ d) $\frac{1}{2}$

19. **The volume of the parallelepiped with its edges represented by the vectors $\hat{i}+\hat{j}$, $\hat{i}+2\hat{j}$, $\hat{i}+\hat{j}+\pi\hat{k}$ is:**
a) π b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{3}$

20. **If f(x) > 0 for all x and g(x) = log(f(x)), then dg is:**
a) $\frac{1}{f(x)}\,dx$ b) $\frac{1}{f(x)}$ f'(x) dx c) $\frac{1}{x}\,dx$ d) $\frac{1}{x}\,f(x)dx$

PART - II

Note: Answer **any seven** questions. Question No. **30 is compulsory.**

7x2 = 14

21. If adj A = $\begin{bmatrix}-1 & 2 & 2\\ 1 & 1 & 2\\ 2 & 2 & 1\end{bmatrix}$, find A^{-1}.
22. If z = x + iy, then find Re $(\frac{1}{z})$ in rectangular form.
23. Find the value of $\tan^{-1}(-\sqrt{3})$.
24. If y = 4x + c is a tangent to the circle $x^2 + y^2 = 9$, find c.
25. Find the slant (oblique) asymptote for the function f(x) = $\frac{x^2-6x+7}{x+5}$.

26. Show that F(x, y) = $\frac{x^2+5xy-10y^2}{3x+7y}$ is a homogeneous function of degree1.

27. Solve $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$

28. Find the constant C such that the function is a density function $f(x) = \begin{cases} cx^2, & 1 < x < 4 \\ 0, & otherwise \end{cases}$ is a density function of x.

29.. Find a polynomial equation of minimum degree with rational coefficients having i - 2 as a root.

30. If f(x)=sinx, then prove that integrate $\int_0^{\pi} f(x)dx = 2\int_0^{\frac{\pi}{2}} f(x)dx.$

PART - III

Note: Answer **any seven** questions. Question **No. 40 is compulsory.**

7x3 = 21

31. Solve the system of linear equations 2x + 5y = - 2, x + 2y = - 3 by matrix inversion method.

32. If |z|=2 show that 8 ≤|z + 6 + 8i|≤12.

33. Solve the equation $7x^3 - 43x^2 = 43x - 7$

34. Prove that $\tan^{-1}\frac{2}{11} + \tan^{-1}\frac{7}{24} = \tan^{-1}\frac{1}{2}$

35. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors, prove that $[\vec{a}+\vec{c}, \vec{a}+\vec{b}, \vec{a}+\vec{b}+\vec{c}] = [\vec{a}, \vec{b}, \vec{c}]$.

36. If $u(x, y) = x^2y + 3xy^4$ $x = e^t$ and y = sin t, find $\frac{du}{dt}$.

37. Evaluate $\int_0^{\frac{\pi}{2}} \frac{dx}{1+5cos^2x}$.

38.. A lottery with 600 tickets gives one prize of 200, four prizes of 100 and six prizes of 50. If the ticket cost is 2, find the expected profit amount of a ticket.

39. Find the Taylor's series about x = 2 for $f(x) = x^3 + 2x + 1$ $(-\infty < x < \infty)$

40. Let Q be the set of all Rational numbers. If * is a binary operation defined on Q as a*b = a + b - ab + 7 and ($\frac{3}{2}$* m = $\frac{87}{10}$ then find the value of m.

PART - IV

Note: Answer **all** the questions. **7x5=35**

41. a) Solve, by Cramer's rule, the system of equations $x_1-x_2=3$, $2x_1+3x_2+4x_3=17$

OR

b) Find the equation of tangent and normal to the curve given by x = 7cos t and y = 2sin t t∈R at any point on the curve.

42. a) If $\omega \neq 1$ is a cube root of unity, show that the roots of the equation $(z - 1)^3 + 8 = 0$ are $-1, 1 - 2\omega, 1 - 2\omega^2$.

OR

b) Find the area of the region bounded by the parabola $y^2 = x$ and the line $y = x - 2$

43. a) Solve the equation $6x^4 - 5x^3 - 38x^2 - 5x + 6 = 0$ if it is known that $\frac{1}{3}$ is a solution.

OR

b) Solve $(x^2-3y^2)\,dx+2xy\,dy=0$.

44. a) A bridge has a parabolic arch that is 10 m high in the centre and 30 m wide at the bottom. Find the height of the arch 6 m from the centre, on either sides.

OR

b) Using vector method, prove that $\cos(\alpha - \beta) = \cos\alpha \cos\beta + \sin\alpha \sin\beta$.

45. a) During war, 1 ship out of 9 was sunk on an average in making a certain voyage. What was the probability that:
(i) Exactly 3 out of a convoy of 6 ships would arrive safely?
(ii) No ships arrive safely from a convoy of 4 ships.

OR

b) Find the equation of the ellipse whose Foci are (2, 1), (2, 1) and the length of the latus rectum is 6

46. a) Find the non-parametric form of Vector equation, and the Cartesian equation of the plane passing through the point (0, 1, 5) and parallel to the straight lines $\vec{r}\ (\hat{\imath} - 2\hat{\jmath} + 4\hat{k})+s(2\hat{\imath} - 3\hat{\jmath} + 6\hat{k})$ and $\vec{r}\ (\hat{\imath} - 3\hat{\jmath} + 5\hat{k})+t(\hat{\imath} - \hat{\jmath} + \hat{k})$.

OR

b) The growth of a population is proportional to the number present. If the population of a colony doubles in 50 years, in how many years will the population become triple?

47. a) A hollow cone with base radius a cm and height b cm is placed on a table. Show that the volume of the largest cylinder that can be hidden underneath is 4/9 times volume of the cone.

OR

b) Using truth table, prove that $p\wedge(q\vee r) = (p\wedge q) \vee (p\wedge r)$.

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