



# QUESTION PAPERS

2024

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## Special Instructions:

- i. While answering your Questions, you must indicate on your answer-book the same Question No. as appear in your Questions Paper.
- ii. All Questions are compulsory.
- iii. Internal choices have been provided in some questions. Attempt only one of the choices in such questions.
- iv. Do not leave blank page / pages in your answer book.
- v. Question numbers 1 – 16 are multiple choice questions (M.C.Q.) carrying 1 mark each.
- vi. Question numbers 17 – 25 are of 3 marks each.
- vii. Question numbers 26 – 28 are of 4 marks each.
- viii. Question numbers 29 – 33 are of 5 marks each.
- ix. Graph paper must be attached in between the answer book.

Q.1. Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be defined as  $f(x) = 3x$  (1)  
Choose the correct answer:

- (a)  $f$  is one-one onto (b)  $f$  is many one onto  
(c)  $f$  is one-one but not onto (d)  $f$  is neither one-one nor onto

Q.2.  $\tan^{-1} \sqrt{3} - \cot^{-1}(-\sqrt{3})$  is equal to (1)

- (a)  $2\sqrt{2}$  (b)  $\pi$  (c)  $-\frac{\pi}{2}$  (d) 0

Q.3. If  $\sin^{-1} x = y$  then: (1)

- (a)  $0 \leq y \leq \pi$  (b)  $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$   
(c)  $0 < y < \pi$  (d)  $-\frac{\pi}{2} < y < \frac{\pi}{2}$

Q.4. The number of all possible matrices of order  $3 \times 3$  with each entry 0 or 1 is: (1)

- (a) 27 (b) 18 (c) 81 (d) 512

Q.5. The second order derivative of  $\log x$  is: (1)

- (a)  $\frac{1}{x}$  (b)  $\frac{1}{x^2}$  (c)  $-\frac{1}{x^2}$  (d) None of these

Q.6. The rate of change of the area of the circle with respect to its Radius  $r = 6$  cm is: (1)



- (a)  $10\pi$  cm      (b)  $12\pi$  cm      (c)  $8\pi$  cm      (d)  $11\pi$  cm

Q.7. The approximate change in the volume of a cube of side  $x$  meters caused by increasing the side by 3 % is: (1)

- (a)  $0.09 x^3 m^3$     (b)  $0.9 x^3 m^3$       (c)  $0.06 x^3 m^3$       (d)  $0.6 x^3 m^3$

Q.8.  $\int e^{x \sin x} (1 + \tan x) dx$  equals to: (1)

- (a)  $e^{x \sin x} + C$     (b)  $e^{x \sin x} + C$     (c)  $e^{x \sin x} + C$     (d)  $e^{x \tan x} + C$

Q.9. Area lying between the curves  $y^2 = 4x$  and  $y = 2x$  is: (1)

- (a)  $\frac{2}{3}$       (b)  $\frac{1}{3}$       (c)  $\frac{1}{4}$       (d)  $\frac{3}{4}$

Q.10. The order of the differential equation (1)

$$2x^2 \frac{d^2 y}{dx^2} - 3 \frac{dy}{dx} + y = 0 \text{ is:}$$

- (a) 2      (b) 1      (c) 0      (d) not defined

Q.11. The integrating factor of the differential equation (1)

$$x \frac{dy}{dx} - y = 2x^2 \text{ is:}$$

- (a)  $e^{-x}$       (b)  $e^{-y}$     (c)  $x$       (d)  $\frac{1}{x}$

Q.12. If  $\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}|$ , Then  $\theta = ?$  (1)

- (a)  $\frac{\pi}{4}$       (b) 0      (c)  $\pi$       (d)  $\frac{\pi}{2}$

Q.13. Direction cosines of  $z$ - axis are: (1)

- (a)  $[0, 1, 0]$     (b)  $[1, 0, 0]$     (c)  $[0, 0, 1]$     (d) None of these

Q.14. Distance of the plane  $2x - y + 2z + 3 = 0$  from the point (3, -2, 1) is: (1)

- (a)  $\frac{3}{1}$       (b)  $\frac{1}{3}$       (c) 0      (d) 13

Q.15. The probability of obtaining an even prime number on each die, when a pair of dice is rolled is: (1)

- (a)  $\frac{1}{3}$       (b)  $\frac{1}{3}$       (c)  $\frac{1}{1}$       (d) 0

Q.16. If A and B are events such that  $P(A/B) = P(B/A)$ , Then: (1)

- (a)  $A \subseteq B$  but  $A \neq B$     (b)  $A = B$       (c)  $A \cap B = \emptyset$     (d)  $P(A) = P(B)$



Q.17. Find gof and fog, if (3)

$$f(x) = |x| \text{ and } g(x) = |5x - 2|$$

Q.18. Using elementary transformations, find the inverse of (3)

$$\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$$

Q.19. Using the properties of the determinants, show that (3)

$$\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = k^2 (3y + k)$$

Q.20. Find the value of k so that the function f defined by (3)

$$f(x) = \begin{cases} k + 1, & x \leq \pi \\ \cos x, & x > \pi \end{cases} \text{ is continuous at point } x = \pi$$

Q.21. Evaluate  $\int_0^{\pi/2} x \ln 2x dx$  (3)

Q.22. By using the properties of the definite integrals, evaluate (3)

$$\int_0^{\frac{\pi}{2}} \frac{\cos^5 x}{\sin^5 x + \cos^5 x} dx$$

Q.23. Solve the differential equation: (3)

$$(x^2 - y^2)dy + 2xy dx = 0$$

OR

Solve the differential equation:

$$x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$$

Q.24. Two cards are drawn at random and without replacement from a pack of 52 playing cards. Find the probability that both the cards are black. (3)

Q.25. Find the probability distribution of number of tails in the simultaneous tosses of 3 coins. (3)

OR

Find the probability of getting 5 exactly twice in 7 throws of a die.

Q.26. Prove that (4)



$$\tan^{-1} \frac{2}{1} + \tan^{-1} \frac{7}{2} = \tan^{-1} \frac{1}{2}$$

OR

Express  $\tan^{-1} \left( \frac{x}{\sqrt{a^2 - x^2}} \right), |x| < a$  in the simplest form:

Q.27. Differentiate  $\sin\{\tan^{-1}(e^x)\}$  with respect to x. (4)

OR

If  $y^x = x^y$ , find  $\frac{dy}{dx}$

Q.28. Find the area of a parallelogram whose adjacent sides are determined by the vectors. (4)

$$\vec{a} = \hat{i} - \hat{j} + 3\hat{k} \text{ and } \vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$$

Q.29. Solve the system of linear equations, using matrix method. (5)

$$\begin{aligned} x - y + z &= 4 \\ 2x + y - 3z &= 0 \\ x + y + z &= 2 \end{aligned}$$



Q.30. Find two positive numbers x and y such that  $x + y = 60$  and  $xy^3$  is maximum. (5)

OR

Find the equation of tangent and normal to the parabola

$$y^2 = 4ax \text{ at point } (at^2, 2at)$$

Q.31. Find the area of the region bounded by the ellipse (5)

$$\frac{x^2}{4} + \frac{y^2}{9} = 1$$

OR

Using integration find the area of region bounded by the triangle whose vertices are  $(-1, 0)$ ,  $(1, 3)$  and  $(3, 2)$

Q.32. Find the shortest distance between the lines (5)

$$\vec{r} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k})$$

$$\vec{r} = (2\hat{i} - \hat{j} - \hat{k}) + \mu(2\hat{i} + \hat{j} + 2\hat{k})$$

OR

Find the equation of plane through the intersection of the planes

$3x - y + 2z - 4 = 0$  and  $x + y + z - 2 = 0$  and passes through the point  $(2, 2, 1)$ .

Q.33. Solve the following linear programming problem (LPP) graphically:

Maximize  $Z = 5x + 3y$  subject to the constraints (5)

$$3x + 5y \leq 15$$

$$5x + 2y \leq 10$$

$$x \geq 0$$

$$y \geq 0$$

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