

# 312301

## Winter-24

12425

03 Hours / 70 Marks

Seat No.

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*Instructions* – (1) All Questions are *Compulsory*.

(2) Answer each next main Question on a new page.

(3) Use of Non-programmable Electronic Pocket Calculator is permissible.

(4) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks**

1. Solve any FIVE of the following:

10

a) Evaluate :  $\int \left( \frac{1}{1+x^2} + \cos x \right) dx$

b) Evaluate :  $\int \sqrt{1 + \cos 2x} dx$

c) Evaluate :  $\int_0^4 (4x - x^2) dx$

d) Find the order and degree of the following differential equation  $\frac{d^2y}{dx^2} = \sqrt{y - \frac{dy}{dx}}$

e) Show that the root of the equation  $x^3 - 2x - 5 = 0$  lies between 2 and 3.

f) Find the approximate square root of a number 10 using Bakhshali Iterative method.

g) A fair coin is tossed 8 times. Find the probability of getting exactly 2 heads.

P.T.O.



2. Solve any **THREE** of the following:

12

a) Evaluate :  $\int \frac{1}{\sqrt{1-x^2}(\sin^{-1}x)^2} dx$

b) Evaluate :  $\int \frac{\cos x}{(\sin x + 1)(\sin x + 2)} dx$

c) Evaluate :  $\int e^x \cdot \sin x dx$

d) Evaluate :  $\int \frac{1}{\sqrt{16-6x-x^2}} dx$

3. Solve any **THREE** of the following:

12

a) Evaluate :  $\int_0^{\pi/2} \frac{dx}{5+4\cos x}$

b) Evaluate :  $\int_0^4 \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5} + \sqrt[3]{9-x}} dx$

c) Solve the differential equation  
 $(2xy + y^2) dx + (x^2 + 2xy + \sin y) dy = 0$

d) Using Bisection method find the root of the equation  
 $x^3 - x - 1 = 0$  (Three iterations only)



4. Solve any THREE of the following: 12

- a) Find the root of the equation  $x^3 + 2x^2 - 8 = 0$  using Regula Falsi method. (Perform three iterations)
- b) Using Newton Raphson method, find a root of the equation  $x^4 - x - 9 = 0$ , perform upto three iterations.
- c) Solve the following equations by Gauss - Seidal method
- $$5x - 2y + 3z = 18$$
- $$x + 7y - 3z = 22$$
- $$2x - y + 6z = 22$$
- d) If 20% of the bolts produced by a machine are defective, determine the probability that out of 4 bolts drawn
- One is defective
  - at the most two are defective.
- e) If probability that an electric motor is defective is 0.01, what is the probability that sample of 300 electric motors will contain exactly 5 defective motors?

5. Solve any TWO of the following: 12

- a) i) Evaluate :  $\int \frac{dx}{3-2\sin^2x}$
- ii) Evaluate :  $\int \frac{1-\tan x}{1+\tan x} dx$
- b) i) Evaluate :  $\int_0^1 \frac{dx}{x^2-x+1}$
- ii) Evaluate :  $\int_0^{\pi/2} \sin^3 x \cos x dx$
- c) i) Evaluate :  $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx$
- ii) Evaluate :  $\int_2^5 \frac{\sqrt{x}}{\sqrt{7-x} + \sqrt{x}} dx$



6. Solve any TWO of the following:

12

- a) i) Form the D.E. if  $y = ax^2 + b$   
ii) Solve :  $\sec^2x \tan y \, dx + \sec^2y \tan x \, dy = 0$

- b) i) Solve the differential equation

$$x \frac{dy}{dx} + y = x^3$$

- ii) Show that the equation

$$(3x^2 + 6xy^2) \, dx + (6x^2y + 4y^2) \, dy = 0 \text{ is an exact D.E.}$$

- c) In a sample of 1000 cases, the mean of a certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal, find

- i) How many students score between 12 and 15?  
ii) How many students score above 18?

Given:

$$A(0.8) = 0.2881$$

$$A(0.4) = 0.1554$$

$$A(1.6) = 0.4452$$