Seat Number: -_____

Duration: 2 ½ hrs   735031123   Marks:- 75

Note:- 1) All questions are compulsory.
       2) Figures to the right indicate maximum marks.

Q1) Attempt any 'Three of the following   (15M)

1) Obtain the reverse of the matrix using elementary operation   (CO1-A)

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

2) Find the inverse of Matrix A using adjoin method.   (CO1-A)

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

3) Find the rank of matrix. A by converting it into normal form.   (CO1-A)

$$A = \begin{bmatrix} 1 & 2 & 1 & 2 \\ 1 & 3 & 2 & 2 \\ 2 & 4 & 3 & 4 \\ 3 & 7 & 4 & 6 \end{bmatrix}$$

4) Examine for consistency and solve, if consistent $x + y + z = 3; 2x - y + 3z = 1;$
   $4x + y + 5z = 2; 3x - 2y + z = 4.$ (CO1-U)

5) Express $\frac{2+i}{2-i}$ in the form of a + ib   (CO1-R)

6) If $Z_1 = -2+4i$ and $Z_2 = 1-3i$ then find $Z_1.Z_2$ (CO1-U)

Q2) Attempt any 'three' of the following   (15M)

1. Solve $\frac{dy}{dx} = xy + x + y + 1$ (CO2-A)

2. Solve $\sec^2 x \tan y \, dx + \sec^2 y . \tan x \, dy = 0$ (CO2-A)

3. Solve $(x^2 - y^2) dx + 2xy \, dy = 0$ (CO2-A)

4. Solve $(3x + 2x^3) dx + (3x + y - 1) dy = 0$ (CO2-A)

5. Solve $p^2 - py + x = 0$ (CO2-A)

6. Solve $y = 2px + p^4 x^2$ (CO2-A)

Q3) Attempt any 'three' of the following   (15M)

1) Write down the prerequisites of error function.   (CO3-R)

2) Find Laplace transform of $f(t) = \sin^2 t$ (CO3-R)

3) Derive and prove Laplace transform of integration.   (CO3-R)

4) Find Laplace transform of $f(t) = t^3 e^{2t}$ (CO3-R)

5) State and derive final value theorem of Laplace transform   (CO3-R)

6) Find Laplace transform of $f(t) = \left(\frac{\sin 4t}{t}\right)$ (CO3-U)

Q4) Attempt any 'three of the following   **(15M)**

                                                                     (CO4-A)

1) Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} x^2 y \, dy \, dx$

2) Change the order of integration by showing region of integration and evaluate.(CO4-A)

$$\int_0^1 \int_{x^2}^x xy \, dx \, dy$$

3) Evaluate $\iint x^3 dx \, dy$ over the circle $x^2 + y^2 = 2ax$ (CO4-A)

4) Change the polar co-ordinate and hence evaluate   (CO4-U)

$$\int_0^a \int_0^x \frac{x^2}{\sqrt{x^2+y^2}} dx \, dy.$$

5) valuate $\iiint (x + y + z) \, dx \, dy \, dz$ over the tetrahedron bounded by the planes x=0, y=0, z=0 and x+y+z =1   (CO4-A)

6) Evaluate $\iint xy \, (x + y) \, dx \, dy$ over the area between curve $y = x^2$ and the line $y = x$.   (CO4-A)

Q5) Attempt any 'three' of the following   **(15M)**

1) Prove that $\overline{n+1} = n \overline{n}$ (CO5-U)

2) Evaluate $\int_0^x x^5 \sin^{-1} x \, dx$ (CO5-A)

3) Derive the properties of error function.   (CO5-R)

4) Prove that $\overline{\frac{1}{2}} = \sqrt{\pi}$ (CO5-U)

5) Prove that $\beta(m,n) = \beta(n,m)$ (CO5-R)

6) State the Beta and Gamma functions

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