UNIT-IV

8. a. Solve $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}-3y=x^2\log x$. **8M**

b. Apply the method of variation of parameters to solve $\frac{d^2y}{dx^2}+y=x\cos x$. **7M**

(or)

9. a. Solve the simultaneous equations, $\frac{dx}{dt}+5x-2y=t$, $\frac{dy}{dt}+2x+y=0$ given that $x=y=0$ when $t=0$. **8M**

b. Solve $\frac{d^2y}{dx^2}+y=\sin x$ by the method of undetermined coefficients. **7M**

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VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

(AUTONOMOUS)

I/IV B.Tech. DEGREE EXAMINATION, JULY, 2021

First Semester

20BS1101 MATRICES AND DIFFERENTIAL CALCULUS

Time: 3hours ***Max. Marks: 70***

Part-A is compulsory

Answer One Question from each Unit of Part-B

Answer to any single question or its part shall be written at one place only

PART-A

10 x 1 = 10M

1. a. Define the rank of a quadratic form.
   b. Define unitary matrix and give one example.
   c. If $-2, 3$ and 4 are the eigen values of a given matrix A then what is the value of det A?
   d. State Lagrange's mean value theorem.
   e. Write the formula for finding the curvature at any point P (x, y) on the curve $y=f(x)$.
   f. State the condition for the differential equation $M(x, y)\,dx + N(x, y)dy = 0$ to be exact.
   g. Find the integrating factor for $y(1+xy)dx+x(1-xy)dy=0$.
   h. Find the complementary function for the differential equation $\frac{d^2y}{dx^2}+4y=\sec 2x$
   i. Write the general form of Legendre's linear differential equation.
   j. Find Wronskian of e^{2x} and e^{-2x}.

PART-B

4 x 15 = 60M

UNIT-I

2\. a. For what values of λ, the equations $x + y + z = 1$, $x + 2y + 4z = \lambda$, $x + 4y + 10z = \lambda^2$ have a solution and solve them completely in each case. **8M**

b. Find the eigen values and the corresponding eigen vectors of the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. **7M**

(or)

3\. a. Examine the nature of the quadratic form $3x^2 - 3y^2 - 5z^2 - 2xy - 6yz - 6xz$ by converting into canonical form and specify the matrix of transformation. **8M**

b. Show that $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ satisfies its characteristic equation and find A^{-1}. **7M**

UNIT-II

4\. a. Using Maclaurin's series find the expansion of $\log_e(1+x)$. **8M**

b. Using Lagrange's mean value theorem, show that $\frac{\pi}{6} + \frac{1}{5\sqrt{3}} < \sin^{-1}\left(\frac{3}{5}\right) < \frac{\pi}{6} + \frac{1}{8}$. **7M**

(or)

5\. a. Expand the function $f(x, y) = e^x \log(1 + y)$ in terms of x and y up to third degree terms using Taylor's theorem. **8M**

b. Show that the function $f(x, y) = x^3 + y^3 - 63(x + y) + 12xy$ has maximum at (-7, -7) and minimum at (3, 3). **7M**

UNIT-III

6\. a. Solve $y^2dx + (x^2 - xy - y^2)\,dy = 0$. **8M**

b. Show that the system of rectangular hyperbolas $x^2 - y^2 = a^2$ and $xy = c^2$ are mutually orthogonal trajectories. **7M**

(or)

7\. a. Solve the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 8x^2e^{2x}\sin 2x$. **8M**

b. A body kept in air with temperature 25°C cools from 140°C to 80°C in 20 minutes. Find when the body cools down to 35°C. **7M**