(or)

9. a. Solve $\frac{dx}{dt}=3x+8y,\ \frac{dy}{dt}=-x-3y$ with $x(0)=6,\ y(0)=-2$. **(CO4 K3) 7M**

b. A circuit consists of an inductance of 0.05 henrys, a resistance of 5 ohms and a condenser of capacitance 4×10^{-4} farad. If $Q=I=0$ when $t=0$. Find Q(t) and I(t) when there is a constant emf of 110 volts. **(CO4 K4) 8M**

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VR20 Reg. No:

VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

(AUTONOMOUS)

I/IV B.Tech. DEGREE EXAMINATION, MARCH, 2023

First Semester

20BS1101 MATRICES AND DIFFERENTIAL CALCULUS

(CE, CSE, ECE, EEE, EIE, IT & ME Branches)

Time: 3 hours ***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 Hermitian and skew-Hermitian matrices. **(CO1 K1)**

b. If $A=\begin{bmatrix}-1&0&0\\0&2&0\\0&0&3\end{bmatrix}$ then find the eigen values of A^T. **(CO1 K2)**

c. State Cayley-Hamilton theorem. **(CO1 K1)**

d. Find the radius of curvature at any point on the curve $xy=c^2$. **(CO2 K2)**

e. Write the geometrical interpretation of Rolle's mean value theorem. **(CO2 K1)**

f. Define an exact differential equation. **(CO3 K1)**

g. Find the integrating factor of the differential equation. $x^2ydx-(x^3+y^3)dy=0$. **(CO3 K2)**

h. Solve $y''+2y'=0$ **(CO3 K2)**

i. State Legendre's linear equation **(CO4 K1)**

j. Write the Wronskian of x and e^x **(CO4 K2)**

PART-B

4 x 15 = 60M

UNIT-I

2. a. Test for consistency and hence solve
x+y+2z=4; 2x-y+3z=9; 3x-y-z=2. **(CO1 K3) 8M**

b. If $A=\begin{bmatrix}1 & 2\\ -1 & 3\end{bmatrix}$ express $A^6-4A^5+8A^4-12A^3+14A^2$ as a linear polynomial in A. **(CO1 K3) 7M**

(or)

3. a. Determine the modal matrix P for $A=\begin{bmatrix}1 & 1 & 3\\ 1 & 5 & 1\\ 3 & 1 & 1\end{bmatrix}$ and hence diagonalize A. **(CO1 K4) 8M**

b. If λ is an eigen value of A with X as the corresponding eigen vector then show that λ^n is eigen value of A^n corresponding to the eigen vector X. **(CO1 K2) 7M**

UNIT-II

4. a. Verify Cauchy's mean value theorem for the function
$f(x)=\frac{1}{x^2}, g(x)=\frac{1}{x}$ on [a,b]. **(CO2 K4) 7M**

b. Expand $e^x \log(1+y)$ in terms of x and y using Taylor's theorem. **(CO2 K3) 8M**

(or)

5. a. Show that the volume of the greatest rectangular parallelopiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ is $\frac{8abc}{3\sqrt{3}}$ units. **(CO2 K3) 8M**

b. Find the dimensions of the rectangular box open at the top of maximum capacity whose surface area is 108sq.inches. **(CO2 K3) 7M**

UNIT-III

6. a. Solve $(xy^3+y)dx+2(x^2y^2+x+y^4)dy=0$. **(CO3 K3) 7M**

b. Find the orthogonal trajectories of the family of cardioids $r=a(1-\cos\theta)$, Where a is the parameter. **(CO3 K3) 8M**

(or)

7. a. Solve $(D^2+2D+1)y=x\cos x$. **(CO3 K3) 7M**

b. Solve $\frac{d^2y}{dx^2}+y=e^{-x}+x^3+e^x\sin x$. **(CO3 K3) 8M**

UNIT-IV

8. a. Solve $\frac{d^2y}{dx^2}-y=\frac{2}{1+e^x}$ by the method of variation of parameters. **(CO4 K3) 8M**

b. Solve $x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10\left(x+\frac{1}{x}\right)$. **(CO4 K3) 7M**