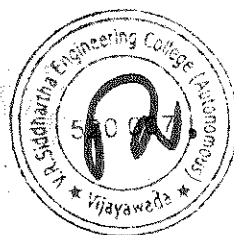


20BS1101

(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:

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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. $x^2 y dx - (x^3 + y^3) dy = 0$. (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)

Page 1 of 4



20BS1101

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**

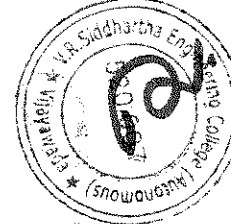
(or)

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**

VR20



20BS1101

(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**