

20BS1101

(or)

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

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Reg. No:

VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

(AUTONOMOUS)

I/IV B.Tech. DEGREE EXAMINATION, April, 2022

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 unitary matrix.
 - b. Find the sum and product of the Eigen values of $A = \begin{bmatrix} 2 & 1 & -1 \\ 3 & 4 & 2 \\ 1 & 0 & 2 \end{bmatrix}$
 - c. Prove that the matrix $A = \begin{bmatrix} 0 & i \\ i & 0 \end{bmatrix}$ is Skew-Hermitian.
 - d. Find the radius of curvature at the origin of the curve $y = x^4 - 4x^3 - 18x^2$
 - e. Write the geometrical interpretation of Lagrange's mean value theorem.
 - f. State Newton's law of cooling.
 - g. Solve $y'' - a^2y = 0, a \neq 0$.
 - h. Write the condition for exactness of a differential equation.
 - i. Find the complementary function for $(D^2 - 2D + 1)y = 0$ where $D = d/dx$.
 - j. State Cauchy's homogeneous differential equation.



20BS1101

PART-B

4 x 15 = 60M

UNIT-I

2. a. Test for consistency and solve the system of equations **7M**
 $x + y + z = 9, 2x + 5y + 7z = 52, 2x + y - z = 0.$

- b. Verify Cayley-Hamilton for the matrix $A = \begin{bmatrix} 3 & 1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 5 \end{bmatrix}$ and hence **8M**
find A^{-1} .

(or)

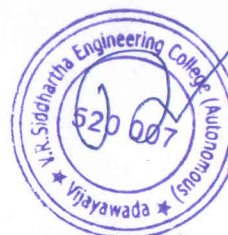
3. a. Reduce the quadratic form $3x^2 + 2y^2 + 3z^2 - 2xy - 2yz$ into canonical form by an Orthogonal transformation and hence find rank, index and signature of the quadratic form. **8M**

- b. Determine a, b, c so that A is orthogonal, where $A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$. **7M**

UNIT-II

4. a. Verify Rolle's theorem for the function $\log \left[\frac{x^2 + ab}{x(a+b)} \right]$ in $[a, b]$ $a > 0, b > 0$. **7M**
- b. Show that the radius of curvature at any point of the astroid $x = a \cos^3 \theta, y = a \sin^3 \theta$ is equal to three times the length of the perpendicular from the origin to the tangent at that point. **8M**

VR20



20BS1101

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5. a. Find the dimensions of the rectangular box open at the top of maximum capacity whose surface area is 108 sq.inches. **8M**
- b. Obtain the Taylor's series expansion of $x^2y + 3y - 2$ in powers of $(x-1)$ and $(y+2)$ using Taylor's Theorem. **7M**

UNIT-III

6. a. Solve $(x^4 e^x - 2mxy^2) dx + 2mx^2 y dy = 0$. **8M**
- b. A murder victim is discovered and a lieutenant from the Forensic science laboratory is summoned to estimate the time of death. The body is located in a room that is kept at a constant temperature of 68°F . The lieutenant arrived at 9.40 P.M. and measured the body temperature as 94.4°F at that time. Another measurement of the body temperature at 11 P.M is 89.2°F . Find the estimated time of death. **7M**

(or)

7. a. Solve $(D^2 + D + 1)y = x^3$. **7M**
- b. Solve $(D^2 - 3D + 2)y = xe^{3x} + \sin 2x$. **8M**

UNIT-IV

8. a. Apply the method of variation of parameters to solve $(D^2 + 4)y = \sec 2x$ **8M**
- b. Solve $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + 2y = x \log x$. **7M**