20BS1101

(or)

9\. a. Solve $\dfrac{dx}{dt} = 3x+8y,\ \dfrac{dy}{dt} = -x-3y$ 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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VR20

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 $y'' - a^2 y = 0,\ a \neq 0$.

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.

PART-B

4 x 15 = 60M

UNIT-I

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

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

(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**

(or)

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 $(x^4e^x-2mxy^2)\,dx+2mx^2y\,dy=0$. **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 68^0F. The lieutenant arrived at 9.40P.M. and measured the body temperature as 94.4^0F at that time. Another measurement of the body temperature at 11P.M is 89.2^0F. 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 $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+2y=x\log x$. **7M**