CODE: 17CA54101

B. Tech I Year I Semester (R17) Supplementary Examinations, February 2018

MATHEMATICS – I

(Common to all branches)

Time: 3 hours Max Marks: 70

PART – A

1. Answer any **ten** questions (10 x 2 = 20 Marks)

(a) Determine the rank of the matrix $\begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 4 & 2 & 6 \end{bmatrix}$.

(b) Define an orthogonal matrix and illustrate with example.

(c) State Cayley-Hamilton Theorem.

(d) Test the diagonal dominance for the system of equations 2x+5y-z = 6, 3x-y+6z=8, 7x+2y+z=10.

(e) Find the Eigen values of a matrix $\begin{bmatrix} 3 & 2 & 1 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{bmatrix}$.

(f) State Cauchy's mean value theorem.

(g) If $x = r\cos\theta, y = r\sin\theta,$ then find the Jacobian of x, y with respect to r, θ.

(h) Solve the differential equation of a free falling body $m\frac{dv}{dt} = mg - v$.

(i) Model the L-R circuit with e.m.f F(t) as a differential equation.

(j) Solve the differential equation $(D^3+D^2+4D+4)y = 0$, where D=d/dx.

(k) Find the Particular Integral (P.I) of $(D^3+4D)y = \sin(2x)$.

(l) Write the matrix form of the quadratic form $3x^2+5y^2+3z^2-2yz+2zx-2xy$.

PART - B

Answer all five units (5 x 10 = 50 Marks)

UNIT-I

2. Reduce the matrix A= $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ into its normal form and hence find its rank.

OR

3. Apply Gauss-Seidel iteration method to solve the equations 20x+y-2z=17, 3x+20y-z=-18, 2x-3y+20z=25.

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UNIT-II

4. Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ and also verify that the product of eigen values of the matrix is equal to its determinant.

OR

5. Reduce the quadratic form 2xy+2xz-2yz to a canonical form by an orthogonal reduction and discuss its nature and also find the modal matrix.

UNIT-III

6. A rectangular box open at top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction.

OR

7. State Lagrange's mean value theorem and verify it for $f(x) = x^2$ in (1, 5). Also deduce the inequality $\frac{h}{1+h^2} < \tan^{-1} h < h,$ when $h \neq 0$ and $h > 0$.

UNIT-IV

8. Solve the differential equations

(a) $xy(1+xy^2)\frac{dy}{dx} = 1.$

(b) $(x^2 - ay)dx = (ax - y^2)dy.$

OR

9. Find the orthogonal trajectories of the family of Confocal and coaxial parabolas $y^2 = 4a(x + a)$

UNIT-V

10. Solve the initial value problem $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 3\sin x + 4\cos x,$ with $y(0) = 1$ and $\left(\frac{dy}{dx}\right)_{x=0} = 0.$

OR

11. Determine the charge q(t) in an *RLC*-circuit with resistance 7 ohm, inductance 1 henry and capacitance 0.1 farad, which is connected to a source of electro motive force E(t)=20V initially charge q=0 coulomb and current i=0 ampere.

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