R18

Code No: 151AA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year I Semester Examinations, March/April - 2023
MATHEMATICS - I
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, MMT, ECM, AE, MIE, PTM, CSBS, CSIT, ITE, CE(SE), CSE(CS), CSE(AI&ML), CSE(DS), CSE(IOT), CSE(N), TTE, AI&DS, AI&ML, CSD)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Find the rank of the matrix by reducing to Echelon form $A = \begin{bmatrix} 1 & 4 & -2 & 1 \\ -2 & -3 & 4 & 3 \\ -3 & 3 & 6 & 12 \end{bmatrix}$ [2]

b) Check whether the matrix $A = \begin{bmatrix} i & 0 & 0 \\ 0 & 0 & i \\ 0 & i & 0 \end{bmatrix}$ is Skew-Hermitian or not. [3]

c) If $A=\begin{bmatrix} 1 & 2 & -3 \\ 0 & 3 & 2 \\ 0 & 0 & -2 \end{bmatrix}$, then find the eigenvalues of $3A^3 +5A^2 -6A +2I$. [2]

d) If $A=\begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$, then find A^3 using Cayley Hamilton theorem. [3]

e) Test for convergence of the series $\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n-1)}$. [2]

f) Test for convergence of the series $\sum_{n=1}^{\infty} \log\left(1+\frac{1}{n}\right)$. [3]

g) Evaluate $\int_0^{\infty} x^2 e^{-x^2}\, dx$ using Beta-Gamma function. [2]

h) Find the value of $'c'$ using Cauchy's mean value theorem for the function $f(x) = x^2$ and $g(x) = x^3$ [1, 2]. [3]

i) If $x^3 + y^3 - 3axy = 0$ then find the value of $\frac{dy}{dx}$. [2]

j) Using Euler's theorem find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$, if $u = \frac{x^3 y^3}{x^3 + y^3}$. [3]

PART - B

(50 Marks)

2.a) Find rank of matrix $A=\begin{bmatrix}1 & 0 & 2 & 1\\ 0 & 1 & -2 & 1\\ 1 & -1 & 4 & 0\\ 2 & 2 & 8 & 0\end{bmatrix}$ by reducing it to normal form.

b) Solve the system of equations x – y + 2z = 4, 3x + y + 4z = 6, x + y + z = 1 by using Gauss elimination method. [5+5]

OR

3.a) Find the inverse of the matrix by using Gauss-Jordan method $\begin{bmatrix}1 & 1 & 3\\ 1 & 3 & -3\\ -2 & -4 & -4\end{bmatrix}$.

b) Solve the system of equations *x+y+54z=110; 27x +6y –z =85; 6x+15y +2z =72* using Gauss Seidel method. [5+5]

4.a) Find the Eigen values and Eigen vectors of $A=\begin{bmatrix}11 & -4 & -7\\ 7 & -2 & -5\\ 10 & -4 & -6\end{bmatrix}$.

b) Verify Cayley Hamilton theorem for the Matrix $A=\begin{bmatrix}1 & 3 & 2\\ 1 & 9 & 1\\ 3 & 7 & 0\end{bmatrix}$ and hence find A^{-1}.

[5+5]

OR

5. Reduce the quadratic form $3x_1^{\ 2}+3x_2^{\ 2}+3x_3^{\ 2}+2x_1x_2+2x_1x_3-2x_2x_3$ to canonical form using orthogonal transformation. Also find signature and rank of the quadratic form. [10]

6.a) Examine the convergence of $\sum\left[\dfrac{1.4.7....(3n-2)}{3.6.9....3n}\right]^2$.

b) Examine the convergence of $x-\dfrac{x^2}{2}+\dfrac{x^3}{3}-\dfrac{x^4}{4}+....,(x>0)$. [5+5]

OR

7.a) Test for convergence of $1+\dfrac{3}{7}x+\dfrac{3.6}{7.10}x^2+\dfrac{3.6.9}{7.10.13}x^3+....$

b) Test for convergence of $\sum\left(\dfrac{n-1}{n}\right)^{n^2}$. [5+5]

8.a) If f(x) = $\sqrt{x}$ and g(x) = $\dfrac{1}{\sqrt{x}}$ prove that ‘c’ of the Cauchy’s generalized mean value theorem is the geometric mean of ‘a’ and ‘b’ for a > 0, b > 0.

b) Find Maclaurin’s series expansion of the f(x, y) $=\sin^2 x$. [5+5]

OR

9.a) Find the area bounded by pair of curve $y = 2 - x$ and $y^2 = 2(2 - x)$.

b) Evaluate $\int_{-\infty}^{\infty} e^{-a^2x^2} dx$. [5+5]

10.a) Find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ using Euler's theorem for the function $u = \cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$.

b) If u = $\frac{yz}{x}$, v = $\frac{xz}{y}$, w = $\frac{xy}{z}$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. [5+5]

OR

11.a) Determine whether the functions U = $\frac{x}{y-z}$, V = $\frac{y}{z-x}$, W= $\frac{z}{x-y}$ are dependent. If dependent find the relationship between them.

b) Find the temperature at any point (x, y, z) in space is $f = 400xyz^2$. Find the highest temperature on the surface of the unit sphere $x^2 + y^2 + z^2 = 1$. [5+5]

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