

Code No: 121AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, October/November - 2020

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, EIE, IT, ETM, MMT, AE, AME, MIE, PTM)

Time: 2 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

- 1.a) Show that the Eigen values of a skew-Hermitian matrix are purely imaginary or zero.

$$\begin{matrix} & i & 0 & 0 \\ & 0 & 0 & i \\ & 0 & i & 0 \end{matrix}$$
- b) Show that the matrix $\begin{matrix} 0 & 0 & i \\ 0 & 0 & i \\ 0 & i & 0 \end{matrix}$ is unitary. Find the Eigen values and Eigen vectors. [8+7]
- 2.a) Reduce the quadratic form $2x_1x_2 + 2x_1x_3 + 2x_2x_3$ to canonical form.

$$\begin{matrix} 0 & 2b & c \\ & & \\ & & \end{matrix}$$
- b) Determine the values of a, b, c when $\begin{matrix} a & b & -c \\ & & \\ & & \end{matrix}$ is orthogonal. [8+7]

$$\begin{matrix} a & -b & c \\ & & \\ & & \end{matrix}$$
- 3.a) State and verify Rolle's theorem for the function $f(x) = x^{2m-1}(a-x)^{2n}$ in $(0, a)$.
- b) Show that $h < e^h - 1 < he^h$ for $h \neq 0$. [8+7]
4. Prove that $\frac{\pi}{6} + \frac{1}{5\sqrt{3}} < \sin^{-1} \frac{3}{5} < \frac{\pi}{6} + \frac{1}{8}$. [15]
- 5.a) Evaluate $\int x^2 + y^2 dx dy$ over the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ in the first quadrant by using the transformation $x = au$ and $y = bv$.
- b) Evaluate $\int r^3 d\theta$ over the area included between the circles $r = 2 \sin \theta$ and $r = 4 \sin \theta$. [8+7]
6. Evaluate $\int xyz dx dy dz$ over the positive octant of the sphere $x^2 + y^2 + z^2 = a^2$. [15]
7. Solve by the method of variation of parameters $D^2 - 2D y = e^x \sin x$. [15]
8. Solve the system of equation using Laplace transform
 $2 \frac{dx}{dt} + \frac{dy}{dt} - x - y = e^{-t}; \frac{dx}{dt} + \frac{dy}{dt} + 2x + y = e^t, x(0) = 2, y(0) = 1$. [15]

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