13-15 1st year - All subjects

Code No: 111AB **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, May - 2016

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, CHEM, EIE, BME, IT, MCT, MMT, AE, AME, MIE, PTE, CEE, AGE)

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

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Verify that the matrix $\frac{1}{3}\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ is orthogonal. [2]

b) Prove that if λ is an Eigen value of a matrix A, then $\lambda + k$ is an Eigen value of A+kI. [3]

c) Verify Rolle's theorem for $f(x) = \frac{\sin x}{e^x}$ in $[0, \pi]$. [2]

d) Find the value of the Jacobian $\frac{\partial(u,v)}{\partial(r,\theta)}$ where $u = x^2 - y^2, v = 2xy$ and $x = r\cos\theta,\ y = r\sin\theta$. [3]

e) Evaluate $\int_0^\infty e^{-x^2} x^{3/2} dx$ [2]

f) Evaluate $\int_{x=0}^{1}\int_{y=0}^{2} xy\,dy\,dx$. [3]

g) Find the particular integral of $(D^2 - D - 2)y = e^{2x}$. [2]

h) Solve the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$. [3]

i) Find the Laplace transform of $t^2 e^{-2t}$. [2]

j) Derive the Laplace transform of the Heaviside step function. [3]

PART-B

(50 Marks)

2.a) Find a matrix P that transforms $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ to diagonal form.

b) Reduce the quadratic form $2xy + 2yz + 2zx$ to the canonical form by orthogonal transformation. [5+5]

OR

3.a) Find the values of a and b for which the equations $x+ay+z=3,\ x+2y+2z=b$ and $x+5z+3z=9$ are consistent.

b) Prove that if A and P are square matrices of the same order and P is invertible, then A and $P^{-1}AP$ have the same Eigen values. [5+5]

4.a) Calculate $\sqrt[5]{245}$ by Lagrange's mean value theorem.

b) Determine whether the function $u=x\sqrt{(1-y^2)}+y\sqrt{(1-x^2)},\ v=\sin^{-1}x+\sin^{-1}y$ is functionally dependent if so find the functional relation. [5+5]

OR

5.a) In a triangle ABC find the maximum value of cosAcosBcosC.

b) Find the maximum and minimum values of the function $f(x,y)=x^4+y^4-2x^2+4xy-2y^2$. [5+5]

6.a) Prove that $\frac{\beta(m,n+1)}{n}+\frac{\beta(m+1,n)}{m}=\frac{\beta(m,n)}{m+n}$.

b) Evaluate $\int_0^{\frac{\pi}{2}}\sin^4 x\,dx$. [5+5]

OR

7.a) Find the volume of the region common to $x^2+y^2=a^2$ and $x^2+z^2=a^2$.

b) Find the volume of the tetrahedron bounded $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$ and the coordinate planes. [5+5]

8.a) Solve $(D^2-1)y=xe^x\sin x$.

b) Solve $(D^3+D^2-D-1)y=\sin 2x$. [5+5]

OR

9.a) Solve the differential equation by the method of variation of parameters $(D^2+1)y=\tan x$.

b) Solve $(D^3+a^2D)y=\sin ax$. [5+5]

10.a) Find the Laplace transform of $\frac{\sin t}{t}$.

b) Using Laplace transform solve the differential equation $y''+9y=\sin 3t;\ y(0)=0,\ y'(0)=0$. [5+5]

OR

11.a) Find the Laplace transform of $f(t)=\begin{cases}2 & 0<t<\pi\\ 0 & \pi<t<2\pi\\ \sin t & t>2\pi\end{cases}$.

b) Evaluate the Laplace transform of $\frac{1}{t}[\![\delta(t-a)]\!]$. [5+5]

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