Code No: 121AB **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, May/June - 2017
MATHEMATICS-I
(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, ETM, MMT, AE, AME, MIE, PTM, CEE, MSNT)

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) Find the inverse of the matrix diag[a, b, c], $a \neq 0$, $b \neq 0$, $c \neq 0$. [2]

b) Find the quadratic form corresponding to the symmetric matrix $\begin{bmatrix} 1 & -1 & 2 \\ -1 & 2 & -2 \\ 2 & -2 & 3 \end{bmatrix}$. [3]

c) Find C of the mean value theorem, if $f(x) = x(x-1)(x-2)$ and a = 0, b = 0.5. [2]

d) If $u = \frac{x+y}{1-xy}$, $v = \tan^{-1} x + \tan^{-1} y$ find $\frac{\partial(u,v)}{\partial(x,y)}$. [3]

e) Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. [2]

f) Evaluate $\int_{-1}^{1}\int_{-2}^{2}\int_{-3}^{3} dx\,dy\,dz$. [3]

g) Find the general solution of $(4D^2 + 4D + 1)y = 0$. [2]

h) Find $\frac{1}{D^2 - 1} e^x$. [3]

i) Find $L\left[te^{2t}\right]$. [2]

j) Find $L^{-1}\left\{\frac{s}{(s-1)(s-2)}\right\}$. [3]

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Part-B (50 Marks)

2. Find for what values of λ the equations $x+y+z=1, x+2y+4z=\lambda, x+4y+10z=\lambda^2$ have a solution and solve them in each case. [10]

OR

3. If $A=\begin{bmatrix}1 & 2 & -1\\ 2 & 1 & -2\\ 2 & -2 & 1\end{bmatrix}$ verify Cayley-Hamilton theorem. Find A^{-1} using Cayley – Hamilton theorem. [10]

4.a) Verify Lagrange's mean value theorem for the function $f(x)=e^x$ in [0, 1].

b) Expand $\log\cos(x+h)$ in powers of h by Taylor's theorem. [5+5]

OR

5.a) If u and v are functions of x and y and $J=\frac{\partial(u,v)}{\partial(x,y)}$, $J'=\frac{\partial(x,y)}{\partial(u,v)}$ then prove that $JJ'=1$.

b) Find the minimum values of $x^2+y^2+z^2$ if $x+y+z=3a$. [5+5]

6. Show that $\int_0^{\pi/2}\sin^p\theta\cos^q\theta d\theta=\frac{\Gamma\left(\frac{p+1}{2}\right)\Gamma\left(\frac{q+1}{2}\right)}{2\Gamma\left(\frac{p+q+2}{2}\right)}$. [10]

OR

7. Change the order of integration and evaluate $\int_0^a\int_{x/a}^{\sqrt{x/a}}\left(x^2+y^2\right)dy\,dx$. [10]

8.a) Solve $x^3\sec^2 y\frac{dy}{dx}+3x^2\tan y=\cos x$.

b) If the surroundings are maintained at 30^0C and the temperature of body cools from 80^0C to 60^0C in 12 minutes, find the temperature of body after 24 minutes. [5+5]

OR

9.a) Solve $\left(D^2+3D+2\right)y=e^{-x}+\cos x$.

b) Solve $\left(D^3-7D^2+14D-8\right)y=e^x\cos 2x$. [5+5]

10.a) Find $L^{-1}\left\{\log\left(1+\frac{a^2}{s^2}\right)\right\}$

b) Find $L^{-1}\left\{\frac{s}{\left(s^2+4\right)^2}\right\}$ by convolution theorem. [5+5]

OR

11. Solve $\frac{d^2x}{dt^2}+2.\frac{dx}{dt}+5x=e^{-t}\sin t, x(0)=0, x'(0)=1$ by Laplace transform. [10]

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