R13

Code No: 111AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, December - 2017
MATHEMATICS-I
(Common to CE, EEE, ME, ECE, CSE, CHEM, EIE, BME, IT, MCT, ETM, MMT, AE, AME, MIE, PTM, 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) Find the rank of $\begin{bmatrix} 1 & -1 & 2 & 1 \\ 1 & 2 & 1 & 1 \\ 2 & 1 & 3 & 2 \\ 1 & -1 & 2 & 1 \end{bmatrix}$. [2]

b) Find the nature of the quadratic form $x^2 + y^2 + 2xy$. [3]

c) If $x = r\cos\theta,\ y = r\sin\theta$ then find the Jacobian $J\left(\frac{r,\theta}{x,y}\right)$. [2]

d) State Rolle's mean theorem and explain its geometrical interpretation. [3]

e) Evaluate $\int_0^{\frac{\pi}{2}} Sin^3\theta Cos^5\theta d\theta$ using beta and gamma function. [2]

f) Evaluate $\int_{-1}^{1}\int_0^{2}\int_0^{3}(x + y + z)dxdydz.$ [3]

g) Find P.I of $\frac{1}{D^2 + 16} Sin4x$ [2]

h) Find the flow of the current in simple closed LR-circuit, initially the current is zero where $L = 2H,\ R = 4\Omega$ and source of the voltage $E(t) = e^t,\ t > 0$. [3]

i) Find $L^{-1}\left(\frac{1}{s^2 - 2s + 5}\right)$ [2]

j) Let $L\{f(t)\} = \bar{f}(s),$ Prove that $L\{f(at)\} = \frac{1}{a}\bar{f}\left(\frac{s}{a}\right)$ [3]

PART-B

(50 Marks)

2.a) If a, b, c are distinct non-zero numbers, show that the homogeneous system with coefficient matrix $\begin{bmatrix} a & b & c \\ a & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{bmatrix}$ has no non-trivial solution.

b) Find the Eigen values and Eigen vectors of $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$. [5+5]

OR

3.a) Reduce the quadratic form $2x^2 + 2y^2 + 2z^2 + 2yz$ to canonical form and hence find the nature.

b) Find the value of 'k' such that the rank of A is 3, where $A = \begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{bmatrix}$. [5+5]

4.a) Examine the maxima and minima of $x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$.

b) Find the approximate value of $\sqrt[5]{245}$ by using Lagrange's mean value theorem. [5+5]

OR

5.a) Find the volume of the largest rectangular parallelepiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

b) Verify Rolle's theorem for $\log\left[\frac{x^2 + ab}{x(a+b)}\right]$ on [a, b], $b > a > 0$. [5+5]

6.a) Define Beta function, Prove that $B(m,n) = B(n,m), m > 0, n > 0$.

b) Evaluate $\int_0^2 x\sqrt{2-x}\,dx$ using Beta and Gamma function. [5+5]

OR

7. Evaluate $\iint_R xy\,dxdy$ where R is the region bounded by x-axis and x = 2a and the curve $x^2 = 4ay$. [10]

8.a) Solve $(1 + y^2)dx = (\tan^{-1} y - x)dy$.

b) Find the orthogonal trajectory of the family of cardioids $r = a(1 - \cos\theta),\ a > 0$. [5+5]

OR

9.a) Solve $\left(D^2+9\right)y=\left(x^2+1\right)e^{3x}$.

b) Solve $\left(D^2+a^2\right)y=Tanax$. [5+5]

10.a) Find $L\left\{\sqrt{t}+\frac{1}{\sqrt{t}}\right\}$ for $t>0$.

b) Solve the integral equation $f(t)=at+\int_0^t f(u)\sin(t-u)du$, $t>0$. [5+5]

OR

11.a) Evaluate $\int_0^\infty e^{-t}\frac{\sin t}{t}dt$.

b) Solve $y''+4y=0$, $y(0)=1$, $y'(0)=6$ using Laplace transform. [5+5]

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