R13

Code No: 111AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, May - 2018
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) If A and B are square symmetric matrices of same order then prove that AB + BA is symmetric. [2]

b) If one of Eigen vectors of $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 5 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ is $\begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix}$, then find the corresponding Eigen value. [3]

c) Find the value of c in Roll's theorem for $f(x) = \sin x$ in $(0, \pi)$. [2]

d) Find the stationary points of the following functions $x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$. [3]

e) Evaluate $\int_0^{\infty} x^2 e^{-x^4} dx$ [2]

f) Evaluate $\int_0^2 \int_0^{x^2} y\,dx\,dy$ [3]

g) Solve the differential equation $(D^2 - 4D + 13)y = 0$ [2]

h) Evaluate $\frac{1}{D^2 - 1}\left(x^2 + x\right)$. [3]

i) Find $L[te^t]$ [2]

j) Find f(t), if $L[f(t)] = \frac{1}{(s-1)^2}$. Hence find $L^{-1}\left[\frac{1}{s(s-1)^2}\right]$ using any theorem of Laplace transforms. [3]

PART-B

(50 Marks)

2.a) Test for the consistency and hence solve the system.
x + y + z = 6, x – y + 2z = 5, 3x + y + z = 8, 2x – 2y + 3z = 7

b) If $\lambda_1, \lambda_2, \lambda_3 .... \lambda_n$ the Eigen values of a non singular matrix A of order 'n' then prove that the Eigen values of A^{-1} are $\frac{1}{\lambda_1}, \frac{1}{\lambda_2}, \frac{1}{\lambda_3} .... \frac{1}{\lambda_n}$ [5+5]

OR

3. Reduce the quadratic form $6x^2+3y^2+3z^2-4xy-2yz+4xz$ by orthogonal reduction to the canonical form. [10]

4.a) Verify Lagranges mean value theorem for $f(x)=\log_e x$ in $[1,e]$.

b) Find the maximum and minimum values of $xy+\frac{a^3}{x}+\frac{a^3}{y}$. [5+5]

OR

5. If $x+y=2e^{\theta}\cos\phi$, $x-y=2ie^{\theta}\sin\phi$, find $\frac{\partial(x,y)}{\partial(\theta,\phi)}$ and verify that $JJ^1=1$ [10]

6.a) Evaluate $\int_0^a x^4\sqrt{a^2-x^2}\,dx$

b) Change the order of integration and evaluate $\int_0^a\int_{x^2/a}^{2a-x} xy^2\,dydx$. [5+5]

OR

7.a) Prove that $\int_0^1 (1-x^n)^{1/n}dx=\frac{\frac{1}{n}\left(\Gamma(\frac{1}{n})\right)^2}{2\Gamma(\frac{2}{n})}$

b) Evaluate $\int_0^a\int_0^{\sqrt{a^2-y^2}}\left(x^2+y^2\right)dxdy$ by changing into polar coordinates. [5+5]

8.a) Find the orthogonal Trajectory of the family of $ay^2=x^3$.

b) Solve the differential equation $(D^2+9)y=\cos 3x+\sin 2x$ [5+5]

OR

9.a) If a population is increasing exponentially at the rate of 2% per year. What will be the percentage increase over a period of 10 years?

b) Solve by the method of variation of Parameters $\frac{d^2y}{dx^2}+y=\sec x$ [5+5]

10.a) Evaluate $\int_0^{\infty}\frac{\sin t}{t}dt$

b) Find the inverse Laplace transform of $\log\left(\frac{s+1}{s-1}\right)$ [5+5]

OR

11. Solve the differential equation $\left(D^2+D\right)y=t^2+2t$, using Laplace transform given that $y(0)=4$, $\frac{dy(0)}{dt}=2$. [10]

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