

Code No: 111AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech I Year Examinations, June - 2014

MATHEMATICS-I

(Common to all Branches)

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

- 1.a) Define an orthogonal matrix. [2m]
 b) When a quadratic form is said to be [3m]
 i) Positive definite ii) Negative definite iii) Positive semi definite.
 c) State Rolle's Theorem. [2m]
 d) When a function $f(x, y)$, with usual notations of partial differential coefficients, will have maximum, minimum and can't be decided? [3m]
 e) In evaluating $\iint_R f(x, y) dx dy$ bounded by the coordinate axes and the line $\frac{x}{a} + \frac{y}{b} = 1$, find the limits of x and y . [2m]
 f) Find the limits of integration after changing the order of integration of $\int_0^1 \int_{x^2}^{2-x} xy dy dx$. [3m]
 g) State Law of Natural Growth. [2m]
 h) Solve the differential equation $(D^2 - 3D + 4)y = 0$. [3m]
 i) If $L[f(t)] = \frac{1}{(s-1)^2}$, then find $L^{-1}\left[\frac{1}{s(s-1)^2}\right]$ using any theorem of Laplace transforms. [2m]
 j) Find $L(5 \sin t + 2 \sin 3t)$. [3m]

PART-B

2. Using Cayley Hamilton theorem find the inverse of the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.

OR

3. Find the Eigen values and the corresponding Eigen vectors of the matrix

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

4. Expand $e^x \sin y$ in powers of x and y .

OR

5. Find the Maximum or minimum values of $f = 3x^4 - 2x^3 - 6x^2 + 6x + 1$.

6.a) Evaluate $\int \int_R r^3 dr d\theta$ over the area included between the circles $r = 2 \sin \theta$ and $r = 4 \sin \theta$.

b) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} dx dy dz$

OR

7.a) Evaluate $\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2) dx dy$

b) Evaluate $\int \int \int_V (xy + yz + zx) dx dy dz$, where V is the region of space bounded by planes by $x=0$, $x=1$, $y=0$, $y=2$ and $z=0$, $z=3$.

8. If a voltage of $20 \cos 5t$ is applied to a series circuit consisting of 10 ohm resistor and 2 henry inductor, determine the current at any time t .

OR

9.a) Solve the differential equation $(D^2 - 2D + 1)y = x^2 e^{3x} - \sin 2x + 3$.

b) Bacteria in a culture grow exponentially so that the initial number has doubled in 3 hours. How many times, the initial number will be present after 9 hours.

10. Using Laplace transform solve the differential equation $\frac{d^2 x}{dt^2} - 2 \frac{dx}{dt} + x = e^t$, given that $x(0) = 2$, $x'(0) = -1$.

OR

11.a) Find the inverse Laplace transform of $\log\left(1 + \frac{16}{s^2}\right)$.

b) Find the Laplace transform of $f(t)$ where $f(t) = \begin{cases} t, & 0 < t < \frac{1}{2} \\ t-1, & \frac{1}{2} < t < 1 \\ 0, & t > 1 \end{cases}$
