R13

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 $\iint\limits_{R} f(x, y)dxdy$ bounded by the coordinate axes and the

        line $\dfrac{x}{a}+\dfrac{y}{b}=1,$ find the limits of x and y.   [2m]
  f)   Find the limits of integration after changing the order of integration
        of $\int_{0}^{1}\int_{x^2}^{2-x} xydydx$.   [3m]
  g)   State Law of Natural Growth.   [2m]
  h)   Solve the differential equation $(D^2 - 3D + 4)y = 0$.   [3m]

  i)   If $L[f(t)] = \dfrac{1}{(s-1)^2}$, then find $L^{-1}\left[\dfrac{1}{s(s-1)^2}\right]$ using any theorem of Laplace

        transforms.   [2m]
  j)   Find $L\left(5\sin t + 2\sin 3t\right)$.   [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
      $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

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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 $\iint_R r^3 dr d\theta$ over the area included between the circles $r = 2\sin\theta$ and $r = 4\sin\theta$.

  b) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} dxdydz$

OR

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

  b) Evaluate $\iiint_V (xy + yz + zx)dxdydz$, 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 cos5t 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 $\dfrac{d^2x}{dt^2} - 2\dfrac{dx}{dt} + x = e^t$, given that $x(0) = 2$, $x'(0) = -1$.

OR

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

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

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