



Reg. No. : .....

Name : .....

**Combined First and Second Semester B.Tech. Degree  
Examination, October 2014  
(2013 Scheme)**

**13.101 : ENGINEERING MATHEMATICS – I (ABCEFHMNPRSTU)**

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Find the radius of curvature at the point  $(-4, 0)$  on the curve  $xy^2 = 16(x+4)$ .
2. Evaluate  $\int_0^1 \int_0^z \int_0^{y+z} dz dy dx$ .
3. Using method of variation of parameters solve the differential equation  $\frac{d^2y}{dx^2} + a^2y = \sec ax$ .
4. Show that the vectors  $(1, 3, 4, 2)$ ,  $(3, -5, 2, 2)$  and  $(2, -1, 3, 2)$  are linearly dependent. Express one vector as a linear combination of others.

5. If  $\lambda = 1$  is an eigen value of  $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix}$ . Find the other eigen values.

PART – B

Answer **one** full question from **each** Module. **Each** question carries **20** marks.

MODULE – I

6. a) Find the values of 'a' and 'b' such that  $\lim_{\theta \rightarrow 0} \frac{\theta(1 + a \cos \theta) - b \sin \theta}{\theta^3} = 1$   
b) Find the minimum value of  $x^2 + y^2 + z^2$  subject to the condition  $xyz = a^3$ .

P.T.O.



7. a) If  $z = F(x, y)$ ,  $x = e^u \cos v$ ,  $y = e^u \sin v$  show that  $x \frac{\partial F}{\partial v} + y \frac{\partial F}{\partial u} = e^{2u} \frac{\partial F}{\partial y}$
- b) Show that the evolute of the curve  $x = a (\cos t + \log \tan \frac{t}{2})$ ;  $y = a \sin t$  is  $y = a \cos h \frac{x}{a}$ .

## MODULE – II

8. a) Evaluate  $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dy dx$  by changing the order of integration.
- b) Find the area lying between the parabola  $y = 4x - x^2$  and the line  $y = x$ .
9. a) Evaluate  $\iint_R x^2 dy dx$  where 'R' is the region bounded by the curves  $y = x$  and  $y = x^2$ .
- b) Find the volume bounded by the cylinder  $x^2 + y^2 = 4$  the planes  $y+z = 3$  and  $z = 0$ .

## MODULE – III

10. a) i) Find the Laplace transform of  $te^{2t} \sin 5t$ .
- ii) Find  $L^{-1} \left( \frac{s^2 + 2}{s(s^2 + 4)} \right)$ .
- b) Solve the differential equation  $(D^2 - 4D + 1)y = e^{2x} \sin 2x$ .
11. a) i) Find  $L \left( \frac{1 - \cos t}{t} \right)$ .
- ii) Find the Laplace transform of the periodic function  $F(t)$  of period 'a' defined by  $F(t) = \begin{cases} 1 & \text{for } 0 < t < \frac{a}{2} \\ -1 & \text{for } \frac{a}{2} < t < a \end{cases}$



b) Solve the differential equation

$$x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 4y = \cos(\log x) + x \sin(\log x).$$

MODULE – IV

12. a) Find the rank of the matrix.

$$\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 6 & 7 & 8 & 9 & 10 \\ 11 & 12 & 13 & 14 & 15 \\ 16 & 17 & 18 & 19 & 20 \\ 21 & 22 & 23 & 24 & 25 \end{bmatrix}$$

b) Diagonalise the matrix  $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

13. a) Find the eigen values and eigen vectors of

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

b) Solve the system of equations.

$$2x_1 + x_2 + 2x_3 + x_4 = 6$$

$$6x_1 - 6x_2 + 6x_3 + 12x_4 = 36$$

$$4x_1 + 3x_2 + 3x_3 - 3x_4 = -1$$

$$2x_1 + 2x_2 - x_3 + x_4 = 10$$

---