

Roll No. \_\_\_\_\_

[Total No. of Pages : 3]

**2E2002****B.Tech. I Year II Semester (Main) Examination - 2013****202 Engg. Mathematics - II****Time : 3 Hours****Maximum Marks : 80  
Min. Passing Marks : 24****Instructions to Candidates:**

*Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

**Unit - I**

1. a) A sphere of constant radius  $2k$  passes through the origin and meets the axes in points A, B and C. Show that the locus of the centroid of tetrahedron OABC is the sphere  $x^2 + y^2 + z^2 = k^2$ . (8)
- b) Find the equation of a right circular cone generated by the line drawn from origin to cut the circle through the three points (1,2,2), (2,1,-2) and (2,-2,1). (8)

**OR**

1. a) Find the equation of the sphere which touches the plane  $3x + 2y - z + 2 = 0$  at the point (1,-2,1) and cuts the sphere  $x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$  orthogonally. (8)
- b) Find the equation of the right circular cylinder having the line  $\frac{x-2}{2} = \frac{y-1}{1} = \frac{z}{3}$  as axis and passing through the point (0,0,3). (8)

**Unit - II**

2. a) Solve the following system of equations:

$$5x + 3y + 7z = 4$$

$$3x + 26y + 2z = 9$$

$$7x + 2y + 10z = 5$$

(8)

- b) Verify Cayley-Hamilton theorem for the following matrix:

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix} \quad (8)$$

**OR**

2. a) Find the eigen values and the corresponding eigen vectors of the following matrix.

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix} \quad (8)$$

- b) Find the inverse of the matrix by using elementary transformations

$$A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix} \quad (8)$$

### Unit - III

3. a) A particle moves on the curve  $x = 2t^2, y = t^2 - 4t, z = 3t - 5$ , where  $t$  is the time. Find the components of velocity and acceleration at time  $t=1$  in the direction  $\hat{i} - 3\hat{j} + 2\hat{k}$ . rtuonline.com (8)

- b) If  $\vec{F} = y\hat{i} - x\hat{j}$ , then evaluate  $\int \vec{F} \cdot d\vec{r}$  from  $(0,0)$  to  $(1,1)$  along the paths

- (i) Parabola  $y = x^2$   
(ii) Line from  $(0,0)$  to  $(1,0)$  and then to  $(1,1)$ . (4+4)

**OR**

3. a) Find  $\text{div } \vec{F}$  and  $\text{Curl } \vec{F}$  where  $\vec{F} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$ . (4+4)

- b) If  $\vec{r}(t) = 5t^2\hat{i} + t\hat{j} - t^3\hat{k}$  then find  $\int_1^2 \left( \vec{r} \times \frac{d^2\vec{r}}{dt^2} \right) dt$  (8)

**Unit - IV**

4. a) Using Green's theorem, evaluate  $\int_C [(y - \sin x) dx + \cos x dy]$  where C is the triangle enclosed by the lines  $y = 0; x = \frac{\pi}{2}; \pi y = 2x$ . (8)
- b) Find Fourier series for the function  $f(x) = \frac{x(\pi^2 - x^2)}{12}$  in  $(-\pi, \pi)$ . (8)

**OR**

4. a) Use Gauss's divergence theorem to show that  $\iiint_S (x dy dz + y dz dx + z dx dy) = 4\pi a^3$ , where the surface S is the sphere  $x^2 + y^2 + z^2 = a^2$ . (8)
- b) Find Fourier sine series for the function  $f(x) = e^{\alpha x}$  for  $0 < x < \pi$ . (8)

**Unit - V**

5. a) Solve in series.

$$(1-x^2) \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} + y = 0 \quad (8)$$

b) Solve  $2xz + qp = px^2 + 2qxy$ . (8)

**OR**

5. a) Solve in series  $x \frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0$ . (8)
- b) Solve  $x(y^2 + z)p - y(x^2 + z)q = (x^2 - y^2)z$ . (8)
-