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 $\dfrac{x-2}{2} = \dfrac{y-1}{1} = \dfrac{z}{3}$ 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:

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

(8)

OR

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

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

(8)

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

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

(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 $\hat{i} - 3\hat{j} + 2\hat{k}$.

(8)

b) If $\vec{F} = y\hat{i} - x\hat{j}$, then evaluate $\int_c \vec{F} . d\vec{r}$ 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 $div \vec{F}$ and $Curl \vec{F}$ where $\vec{F} = grad(x^3 + y^3 + z^3 - 3xyz)$.

(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 $y = 0; x = \dfrac{\pi}{2}; \pi y = 2x$. (8)

    b) Find Fourier series for the function $f(x) = \dfrac{x(\pi^2 - x^2)}{12}$ in $(-\pi, \pi)$. (8)

OR

4. a) Use Gauss's divergence theorem to show that $\iint_s (x\,dy\,dz + y\,dz\,dx + z\,dx\,dy) = 4\pi a^3$,

    where the surface S is the sphere $x^2 + y^2 + z^2 = a^2$. (8)

    b) Find Fourier sine series for the function $f(x) = e^{ax}$ for $0 < x < \pi$. (8)

Unit - V

5. a) Solve in series.

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

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

OR

5. a) Solve in series $x\dfrac{d^2 y}{dx^2} + \dfrac{dy}{dx} + y = 0$. (8)

    b) Solve $x(y^2 + z)p - y(x^2 + z)q = (x^2 - y^2)z$. (8)

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