2E2002

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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:

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$ **(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 $y = 0; x = \frac{\pi}{2}; \pi y = 2x$. **(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 $\iint_s (x\,dy\,dz + y\,dz\,dx + z\,dx\,dy) = 4\pi a^3$, 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.

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

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

OR

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

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