2E2002

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B.Tech. (Sem.II) (Main/Back) Examination - 2014

202 Engineering Mathematics - II

[Time : 3 Hours] [Total 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) Find the equation of sphere having the circle $x^2 + y^2 + z^2 = 9, x - 2y + 2z = 5$ as a great circle. (8)

   (b) Find the equation to the right circular cone with vertex at the origin, axis the line $\frac{x}{2} = \frac{y}{-4} = \frac{z}{3}$ and which passes through the point (1, 1, 2). (8)

OR

1. (a) Obtain the equation of the sphere which passes through the four points (4, –1, 2), (0, –2,3), (1, 5, –1), (2, 0, 1). (8)

   (b) Find the equation of right circular cylinder whose axis is $x = 2y = -z$ and radius is 4. (8)

Unit - II

2. (a) Examine for consistency the following equation and solve them if they are consistent.

   $x+y+z=6$; $2x+y+3z=13$;
   $5x+2y+z=12$; $2x-3y-2z=-10$ (8)

   (b) Find the eigen values and eigen vectors of the following matrix A :

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

OR

2. (a) Test for consistency the following system of equations and if possible, Solve them :

   $5x + 3y + 7z = 4$
   $3x + 26y + 2z = 9$
   $7x + 2y + 10z = 5$ (8)

   (b) Find the characteristic equation of the matrix. Show $A = \begin{bmatrix} 2 & 1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$. Show that the matrix A satisfies it. Hence find A^{-1}. (8)

Unit - III

3. (a) Find the directional derivative of $f(x, y, z) = x^2yz + 4xz^2$ at(1, –2, –1) in the direction of $2\hat{i} - \hat{j} - 2\hat{k}$. (4)

   (b) Prove that $\nabla^2\left(\frac{1}{r}\right) = 0$. (4)

   (c) If $\vec{F} = 2z\hat{i} - x\hat{j} + y\hat{k}$ evaluate $\iiint_V \vec{F} \cdot dV$, where V is the region bounded by the surfaces $x = 0, y = 0, x = 2, y = 4, z = x^2$ and $z = 2$. (8)

OR

3. (a) Find a unit vector normal to the surface $x^2y + 2xz = 4$ at the point (2, –2, 3). (4)

   (b) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, show that div $\left(\frac{\vec{r}}{r^3}\right) = 0$. (4)

   (c) Find the total work done in moving a particle in a force field given by $\vec{F} = 3xy\hat{i} - 5z\hat{j} + 10x\hat{k}$ along the curve $x = t^2 + 1, y = 2t^2, z = t^3$ from t = 1 to t = 2. (8)

Unit - IV

4. (a) Verify Gauss' divergence theorem for the function $\vec{F} = y\hat{i} + x\hat{j} + z^2\hat{k}$ over the cylindrical region bounded by $x^2 + y^2 = 9, z = 0$ and $z = 2$. (8)

(b) Verify Green's theorem for $\int_C [(xy + y^2)dx + x^2 dy]$ where C is bounded by y = x and $y = x^2$. (8)

OR

4. (a) Find the Fourier series to represent f(x) given by $f(x) = \begin{cases} x & \text{for } 0 \le x \le \pi \\ 2\pi - x & \text{for } \pi \le x \le 2\pi \end{cases}$. (8)

(b) Obtain the expansion for y from the following table upto the first harmonic. (8)

x:	0	1	2	3	4	5
y:	9	18	24	28	26	20

Unit - V

5. (a) Solve $(y^2 + z^2 - x^2)p - 2xyq = -2xz$. (4)

(b) Solve $9(p^2 z + q^2) = 4$. (4)

(c) Solve in series : $x(1-x)\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} - y = 0$. (8)

OR

5. (a) Solve $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)z$. (4)

(b) Solve $z = px + qy + C\sqrt{(1 + p^2 + q^2)}$. (4)

(c) Find the complete integral of $2(z+xp+yq)=yp^2$. (8)

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