2E2002

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B. Tech. II Sem. (Main / Back) Exam., May - 2017

202 Engineering Mathematics - II

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks Main: 26

Min. Passing Marks Back: 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.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL ____________ 2. NIL ____________

UNIT - I

Q.1 (a) A sphere of constant radius r passes through the origin O and cuts the axes in A, B and C. Find the locus of the foot of the perpendicular for O to the plane ABC. [8]

(b) Find the equation of a right circular cone with vertex (2, 3, 1), axis parallel to the line $\frac{x}{-1}=\frac{y}{2}=\frac{z}{1}$ and one of its generators have the direction ratios 1, -1, 1. [8]

OR

Q.1 (a) Prove that the center of sphere which touch the line $y = mx,\ z = c$ and $y = -mx,\ z = -c$ lies on the conicoid $mxy + c(1 + m^2)z = 0$. [8]

(b) Find the equation of the right circular cylinder whose guiding curve is the circle $x^2 + y^2 + z^2 = 9,\ \ x - 2y + 2z = 3.$ [8]

UNIT – II

Q.2 (a) Determine the value of k such that the rank of matrix A is 3, where [8]

$$A = \begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{bmatrix}$$

(b) Diagonalize the matrix - [8]

$$A = \begin{bmatrix} 5 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 7 \end{bmatrix}$$

OR

Q.2 (a) Find eigen values and eigen vectors of the matrix - [8]

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

(b) Solve the following system of linear equations: [8]

$x + 2y - z = 3,$

$3x - y + 2z = 1,$

$2x - 2y + 3z = 2,$ and

$x - y + z = -1$

UNIT – III

Q.3 (a) Suppose $\phi(x, y, z) = xy^2z$, and $A = xzi - xy^2j + yz^2k$.

Find $\frac{\partial^3}{\partial x\, \partial y\, \partial z}(\phi A)$ at the point (2, -1, 1). [4]

(b) Suppose $F = -3x^2i + 5xyj$, Evaluate $\int_C F.dr$

where C is the curve in the xy – plane, $y = 2x^2$, from (0, 0) to (1, 2). [4]

(c) Evaluate $\iint_S A.\,n\,ds$, where $A = 18zi - 12j + 3yk$, and S is that part of the plane $2x + 3y + 6z = 12$, which is located in the first octant. [8]

OR

Q.3 (a) If $r = xi + yj + zk$, then prove that $1/r$ is a solution of Laplace's equation. [4]

(b) Show that grad $(r^n) = nr^{n-2}\,\mathbf{r}$, where $\mathbf{r} = xi + yj + zk$. [4]

(c) Let $F = 4xzi - y^2j + yzk$. Evaluate $\iint_S \mathbf{F.n}\,ds$ where S is the surface of the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$. [8]

UNIT – IV

Q.4 (a) Verify Stokes' theorem for $\mathbf{F} = yi + zj + xk$, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary. [8]

(b) Express $f(x) = \begin{cases} -\pi, & -\pi \le x < 0 \\ x, & 0 \le x \le \pi \end{cases}$ as a Fourier series and hence find the sum of the series $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots$ [8]

OR

Q.4 (a) If $\mathbf{F} = xi - yj + (z^2 - 1)\,k$, using Gauss's divergent theorem find the value of $\iint_S \mathbf{F}.\,\mathbf{n}\,ds$ where S is the closed surface bounded by the planes $z = 0$, $z = 1$ and the cylinder $x^2 + y^2 = 4$. [8]

(b) Analyze harmonically the data given below and express $y = f(x)$ in Fourier series up to the third harmonic. [8]

x	0	1	2	3	4	5
f (x)	4	8	15	7	6	2

UNIT – V

Q.5 (a) Solve in series the differential equation : [8]

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

(b) Solve: [8]

(i) $2xzp+2yzq = z^2-x^2-y^2$

(ii) $z(xp-qy) = y^2-x^2$

OR

Q.5 (a) Using Charpit method, obtain complete integral of the equation $(p^2+q^2)y = qz$.

Also find its singular and general integrals. [8]

(b) Solve: [8]

(i) $(x+2z)p+(4xz-y)q=2x^2+y$

(ii) $x^2p^2+y^2q^2=z^2$
