

2E2002

Roll No. _____

Total No of Pages: **4****2E2002****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. NIL2. 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]

[2E2002]

Page 1 of 4

[41920]

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]

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

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

$$2x - 2y + 3z = 2, \text{ and}$$

$$x - y + z = -1$$

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 $\int_C F \cdot dr$

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

- (c) Evaluate $\iint_S \mathbf{A} \cdot \mathbf{n} \, ds$, where $\mathbf{A} = 18z\mathbf{i} - 12\mathbf{j} + 3y\mathbf{k}$, 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 $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$, then prove that $1/r$ is a solution of Laplace's equation. [4]
- (b) Show that $\text{grad}(r^n) = nr^{n-2}\mathbf{r}$, where $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$. [4]
- (c) Let $\mathbf{F} = 4xz\mathbf{i} - y^2\mathbf{j} + yz\mathbf{k}$. Evaluate $\iint_S \mathbf{F} \cdot \mathbf{n} \, ds$ 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 $\mathbf{F} = y\mathbf{i} + z\mathbf{j} + x\mathbf{k}$, 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 $f(x) = \begin{cases} -\pi, & -\pi \leq x < 0 \\ x, & 0 \leq x \leq \pi \end{cases}$ as a Fourier series and hence find the sum of the series $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ [8]

OR

- Q.4 (a) If $\mathbf{F} = x\mathbf{i} - y\mathbf{j} + (z^2 - 1)\mathbf{k}$, using Gauss's divergent theorem find the value of $\iiint_S \mathbf{F} \cdot \mathbf{n} \, ds$ 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]

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

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