

Roll No.

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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. 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]

<u>OR</u>

- 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]

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UNIT - II

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

[8]

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

Diagonalize the matrix -

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

OR

[8]

Find eigen values and eigen vectors of the matrix

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

Solve the following system of linear equations:

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

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

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

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

[8]

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

Find
$$\frac{\partial^3}{\partial x \partial y \partial z}$$
 (ϕA) at the point (2, -1, 1).

[4]

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]

<u>or</u>

- 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 $(r^n) = nr^{n-2}r$, where r = xi + yj + zk.
 - (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

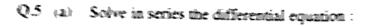
- Q.4 (a) Verify Stokes' theorem for F = yi + zj + xk, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary. [8]
 - (b) Express $f(x) = \begin{cases} -\pi, & -\pi \le x < 0 \\ x, & 0 \le x \le \pi \end{cases}$ as a Fourier series and hence find the sum of the series $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ [8]

<u>OR</u>

- 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 \iint_S **F.** n ds where S is the closed surface bounded by the planes z = 0, z = 1 and the cylinder $x^2 + y^2 = 4$.
 - (b) Analyze harmonically the data given below and express y = f (x) in Fourier seriesup to the third harmonic. [8]

х	0	1	2	3	4	5
f(x)	4	8	15	7	6	2

UNIT - V



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



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

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

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]

[8]

(b) Solve:

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

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

