Roll No. ____________

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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 $\int_C F.\, dr$ [4]

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

(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 $\iint_S$ **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 $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots$ [8]

OR

Q.4 (a) If **F** = xi – yj + $(z^2$-1) 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 $x^2 + y^2 = 4$. [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) $x^2p^2 + y^2q^2 = z^2$
