2E2002

Roll No. ____________

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B. Tech. II Sem. (Main/Back) Exam., May - 2019

202 Engineering Mathematics - II

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 26

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 k passes through the origin and meets the axes in A, B, C. Prove that the locus of the centroid of the triangle ABC is $9(x^2 + y^2 + z^2) = 4k^2$. [8]

(b) Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ at the point $(1, -2, 1)$ and cuts the sphere $x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$ orthogonally. [8]

OR

Q.1 (a) Find the equation of right circular cone generated by straight line drawn from the origin and cut the circle through the three point (1, 2, 2) (2, 1, –2) and (2, –2, 1). [8]

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

UNIT- II

Q.2 (a) Find the rank of the following matrix by reducing it to normal form - [8]

$$\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & 7 \end{bmatrix}$$

(b) State Cayley-Hamilton Theorem, verify it for the following matrix: [8]

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

OR

Q.2 (a) Examine the consistency of the following equation and solve them if they are consistent. [8]

$$x + y + z = 6,\ 2x + y + 3z = 13,\ 5x + 2y + z = 12,\ 2x - 3y - 2z = -10$$

(b) Find the Eigen value and Eigen vectors of the following matrix. [8]

$$\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

UNIT- III

Q.3 (a) A particle moves along the curve $x = t^3 + 1$, $y = t^2$, $z = 2t + 5$, where t is the time. Find the components of its velocity and acceleration at $t = 1$ in the direction of $(\hat{i} + \hat{j} + \hat{k})$. [8]

(b) (i) If $\vec{A}$ is a vector point function and ϕ is a scalar point function, prove that [4]

$$\nabla.(\phi\vec{A}) = \nabla\phi.\vec{A} + \phi(\nabla.\vec{A})$$

(ii) A fluid motion is given by – [4]

$$\vec{A} = (y + z)\hat{i} + (z + x)\hat{j} + (x + y)\hat{k}$$

Is this motion irrotational? If so, find the Velocity Potential.

OR

Q.3 (a) Prove that – [8]

$\nabla \times \left(\frac{\vec{r}\times\vec{a}}{r^3}\right) = \frac{\vec{a}}{r^3} - \frac{3}{r^5}(\vec{r}.\vec{a})\vec{r}$

(b) $\iint_s \vec{F}.\hat{n}\, ds$, where $\vec{F} = (x + y^2)\hat{\imath} - 2x\hat{\jmath} + 2yz\hat{k}$ and s is the surface of the plane $2x + y + 2z = 6$ in the first octant. [8]

UNIT- IV

Q.4 (a) Verify Stokes theorem for $(x^2 + y^2)\hat{\imath} - 2xy\hat{\jmath}$ taken round the rectangular region bounded by $x = \pm a, y = 0, y = b$ [8]

(b) Verify Gauss divergence theorem for the functions $\vec{F} = y\hat{\imath} + x\hat{\jmath} + z^2\hat{k}$ over the cylindrical region bounded by $x^2 + y^2 = 9, z = 0$ and $z = 2$. [8]

OR

Q.4 (a) Find the Fourier series for $f(x) = x + x^2, -\pi < x < \pi$. Hence show that $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \ldots\ldots\ldots\ldots\ldots$ [8]

(b) Obtain the expansion for y from the following table up to the first Harmonic. [8]

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

UNIT- V

Q.5 (a) Solve in series – [8]

$x\frac{d^2y}{dx^2} + \frac{dy}{dx} + xy = 0$

(b) Solve –

(i) $(y^2 + z^2 - x^2)\, p - 2xy\, q = -2xz$ [4]

(ii) $(p^2 + q^2) = x + y$ [4]

OR

Q.5 (a) Solve - [8]

$(x^2 + y^2)(p^2 + q^2) = 1$

(b) Find the complete integral of : [8]

$(p + q)(px + qy) = 1$

by using charpit's method.
