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2E2002

B. Tech. II-Sem. (Back) (Back) Exam., Oct.-Nov. - 2020

202 Engineering Mathematics - II

Time: 2 Hours | **Maximum Marks: 48**
Min Passing Marks: 15

Instructions to Candidates:

*Attempt **three questions**, selecting **one question each** from any three **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) Find the equation of the circle circumscribing the triangle formed by the three points (a, 0, 0.), (0, b, 0), (0, 0, c). Obtain also, the co-ordinate of the centre of this circle. [8]

(b) Find the equation of the right circular cone generated by straight lines drawn from the origin to cut the circle through the three points (1, 2, 2), (2, 1, -2) and (2, -2, 1). [8]

OR

Q.1 (a) A sphere of constant radius 2k passes through the origin and meets the axes in A, B, C. Show that the locus of the centroid of the tetrahedron OABC is the sphere $x^2 + y^2 + z^2 = k^2$. [8]

(b) The axis of a right circular cylinder of radius 2 is $\frac{x-1}{2} = \frac{y}{3} = \frac{z-3}{1}$. Find the equation of the cylinder. [8]

UNIT- II

Q.2 (a) Check the consistency and hence, solve the following system of equations $4x - 2y + 6z = 8$; $x + y - 3z = -1$; $15x - 3y + 9z = 21$. [8]

(b) Using Caley Hamilton Theorem, find A^{-1} for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. Also find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$ [8]

OR

Q.2 (a) Diagonalise the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. [8]

(b) A is non zero matrix of order $m \times 1$ and B is a non zero matrix of order $1 \times n$, then what will be the rank of AB. Find the rank of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 4 & 5 & 1 \\ 5 & 8 & 11 & 14 & 7 \end{bmatrix}$$ [8]

UNIT- III

Q.3 (a) Prove that $\vec{F}(t)$ has a constant magnitude then $\vec{F}.\frac{d\vec{F}}{dt} = 0$ and if, $\vec{F}(t)$ has a constant direction then $\vec{F} \times \frac{d\vec{F}}{dt} = 0$. [8]

(b) A fluid motion is given by $\vec{V} = (y+z)i + (z+x)j + (x+y)k$. Is this motion irrotational? If so, find the velocity potential. Is the motion possible for an incompressible fluid? [8]

OR

Q.3 (a) Find the directional derivative of $f(x, y, z) = e^{2x} \cos yz$ at (0, 0, 0) in the direction of the tangent to the curve $x = a \sin t$, $y = a \cos t$, $z = at$ at $t = \pi/4$. [8]

(b) Evaluate $\iint_S \vec{A} \cdot \hat{n}\, ds$ where $\vec{A} = zi + xj - 3y^2zk$ and S is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 5$. [8]

UNIT- IV

Q.4 (a) Verify Stokes theorem for $\vec{F}=(x^2+y^2)i-2xy\,j$ taken around the rectangle bounded by the lines $x=\pm a$, $y=0$, $y=b$. [8]

(b) If $f(x)=\begin{cases} x; & 0<x<\pi/2 \\ \pi-x; & \frac{\pi}{2}<x<\pi \end{cases}$ then show that $f(x)=\frac{4}{\pi}\left[\sin x-\frac{\sin 3x}{3^2}+\frac{\sin 5x}{5^2}-...\right]$ [8]

OR

Q.4 (a) Evaluate $\iint_S (a^2x^2+b^2y^2+c^2z^2)^{1/2}\,dS$ where S is the surface of the ellipsoid $ax^2+by^2+cz^2=1$. [8]

(b) The turning moment T units of the crankshaft of a steam engine is given for a series of the values of the crank angle θ in degrees.

θ°	0	30	60	90	120	150	180
T	0	5224	8097	7850	5499	2626	0

Find the first four terms in a series of sine to represent T. Also find T when $\theta=75°$. [8]

UNIT- V

Q.5 (a) Find first five non-vanishing terms in the power series solution of the initial value problem $(1-x^2)y''+2xy'=0$; $y(0)=1$, $y'(0)=1$. [8]

(b) Solve $y^2(x+y)p+x^2(x+y)q=(x^2+y^2)z$. [8]

OR

Q.5 (a) Find the solution of the partial differential equation $6yz-6pxy-3qy^2+pq=0$.[8]

(b) Find the complete integral of the following partial differential equation $(p^2+q^2)x=pz$. [8]
