2E2002

Roll. No.:

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B.Tech. I Year II Sem. (Main) Back June-July Examination, 2015

202 Engg. Mathematics-II

Time: 3 hours.

Maximum Marks: 80
Min. Passing Marks: 26

Note: 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) Find the equation of the sphere which has its centre at the origin and which touches the line $2(x+1)=2-y=z+3$. 8

(b) If a right circular cone has three mutually perpendicular generator. Show that the semi-vertical angle is $\tan^{-1}\sqrt{2}$. 8

OR

Q.1 (a) A plane passes through a fixed point (a, b, c) and cuts the axes in A, B, C. Show that the locus of the centre of sphere $OABC$ is $\frac{a}{x}+\frac{b}{y}+\frac{c}{z}=2$. 8

(b) Obtain the equation of right circular cylinder described on the circle through three points (1, 0, 0); (0, 1, 0) and (0, 0, 1) as guiding circle. 8

UNIT-II

Q. 2 (a) Show that the three equations $-2x+y+z=a$, $x-2y+z=b$ and $x+y-2z=c$ have no solution unless $a+b+c=0$, in which case they have infinitely many solutions. Find these solutions when $a=1,\ b=1,\ c=-2$. 8

(b) Find the characteristic equation of the matrix $A=\begin{bmatrix}2 & 1 & 1\\ 0 & 1 & 0\\ 1 & 1 & 2\end{bmatrix}$. Hence find the value of $A^8-5A^7+7A^6-3A^5+A^4-5A^3+8A^2-2A+Z$ 8

OR

Q. 2 (a) Find the eigenvalues and eigenvectors of the matrix $A=\begin{bmatrix}6 & -2 & 2\\ -2 & 3 & -1\\ 2 & -1 & 3\end{bmatrix}$. 8

(b) Find the rank of the matrix by reducing it to normal form $\begin{bmatrix}1 & 2 & 3 & 0\\ 2 & 4 & 3 & 2\\ 3 & 2 & 1 & 3\\ 6 & 8 & 7 & 5\end{bmatrix}$ 8

UNIT-III

Q. 3 (a) Derive radial and transverse velocities and accelerations of a particle describing a plane curve, with the help of vectors. 8

(b) Show that the field defined by $\vec{a}=\left(x^2+xy^2\right)\hat{i}+\left(y^2+x^2y\right)\hat{j}$ is irrotational. Find its scalar potential. 8

OR

Q. 3 (a) If $\vec{r}$ and r have usual meaning, then show that:

(i) $\text{div}\, r^n \vec{r} = (n+3) r^n$

(ii) $\text{curl}\, r^n \vec{r} = 0$ 8

(b) Evaluate $\iint_S \vec{F} \cdot \hat{n}\, ds$; where $\vec{F} = x^2 \hat{i} + y^2 \hat{j} + z^2 \hat{k}$ and S is the part of plane $x + y + z = 1$; which is located in first octant. 8

UNIT-IV

Q. 4 (a) If $f(x) = |\cos x|$, expand $f(x)$ as a Fourier series in the interval $(-\pi, \pi)$. 8

(b) Using Green's theorem, find the area of the region in the first quadrant bounded by the curves $y = x$, $y = \frac{1}{x}$ and $y = \frac{x}{4}$. 8

OR

Q. 4 (a) Obtain the first three cosines terms and the constant terms in the Fourier series of y, where: 8

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(b) Find the Fourier series to represent: 8

$f(x) = x \cos x, \quad -\pi \leq x \leq \pi$

UNIT-V

Q. 5 Solve:

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

[Contd. ....

(ii) $pq = x^m y^n z^{2l}$

(iii) Solve in series: 8

$$x^2 \frac{d^2y}{dx^2} + \left(x + x^2\right)\frac{dy}{dx} + (x-9)y = 0$$

OR

Q. 5 (a) Solve in series: 8

$$4x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$$

(b) Solve:

(i) $\left(y^2 + z^2 - x^2\right)p - 2xyq = -2xz$ 4

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

—— x ——