

**2E2002****2E2002**

**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. **rtuonline.com**

Use of following supporting material is permitted during examination. (Mentioned in form No. 205).

1. NIL2. NIL

## UNIT-I

Q. 1 (a) Find the equation of the sphere which has its centre at the origin and which touches the line  $2(x+1) = 2-y = z+3$ . **rtuonline.com** 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. 4 (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

- 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

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- 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

- 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  $\vec{a} = (x^2 + xy^2)\hat{i} + (y^2 + x^2y)\hat{j}$  is irrotational. Find its scalar potential. 8

OR

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

(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

rtuonline.com 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

8

(b) Find the Fourier series to represent:

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

UNIT-V

Q. 5 Solve:

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

4

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

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(iii) Solve in series:

8

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

OR

Q. 5 (a) Solve in series:

8

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

(b) Solve:

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

4

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

4

— x —