2E1022

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# 2E1022

## B. Tech. (I Year) (Sem. II) Examination, June/July - 2012
## Engineering Mathematics - II (Old)

Time : **3** Hours] [Maximum Marks : **80**
[Min. Passing Marks : **24**

*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

1 (a) Find the coordinates of centre and radius of the circle

$$x^2+y^2+z^2-2y-4z=11,\ x+2y+2z=15$$

8

(b) Find the equation of the right circular cone generated by straight line drawn from the origin to cut the circle through the three points (1,2,2) (2,1,–2) and (2,–2,1).

8

OR

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

8

(b) Find the equation of a right circular cylinder whose generators are parallel to z axis and intersect the surface $ax^2+by^2+cz^2=1$ and $lx+my+nz=p$.

8

## UNIT - II

2 (a) Find out for what values of $\lambda$ the equations

$$x + y + z = 1$$
$$x + 2y + 4z = \lambda$$

and $x + 4y + 10z = \lambda^2$

have a solution and solve them completely in each case. 8

(b) If $A = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{bmatrix}$

Find the characteristic equation of A. Prove that A satisfies this equation and hence find $A^{-1}$. 8

**OR**

2 (a) Examine whether the following equations are consistent and solve them if they are consistent :

$$x + 2y - z = 3$$
$$3x - y + 2z = 1$$
$$2x - 2y + 3z = 2$$
$$x - y + z = -1$$

8

(b) Find the eigen values and the corresponding eigen vectors of the following matrix :

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

8

## UNIT - III

3 (a) Find by vector method the tangential and normal components of the velocity and acceleration. 4

(b) Show that the vector field defined by

$$\vec{A} = 2xyz^3\,\hat{i} + x^2z^3\,\hat{j} + 3x^2\,yz^2\,\hat{k}$$

is irrotational and find the scalar potential. 4

(c) Verify Gauss's Divergence theorem and show that

$$\int_s \vec{F}\cdot\hat{n}\, ds = \frac{1}{3}a^5, \text{ where } \vec{F} = (x^3 - yz)\hat{i} - 2x^2y\hat{j} + 2\hat{k}$$

$s$ is the surface of the cube bounded by the coordinate planes: $x = y = z = 0$; $x = y = z = a$

8

OR

3 (a) Find the constants $a$ and $b$ so that the surface $ax^2 - byz = (a+2)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at the point (1, −1, 2).

4

(b) Find $\lambda, \mu$ and $w$ if the following vector is irrotational

$$(2x + 3y + \lambda z)\hat{i} + (\mu x + 2y + 3z)\hat{j} + (2x + wy + 3z)\hat{k}$$

4

(c) Verify Stokes theorem for the function $\vec{F} = x^2\hat{i} + xy\hat{j}$ integrated round the square in the plane $z = 0$, whose sides are along the lines $x = y = 0$ and $x = y = a$.

8

## UNIT - IV

4 (a) The radial and transverse velocities of a particle are $\lambda r$ and $\mu\theta$. Find its path and also its radial and transverse components of accelerations.

8

(b) A particle of mass $m$ is falling under gravity through a medium whose resistance is $\mu$ times the velocity. If the particle is released from the rest; show that the distance fallen through in time $t$ is,

$$g\frac{m^2}{\mu^2}\left[e^{-\frac{\mu t}{m}} - 1 + \frac{\mu t}{m}\right]$$

8

OR

4 (a) Prove that the angular acceleration in the direction of motion of a point moving in a plane is

$$\frac{\vartheta}{\rho}\frac{d\vartheta}{ds} - \frac{\vartheta^2}{\rho^2}\frac{d\rho}{ds}$$

8

(b) A particle of mass $m$ is projected vertically under gravity, the resistance of the air being $m\,k$ times the velocity; show that the highest height attained by the particle is,

$$\frac{V^2}{g}\left[\lambda - \log(1+\lambda)\right],$$

where $V$ is the terminal velocity of the particle and $\lambda V$ is the initial vertical velocity. 8

## UNIT - V

5 (a) Solve : $(y+z)p+(z+x)q = x+y$ 4

(b) Solve : $z^2\left(p^2+q^2\right) = x^2+y^2$ 4

(c) Solve in series

$$\left(2x+x^3\right)\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6xy = 0$$

8

**OR**

5 (a) Solve : $\left(x^2-yz\right)p+\left(y^2-zx\right)q = z^2-xy$ 4

(b) Solve : $\left(x^2+y^2\right)\left(p^2+q^2\right) = 1$ 4

(c) Apply Charpits method to solve

$(p+q)(px+qy)-1=0$ 8

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