24/06/2010 Exam cell

2E1011

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2E1011

B.Tech. IInd Semester (Main/Back) Examination, June - 2010

Engineering Mathematics -II

Common to all branches of Engineering

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt overall **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 may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit - I

1. a) Find the equation of the sphere which passes through the points (1,0,0), (0,1,0), (0,0,1) and has its radius as small as possible. **(8)**

   b) Find the equation of the cone obtained by rotating the line $2x + 3y = 6;\ z = 0$ about the y-axis. **(8)**

OR

   a) Find the equation of the sphere which touches the sphere $x^2 + y^2 + z^2 + 2x - 6y + 1 = 0$ at (1, 2, -2) and passes through the origin. **(6)**

   b) Obtain the equation of the right circular cylinder described on the circle through the three points (1, 0, 0), (0, 1, 0) and (0, 0, 1) as guiding circle. **(10)**

Unit - II

2. a) Use elementary row transformations to find the inverse of the matrix **(8)**

$$A=\begin{bmatrix} 3 & 1 & 5 \\ 1 & 3 & 2 \\ 5 & -2 & 4 \end{bmatrix}$$

   b) Find the eigen values and eigen vectors of the matrix **(8)**

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

OR

a) Test for consistency the following system of equations and if possible, solve them

$x+y+z=6$

$x-y+2z=5$

$3x+y+z=8$ **(8)**

$2x-2y+3z=7$

b) Find the characteristic equation of the matrix

$$A=\begin{bmatrix}0 & 1 & 2\\ 1 & 2 & 3\\ 3 & 1 & 1\end{bmatrix}$$

Show that the equation is satisfied by A. **(8)**

Unit - III

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

b) Use Green's theorem to evaluate $\int_C (x^2-2xy)dx+(x^2y+3)dy$ around the boundary C of the region $y^2 = 8x$ and $x = 2$. **(8)**

OR

a) Find a unit vector normal to the surface $x^3+y^3+3xyz=3$ at the point (1, 2, -1). **(4)**

b) Prove that $\nabla^2 f(r)=f''(r)+\frac{2}{r}f'(r)$. **(4)**

c) Verify Gauss's divergence theorem given that $\vec{F}=4xz\hat{i}-y^2\hat{j}+yz\hat{k}$ and S is the surface of the cube bounded by the planes $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$ and $z = 1$. **(8)**

Unit - IV

4. a) A particle moves in a catenary $(s=c\tan\psi)$ and the direction of its acceleration at any point makes equal angles with the tangent and the normal to the path at the point. If the speed at the vertex (where $\psi=0$) be u, show that the velocity and acceleration at any other point are given by ue^{ψ} and $\frac{\sqrt{2}}{c}.u^2.e^{2\psi}.\cos^2\psi$. **(8)**

b) A particle is projected in a medium whose resistance is proportional to the cube of the velocity and no other force acts on the particle. While the velocity diminishes from v_1 to v_2 and the particle traverses a distance D in time t, show that $\frac{D}{t}=\frac{2v_1 v_2}{v_1+v_2}$. **(8)**

OR

a) A small bead slides with constant speed v on a smooth wire in the shape of a cardioid $r=a\,(1+\cos\theta)$. Show that the angular velocity is $\frac{v}{2a}\cdot Sec\frac{\theta}{2}$ and that the radial component of the acceleration is constant. **(8)**

b) A heavy particle is projected in a resisting medium the resistance varying as velocity. If v_1 and v_2 are the velocities at any point in its upward and downward paths and t the interval between its passage through this point, prove that

$$v_1+v_2=gt,\ V-v_2=(V+v_1)e^{-gt/V}$$

where V is its terminal velocity. **(8)**

Unit - V

5. a) Solve in series :

$$x\left(1-x^2\right)\frac{d^2y}{dx^2}+\left(1-3x^2\right)\frac{dy}{dx}-xy=0$$ **(10)**

b) Solve : $p+3q=5z+\tan(y-3x)$. **(6)**

OR

a) Solve : $(y-x)(qy-px)=(p-q)^2$. **(8)**

b) Find complete integral by Charpit's method :

$pxy+pq+qy=yz$. **(8)**
