

**Roll No.**

**Total No. of Pages : 03**

**Total No. of Questions : 09**

**B.Tech.(2009-2010 Batches) (Sem.-2)**

## ENGINEERING MATHEMATICS – II

**Subject Code : AM-102**

**Paper ID : [A0119]**

**Time : 3 Hrs.**

**Max. Marks : 60**

### INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

## SECTION-A

- 1. Write briefly :**

- a) Verify that the following matrix  $B$  is orthogonal :

$$B = \begin{bmatrix} \cos A & 0 & \sin A \\ 0 & 1 & 0 \\ \sin A & 0 & \cos A \end{bmatrix}$$

- b) Show that every square matrix can be written as  $P+iQ$ , where  $P$  and  $Q$  are Hermitian matrices.
- c) Show that the differential equation  $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$  is exact.
- d) Solve the differential equation  $(D^2 + 6D + 9)y = 0$ .
- e) A particle executing simple harmonic motion of amplitude 5 cm has a speed of 8 cm/sec when at a distance of 3 cms from the centre of the path. Find the period of the motion of the particle.
- f) If  $\phi = 3x^2y - y^3z^2$ , find  $\text{grad } \phi$  at the point  $(1, -2, -1)$ .
- g) Verify Green's theorem for  $\int_C [(xy + y^2)dx + x^2dy]$ , where  $C$  is bounded by  $y = x$  and  $y = x^2$ .
- h) Show that the vector field  $\vec{F} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$  is irrotational.

- i) If mean of a Poisson distribution is  $m$ , then find its S.D.  
j) State two applications of  $\chi^2$  -test.

### SECTION-B

2. a) Reduce the following matrix to normal form and hence find its inverse. 4

$$A = \begin{bmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{bmatrix}$$

- b) Test the following system of equations for consistency and solve. 4

$$x+2y+z = 3; 2x+3y+2z = 5; 3x-5y+5z = 2; 3x+9y-z = 4.$$

3. Find complete solutions of the following differential equations :

a)  $(x^3y^2+x)dy + (x^2y^3-y)dx = 0$  4

b)  $y = xp^2 + p$  4

4. a) Find complementary function and particular integral of the following differential equation : 4

$$(D^2 - 4D + 3)y = \sin 3x \cos 2x$$

- b) Find complete solution of the following Legendre differential equation : 4

$$(2x+3)^2 \frac{d^2y}{dx^2} - (2x+3) \frac{dy}{dx} - 12y = 6x$$

5. A constant *e.m.f*  $E$  at time  $t = 0$  is applied to circuit consisting of inductance  $L$ , resistance  $R$  and capacitance  $C$  in series. The initial values of the current and the charge being zero, find the current at any time  $t$ , if  $CR^2 < 4L$ . 8

### SECTION-C

6. a) Find the directional derivative of  $\phi(x,y,z) = xy^2 + yz^3$  at the point  $(2,-1,1)$  in the direction of the vector  $\hat{i} + 2\hat{j} + 2\hat{k}$ . 4

- b) If  $\vec{F} = 2y\hat{i} - z\hat{j} + x\hat{k}$ , evaluate  $\int_C \vec{F} \times d\vec{R}$  along the curve  $C : x = \cos t, y = \sin t, z = 2 \cos t$  from  $t = 0$  to  $t = \pi/2$ . 4

7. a) Apply Green's theorem, evaluate  $\int_C [(y - \sin x)dx + \cos x dy]$ , where  $C$  is the plane triangle enclosed by the lines  $y = 0$ ,  $x = \pi/2$  and  $y = \frac{2}{\pi}x$ . 4

- b) Verify Stoke's theorem for a vector field defined by  $\vec{F} = -y^3\hat{i} + x^3\hat{j}$  in the region  $x^2 + y^2 \leq 1, z = 0$ . 4

8. a) The probability density function of a variate  $X$  is given below :

<b>X :</b>	0	1	2	3	4	5	6
<b>p(X) :</b>	k	3k	5k	7k	9k	11k	13k

Find  $P(X < 4)$ ,  $P(X \geq 5)$ ,  $P(3 < X \leq 6)$ . What will be the minimum value of  $k$  so that  $P(X \leq 2) > 3$ ? 4

- b) Fit a second degree parabola to the following data : 4

<b>x :</b>	1	2	3	4	5	6	7	8	9
<b>y :</b>	2	6	7	8	10	11	11	10	9

9. a) In two large populations there are 30% and 25% respectively of fair haired people. Is this difference likely to be hidden in samples of 1200 and 900 respectively from the two populations? 4

- b) In an experiment on pea breeding, the following frequency of seeds were obtained :

Round & Yellow	Wrinkled & Yellow	Round & Green	Wrinkled & Green	Total
315	101	108	32	556

Theory predicts that the frequencies should be in proportions 9:3:3:1. Examine the correspondence between theory and experiment. 4