

Roll No. ....1606173.....

Total No. of Pages : 3

**BT-2/J07**

**8247**

**Mathematics-II (2005-06)**

**Paper : MATH-102 E**

**Option : II**

Time : Three Hours]

[Maximum Marks : 100

**Note :-** Attempt **FIVE** questions in all, selecting at least **ONE** question from each unit. **Each** question carries **equal** marks.

### UNIT-I

1. (i) Use Gauss- Jordan method to find the inverse of the following matrix :

$$\begin{bmatrix} 2 & 1 & -1 \\ 0 & 2 & 1 \\ 5 & 2 & -3 \end{bmatrix}$$

10

- (ii) Show that the equations :

$$3x + 4y + 5z = a,$$

$$4x + 5y + 6z = b,$$

$$5x + 6y + 7z = c$$

do not have a solution unless  $a+c = 2b$ .

10

2. (i) For a symmetrical square matrix, show that the eigen vectors corresponding to two unequal eigen values are orthogonal. 10

- (ii) Show that the eigen values of a Skew-Hermitian matrix (and thus of a Skew-symmetric matrix) are purely imaginary or zero.

10

UNIT-II

3. (i) Solve:  $(x^4 e^x - 2m x y^2) dx + 2m x^2 y dy = 0$ . 10 ✓

(ii) Two friends A and B order coffee and receive cups of equal temperature at the same time. A adds a small amount of cool cream immediately but does not drink his coffee until 10 minutes later, B waits for 10 minutes and adds the same amount of cool cream and begins to drink. Assuming the Newton's law of cooling, decide who drinks the hotter coffee? 10

4. (i) Solve:  $\frac{d^2 y}{dx^2} - 4y = x \cdot \sinh x$ . 10 8

(ii) In an L-C-R circuit, the charge  $q$  on a plate of a condenser is given by:

$$L \frac{d^2 q}{dt^2} + R \frac{dq}{dt} + \frac{q}{c} = E \cdot \sin pt.$$

The circuit is tuned to resonance so that  $p^2 = 1/LC$ . If initially the current  $i$  and the charge  $q$  be zero, show that, for small values of  $R/L$ , the current in the circuit at time  $t$  is given by  $(Et / 2L) \sin pt$ . 10

UNIT-III

5. (i) Solve:  $px(z - 2y^2) = (z - qy)(z - y^2 - 2x^3)$ . 10 4

(ii) Solve:  $2z + p^2 + qy + 2y^2 = 0$ . 10

6. (i) By the method of separation of variables, solve:

$$3 \frac{\partial u}{\partial x} + 2 \frac{\partial u}{\partial y} = 0, u(x,0) = 4e^{-x}. \quad 10$$

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- (ii) Solve completely the equation :  $\frac{\partial^2 y}{\partial t^2} = C^2 \cdot \frac{\partial^2 y}{\partial x^2}$ , representing the vibrations of a string of length  $\ell$ , fixed at both ends, given that  $y(0, t) = 0$ ;  $y(\ell, t) = 0$ ;  $y(x, 0) = f(x)$  and  $\frac{\partial y}{\partial t}(x, 0) = 0$ ,  $0 < x < \ell$ .
- 10

## UNIT-IV

7. (i) Evaluate:  $L \left[ \int_0^t e^{-t} \cos t \, dt \right]$ . ✓  
10
- (ii) State and prove Convolution theorem. 3  
10
8. (i) Solve :  $t y'' + 2y' + ty = \cos t$ , given that  $y(0) = 1$ .  
10
- (ii) Calculate the maximum deflection of an encastre beam 1 ft. long carrying a uniformly distributed load  $w$  lb/ft. on its central half length.  
10