

Roll No.

Total Pages : 3

Exam. Code

6011

8051

BT-2/M-11
MATHEMATICS-II
 Paper : MATH-102(E)
 (2006 onward)

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt five questions in all, selecting at least *one* question from each Unit.

UNIT-I

1. (a) Find the inverse of the following matrix by Gauss Jordan method :

$$A = \begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}$$

10

- (b) Find the eigenvalues and eigenvectors of the following matrix.

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

10

2. (a) Verify Cayley-Hamilton theorem for the matrix A and find its inverse :

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

- (b) Prove that $\begin{bmatrix} \frac{i+1}{2} & \frac{i-1}{2} \\ \frac{i+1}{2} & \frac{1-i}{2} \end{bmatrix}$ is unitary.

10

UNIT-II

3. (a) Solve $(x^2y - 2xy^2) dx - (x^3 - 3x^2y) dy = 0$. 10
 (b) Find the orthogonal trajectories of the family of parabolas $y = ax^2$. 10
 4. (a) Solve by the method of variation of parameters :

$$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x. \quad 10$$

- (b) A second's pendulum which gains 10 sec/day at one place loses 10 sec/day at another. Compare the acceleration due to gravity at the two places. 10

UNIT-III

5. (a) Evaluate $\int_0^{\infty} t.e^{-2t} \cos t \, dt$ 5

- (b) Find the inverse Laplace transform of

$$\frac{2s^2 - 6s + 5}{(s-1)(s-2)(s-3)}. \quad 5$$

- (c) Apply Convolution theorem to evaluate 10

$$f^{-1} \left\{ \frac{s}{s^2 + 1} \right\}$$

6. (a) Solve by Laplace Transform method :

$$y'' + 4y' + 3y = e^{-t}; y(0) = y'(0) = 1. \quad 10$$

- (b) Find the Laplace transform of the function

$$f(t) = \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi. \end{cases} \quad 10$$

UNIT-IV

7. (a) Form a P.D.E. from

$$z = xf_1(x+y) + f_2(x+y). \quad 5$$

- (b) Solve

$$(y + zx)p - (x + yz)q = x^2 - y^2. \quad 7$$

- (c) Solve by Charpit's method

$$pxy + pq + qy = yz. \quad 8$$

8. (a) Solve $r + s - 6t = y \cos x$. 10

- (b) Using method of separation of variables, solve

$$4 \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u;$$

$$\text{given that } u = 3e^{-y} - e^{-5y} \text{ when } x = 0. \quad 10$$
