



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech/SEM-2/M-201/2010

2010

MATHEMATICS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

i) If $A = \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$, then A^{100} is

a) $2^{99} \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

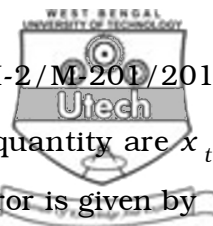
b) $2^{101} \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

c) $2^{100} \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

d) none of these.

ii) If λ is a eigenvalue of A , then λ^4 is an eigenvalue of

- 2



vii) If the true and approximate value of a quantity are x_t and x_a respectively, then the relative error is given by

- a) $\left| \frac{x_t - x_a}{x_t} \right|$ b) $\left| \frac{x_a - x_t}{x_a} \right|$
 c) $\left| \frac{x_a - x_t}{x_t - x_a} \right|$ d) $|x_t - x_a|$.

viii) The sum of the eigenvalues of

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

- a) 4 b) 5
 c) 2 d) none of these.

ix) The value of the determinant $\begin{vmatrix} 17 & 58 & 97 \\ 19 & 60 & 99 \\ 18 & 59 & 98 \end{vmatrix}$ is

- a) 1 b) 2
 c) 3 d) 0.

x) The value of λ for which the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & -3 & 1 \\ 3 & -2 & \lambda \end{bmatrix}$ is

singular, is

- a) $3/2$ b) 2
 c) 1 d) $1/3$.

xi) $\frac{1}{D-1} x^2$ is equal to

- GROUP – B**

Answer any *three* of the following. $3 \times 5 = 15$

- $$5x_1 + x_2 + 2x_3 = 13.$$



3. Prove that $\Delta f e^{hD} = 1$.

(The notations have their usual meanings).

4. Expand by Laplace's method to prove that

$$\begin{vmatrix} o & a & b & c \\ -a & o & d & e \\ -b & -d & o & f \\ -c & -e & -f & o \end{vmatrix} = (af - be + cd)^2.$$

5. Solve $\frac{dy}{dx} + y = y^3 (\cos x - \sin x)$.

6. Evaluate $\int_0^{\pi/6} \sqrt{1 + \sin x} \, dx$ using Simpson's one-third rule by taking five ordinates.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Show that $(3, 1, -2)$, $(2, 1, 4)$ and $(1, -1, 2)$ form a basis of R^3 .

b) Find the eigenvalues and eigenvectors of the matrix

$$\begin{bmatrix} 1 & -1 & 2 \\ 2 & -2 & 4 \\ 3 & -3 & 6 \end{bmatrix}$$

c) Solve by Cramer's rule :

$$x + y + z = 6$$

$$x + 2y + 3z = 14$$

$$x - y + z = 2.$$



8. a) Solve the differential equation by Laplace

Transformation :

$$\frac{d^2 y}{dt^2} - 2 \frac{dy}{dt} - 3y = t \cos t$$

$$y(0) = 0, y'(0) = 0.$$

- b) Solve by the method of variation of parameters :

$$\frac{d^2 y}{dx^2} + a^2 y = \sec ax.$$

- c) Find the particular integral of

$$(D^2 + 4)y = x \sin^2 x.$$

9. a) Estimate the missing term from the table :

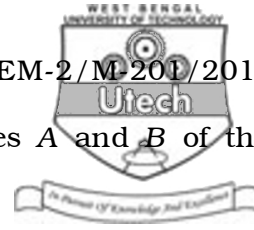
x	2	4	6	8	10
y	5	13	*	53	85

- b) The values of a function $f(x)$ are given for certain values of x as follows :

x :	4	5	6	8
f(x) :	3.11	2.96	2.85	2.7

Obtain the value of $f(5.5)$ using Lagrange's interpolation formula.

- c) Compute $\int_0^2 \frac{\sin x}{\sqrt{x}} dx$ using Simpson's one-third rule taking $h = \frac{1}{6}$.



10. a) Prove that for two invertible matrices A and B of the same order $(AB)^{-1} = B^{-1}A^{-1}$.

b) Reduce the following matrix to a row-reduced echelon form and hence find its rank :

$$\begin{bmatrix} 1 & 2 & 1 & 0 \\ 2 & 4 & 8 & 6 \\ 0 & 0 & 5 & 8 \\ 3 & 6 & 6 & 3 \end{bmatrix}$$

c) Solve $(D^2 - 5D + 6)y = x^2 e^{3x}$, $D \int \frac{d}{dx}$.
