

Name : .....  
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Invigilator's Signature : .....

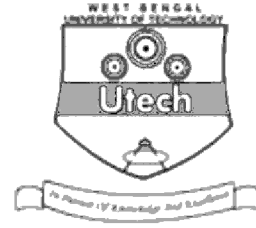
**CS/B.Pharm/SEM-1/M-103/2009-10**  
**2009**  
**REMEDIAL MATHEMATICS**

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  $A$  is a square matrix and  $A'$  its transpose, then  $A + A'$  is
- a) a skew-symmetric matrix
  - b) a diagonal matrix
  - c) a unit matrix
  - d) a symmetric matrix.



ii)  $\int_{-2}^2 x^3 \cos x \, dx$  is equal to

- a) 4
- b) 2
- c) 0
- d) none of these.

iii) The order of the differential equation  $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 + y = 0$  is

- a) 3
- b) 2
- c) 4
- d) none of these.

iv)  $\lim_{x \rightarrow \pi} \frac{\sin x}{\pi - x}$  is equal to

- a) 0
- b)  $\frac{1}{2}$
- c) 1
- d) -1.

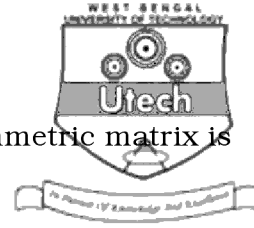
v) A matrix is said to be singular if

- a)  $\det A \neq 0$
- b)  $\det A = 0$
- c)  $\text{adj } A \neq 0$
- d)  $\text{adj } A = 0$ .

vi) If  $f(x) = |x|$ , then  $f'(x) =$

- a) 2
- b) 1
- c) 0
- d) does not exist.





xi) Every diagonal element of a skew-symmetric matrix is

- a) 1
- b) 0
- c) -1
- d)  $i$ .

xii)  $\int e^x (\cos x - \sin x) dx$  is equal to

- a)  $e^x + c$
- b)  $e^x \cos x + c$
- c)  $e^x \sin x + c$
- d)  $\cos x \sin x + c$ .

xiii) The value of  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x - 1}$  is

- a) 0
- b) 1
- c) 2
- d) none of these.

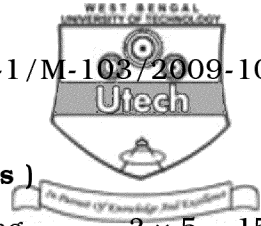
xiv) Let  $A$  be a matrix of order  $m \times p$  and  $B$  of order  $p \times q$ .

Then  $AB$  is a matrix of order

- a)  $p \times q$
- b)  $m \times p$
- c)  $p \times p$
- d)  $m \times q$ .

xv) If  $x = r \cos \theta$  and  $y = r \sin \theta$ , then  $x dx + y dy$  is

- a)  $r dr$
- b)  $r d\theta$
- c)  $r$
- d)  $\theta$ .



**GROUP – B**  
**( Short Answer Type Questions )**

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

2. Find the matrices  $A$  and  $B$  if  $2A + 3B = \begin{pmatrix} 8 & 3 \\ 7 & 6 \end{pmatrix}$ ,

$$A + B^T = \begin{pmatrix} 3 & 1 \\ 3 & 3 \end{pmatrix}.$$

3. Show that  $\lim_{x \rightarrow 0} \frac{x^2}{x} = 0$ .

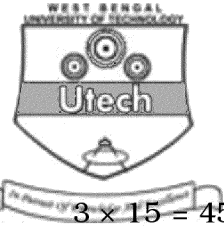
4. If  $y = \sqrt{3x+2}$ , prove that  $y \frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$ .

5. Prove that  $\begin{vmatrix} b+c & c+a & a+b \\ q+r & r+p & p+q \\ y+z & z+x & x+y \end{vmatrix} = 2 \begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix}$ .

6. If  $A = \begin{pmatrix} 3 & -4 \\ 1 & -1 \end{pmatrix}$ , show that  $A^n = \begin{pmatrix} 1+2n & -4n \\ n & 1-2n \end{pmatrix}$ .

7. Evaluate  $\int_0^4 \frac{dx}{x + \sqrt{16-x^2}}$ .

8. Find the differential equation of the system of circles touching  $y$ -axis at the origin.



**GROUP - C**  
**( Long Answer Type Questions )**  
 Answer any *three* of the following.

9. a) Solve  $4^x - 3 \cdot 2^{x+2} + 2^5 = 0$

b) Prove that 
$$\begin{vmatrix} a-b-c & 2b & 2c \\ 2a & b-c-a & 2c \\ 2a & 2b & c-a-b \end{vmatrix} = (a+b+c)^3.$$

c) Evaluate  $\int \tan^{-1} \sqrt{x} \, dx.$

10. a) Solve by Cramer's rule :

$$2x - y = 3, \quad 3y - 2z = 5, \quad 2z - x = -4.$$

b) Prove that

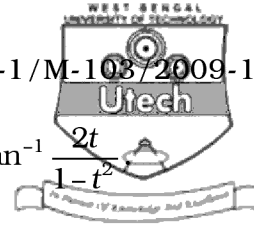
$$\lim_{n \rightarrow \infty} \left[ \frac{1}{n} + \frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \dots + \frac{1}{8n} \right] = \frac{7}{16}.$$

c) Show that every square matrix can be expressed as the sum of a symmetric and a skew symmetric matrix.

11. a) Find the matrix  $A$  if  $\text{adj } A = \begin{pmatrix} 2 & 2 & 0 \\ 2 & 5 & 1 \\ 0 & 1 & 1 \end{pmatrix}$  and  $\det A = 2.$

b) State Rolle's theorem. Verify Rolle's theorem for the function  $f(x) = x(x-1)(x-2)$  in  $0 < x < 2.$

c) Evaluate :  $\int \sqrt{\tan} \, dx.$



12. a) Find  $\frac{dy}{dx}$  if  $y = \sin^{-1} \frac{2t}{1+t^2}$  and  $x = \tan^{-1} \frac{2t}{1-t^2}$
- b) Solve  $x \frac{dy}{dx} + y = y^2 \log x$ .
- c) Show that  $\int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} dx = \frac{\pi^2}{4}$ .
13. a) If  $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$ , find  $A^{-1}$ .
- b) Find the values of  $a$ ,  $b$  and  $c$  so that  $\lim_{x \rightarrow 0} \left[ \frac{ae^x - b \cos x + ce^{-x}}{x \sin x} \right] = 2$ .
- c) If  $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$  and  $B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ , examine whether  $AB = BA$  or not.
14. a) Find the maximum or minimum value of  $x^{\frac{1}{x}}$ .
- b) If  $y = (x^2 - 1)^n$ , then show that  $(x^2 - 1)y_{n+2} + 2xy_{n+1} - n(n+1)y_n = 0$ .
- c) Solve  $\frac{d^3y}{dx^3} + 3 \frac{d^2y}{dx^2} + 3 \frac{dy}{dx} + y = e^{-x}$ .

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