

Name :

Roll No. :

Invigilator's Signature :

**CS/MBA(OLD)/SEM-1 (FT & PT)/MB-105/2009-10
2009**

QUANTITATIVE METHODS-I

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 :

$$10 \infty 1 = 10$$

i) When three unbiased coins are tossed, probability of getting at least one head is

a) $\frac{1}{8}$

b) $\frac{3}{8}$

c) $\frac{7}{8}$

d) none of these.

ii) If in a determinant rows are changed into columns and vice versa, the value of the determinant

a) remains the same

b) becomes zero

c) becomes one

d) none of these.



- vii) Suppose the marginal cost function is given by $MC (q) = 4e^{2q}$. The fixed cost is 10. The total cost $TC (q)$ is
- a) $2e^{2q} + 8$ b) $2e^{2q} + 10$
- c) $4e^{2q} + 8$ d) $4e^{2q} + 10$.
- viii) The functions f and g are defined by $f (x) = 2x$ and $g (x) = 1 / x, x \neq 0$. The value of $fg (x)$ is
- a) $x / 2$ b) $2 / x$
- c) $2x^2$ d) $x^2 / 2$.
- ix) If $P (A) = \frac{1}{4}$, $P (B) = \frac{3}{4}$ and $P (A \cap B) = \frac{3}{16}$, then the events A and B are
- a) independent b) mutually exclusive
- c) equally likely d) none of these.
- x) If $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ and $ad - bc \neq 0$, then A^{-1} equals
- a) $\begin{pmatrix} d & b \\ c & a \end{pmatrix}$
- b) $\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$
- c) $\frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$
- d) $\frac{1}{ad - bc} \begin{pmatrix} d & b \\ c & a \end{pmatrix}$.



xi) If $y = x^2 e^{mx}$, then $\frac{dy}{dx}$ equals

- a) $x^2 + e^{mx}$
- b) $mx^2 + e^{mx}$
- c) $(mx + 2) e^{mx} .x$
- d) $2xe^{mx}$.

xii) The centre of the circle passing through the origin and cutting off intercepts a and b on the X and Y axes is

- a) $\left(\frac{a}{2}, \frac{b}{2}\right)$
- b) $\left(\frac{-a}{2}, \frac{-b}{2}\right)$
- c) (a, b)
- d) $(a/2, -b/2)$.

GROUP – B

(Short Answer Type Questions)

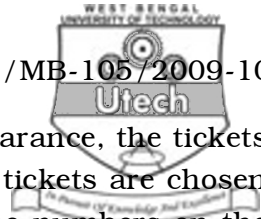
Answer any *three* of the following. $3 \times 5 = 15$

2. Evaluate the following limit :

$$\lim_{x \rightarrow 1} \frac{\sqrt{x+8} - \sqrt{8x+1}}{\sqrt{5-x} - \sqrt{7x-3}}$$

3. If $x^m y^n = (x+y)^{m+n}$, show that $\frac{dy}{dx} = \frac{y}{x}$.

4. Evaluate : $\int e^{mx} \cos x \, dx$.



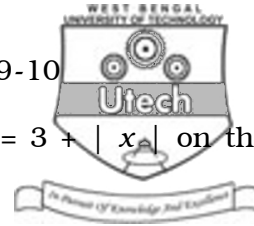
5. A box contains 20 tickets of identical appearance, the tickets being numbered 1, 2, 3, 20. If 3 tickets are chosen at random, what is the probability that the numbers on the tickets drawn are in arithmetic progression ?
6. The line $y = mx$ and the curve $y = x^2 - 2x$ intersect at the origin O and meet again at a point A . If P is the mid-point of OA , find the equation of the locus of P as m varies.

GROUP – C

(Long Answer Type Questions)

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

7. a) Show that the maximum value of the function $f(x) = x + \frac{1}{x}$ is less than its minimum value. Sketch the curve of this function, indicating the asymptotes, if any.
- b) The total cost function of a firm is given by $C(x) = \frac{1}{3}x^3 - 5x^2 + 28x + 10$, where x denotes the quantity of output. A tax at the rate of Rs. 2 per unit of output is imposed and the producer adds it to his costs. The market demand function is given by $P = 2350 - 5x$, where P denotes the unit price. Find the profit maximizing output and the corresponding price. $8 + 7$
8. a) Find the equation of the straight line that passes through the intersection of the lines $3x + 4y = 17$ and $4x - 2y = 8$ and which is perpendicular to the line $7x + 5y = 12$.
- b) Find the equation of the circle which passes through the points $(3, 4)$ and $(3, -6)$ and which has its centre on the straight line $2x + 3y = 3$.
- c) Show that the coordinates of the vertices of an equilateral triangle cannot be all rational. $5 + 5 + 5$



9. a) Calculate the average value of $f(x) = 3 + |x|$ on the interval $[-2, 4]$.

b) Find the area bounded by the parabolas $y^2 = 4x$, $x^2 = 4y$ and the x -axis.

c) A function $f(x)$ is defined as follows :

$$f(x) = \frac{3}{2} - x, \text{ when } 0 < x < 1/2.$$

$$= \frac{1}{2}, \text{ when } x = 1/2$$

$$= 1/2 - x, \text{ when } 1/2 < x < 1.$$

Examine the continuity of the function at $x = 1/2$.

5 + 6 + 4

10. a) Find the value of x , in terms of a, b, c given that

$$\begin{bmatrix} x+a & b & c \\ c & x+b & a \\ a & b & x+c \end{bmatrix} = 0$$

b) State Cauchy's root test. Prove that the series

$$\frac{1}{3} + \left(\frac{2}{5}\right)^2 + \left(\frac{3}{7}\right)^3 + \dots + \left(\frac{n}{2n+1}\right)^n + \dots \text{ converges.}$$

c) If $A = \begin{bmatrix} 3 & 2 & 5 \\ 4 & 1 & 3 \\ 0 & 6 & 7 \end{bmatrix}$, express A as a sum of two

matrices such that one is symmetric and the other skew-symmetric.

5 + 6 + 4



11. a) The letters of the word "THEORY" are permuted and then the words are arranged as in a dictionary. What is the rank of the word "THEORY" in that dictionary ?
- b) A motorist plans a journey and event X is arrival at his destination in less than 3 hrs. He estimates the probability of dry weather, rain or snow to be $1/3$, $1/2$ and $1/6$ respectively. The probabilities of event X in these conditions are $3/4$, $2/5$ and $1/10$ respectively. What is the probability that the motorist completes his journey in 3 hours ? What is the probability that if he fails to arrive in less than 3 hours, there was a fall of snow ?

c) Evaluate : $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx.$ 6 + 6 + 3
