MA ECONOMICS
First Semester
Mathematical Economics
MEC-104

Duration: 3Hrs.

Full Marks: 70

Part-A (Objective) =20
Part-B (Descriptive) =50

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins.

Marks: 50

Answer any *four* from *Question no.* 2 to 8
Question no. 1 is compulsory.

1. An amount of Rs. 5000 is put into three investment at the rate of interest of 6% , 7% and 8% per annum respectively. The total annual income is Rs.358. If the combined income from the first two investment is Rs. 70 more than the income from the third, find the amount of each investment by matrix method. **(10)**

2. (i) Define singleton set and void set. Give examples. **(4+4+2=10)**

(ii) A man borrows Rs 40,000 without interest and agrees to pay back in 12 monthly instalments, each instalment being twice the preceeding one. Find the second and the last instalments.

(iii) Distinguish between $\lim_{x \to a} f(x)$ and $f(a)$.

3. Evaluate any two: **(5 + 5 = 10)**

(i) $\lim_{x \to \frac{1}{2}} \frac{2x^2+3x-2}{2x^2+5x-3}$

(ii) $\lim_{x \to \infty} \frac{3x^3+5x-6}{6x-3x^2+10x^3}$

(iii) $\lim_{x \to 0} \frac{e^x+e^{-x}-2}{x^2}$

4. Answer the following: **(4+6=10)**

(i) Find the average revenue function (AR) and marginal revenue function (MR) for the following total revenue function (TR). Evaluate them at Q = 7 units

$$TR = 27Q - \frac{Q^2}{3} + Q^3$$

(ii) A person is appointed on a basic pay of Rs 10,000 per month and gets an increment of Rs 500 every year. He contributes 15% of his salary to his provident fund. What will be his total contribution to provident fund during his 30 years of service?

5. (i) A monopolist faces the following market situation.   **(6+4=10)**

$$Q1 = 24 - 0.2\ P1$$
$$Q_2 = 10 - 0.05\ P_2$$
$$TC = 50 + 40\ Q\quad (\ Q = Q1 + Q2\ )$$

where Q1, Q2, P1, P2 have the usual meanings. Obtain the prices the monopolist will charge (a) with discrimination and (b) without discrimination.

(ii) In a survey on reading of newspaper in a locality, the following results are obtained. 50% of the people read "The Assam Tribune", 30% read "The Sentinal" and 70% read "The Times of India". 10% read Tribune and Sentinal, 20% read Sentinal and Times of India. 42% read Tribune and Times of India and 4% do not read any newspaper. Using operations of set, find out the percentage of people who read all the three papers.

$$Y = 2x^2 - 16x + 50$$

6. Evaluate the following :   **(3+3+4= 10)**

(i) $\int \frac{x^2 - x + 1}{x^4}\, dx$

(ii) $\int (x^{\frac{1}{2}} + x^{\frac{-1}{2}})\, dx$

(iii) $\int \frac{x^2 - 5x + 6}{x - 2}\, dx$

7. (i) The marginal revenue function is given by.   **(4+6 =10)**
$$MR = R'(Q) = 50 - 4Q$$

Find the point elasticity of demand when Q=10

(ii) Given the MC function
$$MC = C'(Q) = Q^2 - 4Q + 3$$

Find the level of output (Q) at which the average variable cost (AVC) will be minimum.

8. (i) Define scalar matrix and involutory matrix with example.   **(3+3+4=10)**

(ii) A $=[a_{ij}]$ & B$=[b_{ij}]$ are any two matrix. If AB= A and BA= B then show that $A^2 = A$ & $B^2 = B$

(iii) Show that the following matrix is a nilpotent matrix. Also mention the index.
$$A = \begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$$

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Duration: 20 minutes   **Marks – 20**

(PART A - Objective Type)

A. Multiple Choice Question: 1×20=20

1. If A and B are disjoint sets, then n(A∩B) = _____ .
   a) 1   b) 0   c) ϕ d) none of these

2. In the expansion of $(a+x)^n$, if 'n' is even, then middle term will be
   a) n^{th} term   b) $\left(\frac{n}{2}\right)^{th}$ term   c) $\left(\frac{n+1}{2}\right)^{th}$ term   d) none of these.

3. If $r < 1$, then the sum $a + ar + ar^2 + ar^3 + \cdots \infty$ is
   a) $\frac{a(1-r^n)}{1-r}$ b) $\frac{a}{1-r}$ c) ∞ d) none of these.

4. The sum $1 + 2 + 3 + \ldots + n$, where 'n' is a positive integer, is
   a) $\frac{n(n+1)}{2}$ b) $\frac{n(n+1)(2n+1)}{6}$ c) $\left\{\frac{n(n+1)}{2}\right\}^2$ d) none of these.

5. for $a > 0$, $\log_a 0 =$ _____
   a) 0   b) $-\infty$ c) ∞ d) none of these.

6. If $f(x) = x^2 - 3|x|$ and if a is a positive real number, then $f(a) =$ _____
   a) $a^2 + 3a$ b) $a^2 - 3a$ c) $a^2 - 3|a|$ d) None of these.

7. Slope of the function y = c, where 'c' is a function, is
   a) 0   b) ∞ c) 1   d) none of these.

8. If $y = 3x^2 - 4$, then its inverse function is
   a) $x = \frac{y+4}{3}$,   b) $x = \sqrt{y}$ c) $x = \sqrt{\frac{y+4}{3}}$ d) none of these.

9. $\lim_{x \to \infty} \frac{3}{x^2}$ is
   a) ∞ b) $-\infty$ c) 0,   d) does not exist.

10. Let $(x) = \frac{x^2-4}{x-2}$, which of the following statements are true.

    a) f(x) is continuous at x = 2,   b) limit of the function f(x) exists at x = 2,

    c) f(x) is not continuous at x = 2,   d) both (b) and (c).

11. $\frac{d}{dx}(\frac{1}{\sqrt{x}}) = $ _____

    a) $\frac{1}{2x^{\frac{3}{2}}}$,   b) $\frac{1}{2x^{-\frac{3}{2}}}$,   c) $-\frac{1}{2x^{-\frac{3}{2}}}$,   d) none of these.

12. If $= e^{\log_e x}$, then $\frac{dy}{dx} = $ _____

    a) $e^{\log_e x}$ b) $\frac{1}{x}$ c) $\frac{e^x}{x}$ d) $\frac{e^{\log_e x}}{x}$

13. $\int dx = $ _____

    a) 0   b) 1   c) x   d) None of these.

14. If $f(x) = a^x$, then $\int f(x)dx = $ _____

    a) $\frac{e^{ax}}{x}$ b) $\frac{a^{\log_e x}}{\log x}$ c) $\frac{a^x}{\log_e a}$ d) None of these.

15. If the marginal cost (MC) function of a firm is given by,

    $MC = C'(Q) = 3Q^2 + 2$ and the total fixed cost is10, then the total cost will be_____

    a) 3/2Q + 10   b) 3/2 Q²+ 20   c) Q³+ 2Q +10   d) None of these.

16. A raw matrix has _____ row & _____number of columns.

17. Two matrices A & B are comfortable for the product AB if the number of _____ in A is same as the number of_____ in B.

18. A square matrix A= [a$_{ij}$] is called a idempotent matrix if A²= _____

19. Matrix A= [a$_{ij}$] is invertible iff A is_____.

20. Let AX=B be a system of n linear equations in n unknowns. If | A| = 0 and (adj A)B≠ O , then the system is inconsistent.

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