ECO/V/CC/07

2021

(CBCS)
(5th Semester)
ECONOMICS

SEVENTH PAPER
[Quantitative Techniques – I]

Full Marks: 75
Time: 2 *hours*

INSTRUCTIONS TO CANDIDATES

(Please read the instructions carefully before you start writing your answers)

1. Questions should be attempted as per instructions.
2. Do not copy the Questions. Indicate the Section and Question No. clearly while attempting the answer.
3. For Multiple choice answers, candidate should indicate the Question No., Sub. No., (if any) and the correct answer. For example :

   1. Name the State capital of Mizoram.

   (a) Lunglei

   (b) Aizawl

   (c) Champhai

   Candidate should provide answer as—Q. No. *1* : *(b) Aizawl*
   [Candidate should avoid writing only *(b)*]
4. Section B - Answer to Short Answer should be limited to **One Page** only.
5. The figures in the margin indicate full marks for the questions.

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SECTION : A – OBJECTIVE

(Marks: 30)

Choose the correct answer from the following: 1x30=30

1. If set A = {ϕ}, then set A is a/an
   (a) infinite set
   (b) overlapping set
   (c) null set
   (d) singleton set

2. Any set containing n numbers of elements has _____ number of subsets.
   (a) $2n^2$
   (b) 2^n
   (c) n^2
   (d) $2n^2 - 1$

3. The set of all possible pairs *(a, b)* where *a* belongs to A and *b* belongs to B is called
   (a) domain of A and B
   (b) cartesian product of A and B
   (c) range of A and B
   (d) associative law

4. A quadratic function may be used to describe
   (a) average fixed cost
   (b) cost function
   (c) trade cycle
   (d) none of the above

5. If equations are satisfied by the same value of the unknown quantities, they are called
   (a) Simultaneous equation
   (b) Linear equation
   (c) Quadratic equation
   (d) Cubic equation

6. The expression $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ is called the
   (a) commutative law of union
   (b) distributive law of union
   (c) associative law of union
   (d) distributive law of intersection

7. If the marginal revenue (MR) = 0, then elasticity of demand (η) is
   (a) > 1
   (b) < 1
   (c) = 1
   (d) ≤ 1

8. When the minimum of Average Cost (AC) is 250, then Marginal cost (MC) will be
   (a) 500
   (b) 250
   (c) 125
   (d) 75

9. If $\frac{dy}{dx} < 0$,
   (a) The curve remains stationary for a moment and then changes its course.
   (b) The curve rises from left to right
   (c) The curve moves horizontally
   (d) The curve falls from left to right

10. The second order condition for minimum value is
    (a) $\frac{d^2y}{dx^2} > 0$
    (b) $\frac{d^2y}{dx^2} = 0$
    (c) $\frac{d^2y}{dx^2} < 0$
    (d) $\frac{d^2y}{dx^2} \geq 0$

11. A function can be differentiated if
    (a) the dependent variable is a function of independent variable
    (b) the independent variable is a function of dependent variable
    (c) the dependent variable is a continuous function of independent variable
    (d) the independent variable is a continuous function of dependent variable

12. Given, revenue (R) =100 and quantity (Q) = 5, then price (P) will be
    (a) 100
    (b) 0.025
    (c) 20
    (d) 25

13. The value of $\int \frac{1}{x}\, dx$ =
    (a) $\log x$
    (b) $log\, x + C$
    (c) x
    (d) $x + C$

14. Consumer's surplus can be obtained by integrating
    (a) supply function
    (b) demand function
    (c) utility function
    (d) none of the above

15. The integral of e^{7x} is
    (a) $7e^{7x}$
    (b) e^x
    (c) $\frac{1}{7}e^{7x}$
    (d) e^{7x}

16. $\int_a^b (5x + 4)dx$ is
    (a) an indefinite integral
    (b) a definite integral
    (c) a constant integral
    (d) all of the above

17. Total cost function can be obtained by integrating
    (a) average cost function
    (b) marginal cost function
    (c) revenue function
    (d) none of the above

18. The marginal cost function of a firm is MC = 6x + e^x + x^2, where x is output, the total cost function will be
    (a) $x^2 + e^{ax} + \frac{x^2}{2}$
    (b) 4x + log x + $\frac{x}{2}$
    (c) $2x^2 + e^x + \frac{x}{2}$
    (d) $3x^2 + e^x + \frac{x^3}{3}$

19. The necessary and sufficient condition for a square matrix to possess its inverse is
    (a) $|A| = 1$
    (b) $|A| = 0$
    (c) $|A| \neq 1$
    (d) $|A| \neq 0$

20. The addition of a constant multiple of one row (or column) to another row (or column) leaves the determinant _____
    (a) changed
    (b) unchanged
    (c) zero
    (d) vanishes

21. The determinant of a matrix equals
    (a) the determinant of its transpose
    (b) the transpose of its determinant
    (c) the inverse of its determinant
    (d) the transpose of the inverse

22. The maximum number of linearly independent rows of a matrix is
    (a) rank of a matrix
    (b) dimension of the matrix
    (c) order of the matrix
    (d) transpose of the matrix

23. If A is $m \times n$ matrix and B is $n \times q$ matrix, then AB is
    (a) $n \times n$ matrix
    (b) $m \times n$ matrix
    (c) $m \times q$ matrix
    (d) $n \times q$ matrix

24. The transpose of a product of two matrices (AB)' is
    (a) A'B'
    (b) B'A'
    (c) A' + B'
    (d) AB

25. In LPP, those quantities (or expressions) which state the side conditions on the different activities of the problem are called _____
    (a) structural constraints
    (b) non- negativity constraints
    (c) budget constraints
    (d) objective function

26. In LPP, an area which satisfies all the constraints simultaneously are called _____
    (a) feasible region
    (b) extreme points
    (c) optimal solution
    (d) point of inflection

27. In LPP, linearity of the constraints implies that
    (a) each resource is heterogeneous
    (b) each resource is not heterogeneous
    (c) each resource is homogeneous
    (d) each resource is not homogeneous

28. Every linear programming problem in its standard form involves
    (a) objective function, structural constraints and non-negativity constraints
    (b) objective function, structural constraints and negativity constraints
    (c) non-linear function, , structural constraints and non-negativity constraints
    (d) non-linear function, structural constraints and negativity constraints

29. In linear programming problems, presence of constraints in the activity usually is because-
    (a) resources are abundant
    (b) resources are limited
    (c) prices are fixed
    (d) none of the above

30. Which of the following statements is not true regarding linear programming problem?
    (a) variables are linearly related
    (b) variables can take non-negative values only
    (c) there are equality constraint only
    (d) none of the above

SECTION : B – SHORT ANSWER

(Marks : 45)

Answer the following questions in not more than 1 (one) page each, choosing 3 (three) questions from each unit.

3x15=45

Unit – I

1. Differentiate between exogenous and endogenous variables.

2. Answer the following
   (a) Enumerate all the sub-sets of { 3,5,7}
   (b) Write all the proper sub-sets of {2, 4, 6}

3. Verify the associative law of intersection by using the following sets
   A = {2, 3, 4} B = {3, 4, 7} and C = {4, 8}

4. A town has a population of 5000. Out of it, 2200 read 'Aizawl Post' paper and 3200 read 'Vanglaini' paper, while 1500 read both the newspapers. Indicate how many read neither the Aizawl Post nor Vanglaini?

Unit – II

5. Find the derivative of
   (a) $y = (2x + 4)(3x^2 + 1)$
   OR
   (b) $y = (4x^2 - 5x)^3$

6. Prove that elasticity is the ratio of the marginal function and the average function.

7. A firm's revenue function is given by $R = 2Q^3 - 5Q + 6$, find
   (a) average revenue function
   (b) marginal revenue function

8. If the total revenue and total cost functions of a firm are given by $R = 400Q + 10Q^2$ and $C = 100 + 500Q$ respectively, find the equilibrium level of output.

Unit - III

9. Evaluate

   (a) $\int(12x^3 - 9x^2 + 8x - 3)dx$

   OR

   (b) $\int \frac{x^2}{2+3x}\, dx$

10. Evaluate

   (a) $\int_0^2 2^x\, dx$

   OR

   (b) $\int_0^3 (3x^2 + 5)\, dx$

11. Given the marginal revenue function MR = $8 - 6q - 2q^2$, determine the total revenue function.

12. If the demand function is $p = 85 - 4x - x^2$, find consumer's surplus when $x_0 = 5$ and $p_0 = 64$.

Unit - IV

13. Differentiate between idempotent matrix and identity matrix.

14. If A = $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, B = \begin{pmatrix} 1 & 2 \\ 2 & 3 \\ 4 & 5 \end{pmatrix}$, find BA.

15. If AX = B, where X = $\begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$, A = $\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$, B = $\begin{bmatrix} -1 \\ 2 \end{bmatrix}$, find X

16. Solve the equations by Crammer's Rule;

   $9x_1 + x_2 = 13$

   $8x_1 + 2x_2 = 16$

Unit - V

17. Mention the basic assumptions of linear programming problem.

18. Explain feasible and basic solutions.

19. Using graphical method, maximise

   $\pi = 3x_1 + 5x_2$

   Subject to $x_1 \leq 5$

   $x_2 \leq 8$

   and $x_1, x_2 \geq 0$.

   Indicate the feasible region.

20. Obtain the dual problem of the following LPP

Maximise $Z = 2x_1 + 5x_2 + 6x_3$

Subject to $5x_1 + 6x_2 - x_3 \leq 3$

$-2x_1 + x_2 + 4x_3 \leq 4$

$x_1 - 5x_2 + 3x_3 \leq 1$

$-3x_1 - 3x_2 + 7x_3 \leq 6$

$x_1, x_2, x_3 \geq 0$

***** End of Question *****