FIRST SEMESTER M.A. DEGREE EXAMINATION, NOVEMBER 2023
(CBCSS - PG)
(Regular/Supplementary/Improvement)
CC19P ECO1 C04 – QUANTITATIVE METHODS FOR ECONOMIC ANALYSIS – I
(Economics)
(2019 Admission onwards)

Time: 3 Hours　　　　　　　　　　　　　　　　　　　　　Maximum: 30 Weightage

Part A
Answer *all* questions. Each question carries 1/5 weightage.

1. A square matrix A equal to its transpose is:

    (a) Symmetric matrix　　　　　　　　(b) Skew symmetric matrix

    (c) Scalar matrix　　　　　　　　　　(d) Idempotent matrix

2. The value of the determinant |5| is:

    (a) 0　　　　　　(b) 5　　　　　　(c) 1　　　　　　(d) None of these

3. Two third of a number decreased by 2 equals 4. The number is:

    (a) 6　　　　　　(b) 8　　　　　　(c) 9　　　　　　(d) 7

4. The amount of fertilizer applied (x) and yield per plot (y) of a crop are related by an equation $y = 20.38 + 2.5x - 0.125x^2$. Then the quantity of fertilizer to be used to get maximum yield is equal to:

    (a) 20　　　　　　(b) 10　　　　　　(c) 20.38　　　　　　(d) 2.5

5. The rank of the matrix $\begin{pmatrix} 3 & 2 \\ 6 & 4 \end{pmatrix}$ is:

    (a) 0　　　　　　(b) 1　　　　　　(c) 2　　　　　　(d) None of these

6. $\lim_{x \to 0} \frac{\sin x}{x}$ is:

    (a) 0　　　　　　(b) 1　　　　　　(c) cos x　　　　　　(d) None of these

7. $\frac{d(e^{-3x})}{dx}$ is:

    (a) e^{-3x}　　　　(b) $3e^{-x}$　　　　(c) $-e^{-3x}$　　　　(d) $-3e^{-3x}$

8. The slope of the supply function $S = 2 + 7P$ is:

    (a) 0　　　　　　(b) 2　　　　　　(c) 5　　　　　　(d) 7

9. The point of intersection of demand and supply curves is known as:

    (a) Break-even point　(b) Equilibrium point　(c) Isoquants　　　(d) None of these

10. If $u = e^{-4xyz}$, then $\frac{\partial u}{\partial x}$ at $y = 1,\ z = 1$ is:

    (a) $-4e^{-4x}$　　　　(b) $4e^{-4x}$　　　　(c) e^{-4x}　　　　(d) $-4e^{-4xyz}$

11. $\int \frac{1}{x^2} dx$ is equal to:

(a) $\frac{-1}{x} + c$ (b) $\frac{-1}{x^2} + c$ (c) $\frac{-2}{x^3}$ (d) $\log x^2 + c$

12. The producers surplus when the supply function is $p = 10 + 2q$ and the equilibrium price 20 is:

(a) 35   (b) 25   (c) 100   (d) 50

13. The degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^2 + \frac{d^2y}{dx^2} - 6y = 0$ is:

(a) First   (b) Second   (c) Third   (d) None of these

14. Which of the following areas can the difference equation be applied?

(a) Cob-Web model   (b) Harrod Domar model

(c) Both a and b   (d) None of these

15. The arithmetic mean between a and 10 is 30, the value of 'a' should be:

(a) 45   (b) 50   (c) 60   (d) 53

(15 × 1/5 = 3 Weightage)

Part B (Very Short Answer Questions)

Answer any *five* questions. Each question carries 1 weightage.

16. Define exponential function.

17. Given $Q = 700 - 2P + 0.02y$, where p= 25 and $y = 5000$. Find the price elasticity of demand.

18. Define price elasticity of demand.

19. Find the first order and second order partial derivatives of

$Z = 3x^3 - 2xy^2 + 2x^2y + y^3 + 8$.

20. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if $z = \frac{x}{y}$.

21. (i) Write down general formula for first order linear difference equation.

(ii) Solve: $y_{t+1} = 0.6_{yt}$ with $y_0 = 10$.

22. Identify the number of terms in the A.P. 10, 13, ….. , 40.

23. The salary of employee increases every year by 7% of his initial salary and his initial basic salary is Rs.5000. Find his salary at the end of 5th year.

(5 × 1 = 5 Weightage)

Part C (Short Answer Questions)

Answer any *seven* questions. Each question carries 2 weightage.

24. Show that $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$.

25. Obtain the inverse of matrix $\begin{bmatrix} 2 & -3 & 0 \\ 3 & 1 & -2 \\ -1 & 0 & -4 \end{bmatrix}$

26. Solve the system of equations by Crammer's rule.

$2x - 3y + 5z = 11, 5x + 2y - 7z = -12, -4x + 3y + z = 5$.

27. Find the rank of the matrix $\begin{pmatrix} 2 & 3 & 1 & 2 \\ 1 & 0 & 1 & 2 \\ 2 & 0 & 2 & 4 \end{pmatrix}$.

28. Define the term limit of a function. Find $\lim_{x \to 0} \frac{x-2}{x+2}$.

29. The demand function faced by a firm is $p = 500 - 0.2x$ and its cost function is $c = 25x + 10000$ (p=price, x=output, c=cost). Find the output at which the profits of the firm are maximum. Also find the price it will charge.

30. Optimize $TC = 15 + 4Q - 3Q^2 + 2Q^3$.

31. Evaluate $\int_0^\infty xe^{-x} dx$.

32. What is first order linear differential equation and then solve $\frac{dy}{dx} + \frac{3}{x}y = \frac{1}{x^2}$.

33. Calculate the total interest on (i) Rs. 500 for 73 days, (ii) Rs. 600 for 15 weeks and (iii) Rs. 850 for 4 months, all at 7% per annum.

(7 × 2 = 14 Weightage)

Part D (Essay questions)

Answer any *two* questions. Each question carries 4 weightage.

34. Find the adjoint of the matrix and verify that $A(AdjA) = |A|I$ if $A = \begin{pmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{pmatrix}$

35. A firm has the following total cost and demand functions:

$C = \frac{1}{3}Q^3 - 7Q^2 + 111Q + 50$ and $Q = 100 - p$. Find profit maximizing level of output; also find profit at this level of output.

36. Demand and Supply functions under perfect competition are given by $Q_D = 16 - x^2$ and $Q_s = 2x^2 + 4$. Find market price, consumer's surplus and producer's surplus.

37. (i) The rate at which the volume of sales (Q) for a new type of printer increase after an advertising campaign is given by the equation $\frac{dQ}{dt} = 0.05(500 - Q)$, given that $Q = 0$ at $t = 0$. Q is the number of printers sold, t is the time in years. Solve the differential equation to obtain an expression for Q in terms of t.

(ii) Write down differential equations of the type limited and unlimited growth.

(2 × 4 = 8 Weightage)

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