Name.....

Reg. No.....

FIRST SEMESTER M.A. (CBCSS) REGULAR/SUPPLEMENTARY DEGREE EXAMINATION, NOVEMBER 2023

Economics

ECO 1C 04—QUANTITATIVE METHODS FOR ECONOMIC ANALYSIS—I

(2019 Admission onwards)

Time : Three Hours Maximum Weightage : 30

Part A (Multiple Choice Questions)

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

1. What is the result of multiplying a matrix by its transpose ?

   (a) The result is the identity matrix.

   (b) The result is a zero matrix.

   (c) The result is a diagonal matrix.

   (d) The result is a symmetric matrix.

2. If the total utility function is $U(q) = 3q^2 - 2q + 5$, what is the marginal utility function ?

   (a) $U'(q) = 6q - 2$.

   (b) $U'(q) = 6q - 2q + 5$.

   (c) $U'(q) = 6q - 2 - 5$.

   (d) $U'(q) = 6q - 2 + 5$.

3. XYZ borrowed Rs. 2,000 from a friend at an annual interest rate of 6 %. If the interest i compounded annually, how much interest will John have to pay after 2 years ?

   (a) Rs. 240.

   (b) Rs. 260.

   (c) Rs. 280.

   (d) Rs. 320.

4. Consider the function $f(x, y) = 3x^2y - 2xy^3$. Find the partial derivatives of f with respe to x.

   (a) $\partial f / \partial x = 6xy - 2y^3$.

   (b) $\partial f / \partial x = 6x - 6xy^2$.

   (c) $\partial f / \partial x = 6x^2 - 2y^3$.

   (d) $\partial f / \partial x = 3y - 2xy^3$.

5. The slope of a curve at a specific point is given by :

   (a) The first derivative of the curve at that point.

   (b) The second derivative of the curve at that point.

(c) The integral of the curve over a specific interval.

(d) The average rate of change of the curve over a specific interval.

6. The definite integral $\int[a,b]f(x)dx$ represents :

(a) The average value of the function $f(x)$ over the interval $[a, b]$.

(b) The slope of the function $f(x)$ at a specific point.

(c) The area under the curve of the function $f(x)$ between $x = a$ and $x = b$.

(d) The maximum value of the function $f(x)$ over the interval $[a, b]$.

7. Which of the following is true about arithmetic sequences ?

(a) The common difference between consecutive terms is constant.

(b) The ratio between consecutive terms is constant.

(c) The sum of any two consecutive terms is constant.

(d) The product of any two consecutive terms is constant.

8. The difference equation $y\_\{t+2\}-2y\_\{t+1\}+y\_t=0$ is of :

(a) First order. (b) Second order.

(c) Third order. (d) Zero order.

9. The concept of intertemporal optimization in Economics often involves solving :

(a) Ordinary differential equations.

(b) Partial differential equations.

(c) Integral equations.

(d) Stochastic differential equations.

10. What is the general relationship between interest rates and bond prices ?

(a) Interest rates and bond prices move in the same direction.

(b) Interest rates and bond prices move in opposite directions.

(c) Interest rates have no impact on bond prices.

(d) The relationship between interest rates and bond prices is uncertain.

11. The Internal Rate of Return (IRR) is defined as :

(a) The discount rate at which the net present value of cash flows is zero.

(b) The rate of return that exceeds the cost of capital.

(c) The rate of return on an investment based on the initial cash outflow and subsequent cash inflows.

(d) The rate of return that ensures profitability for a project.

12. The integral of $2x^3$ with respect to x is :

(a) $x^4 + C$.

(b) $x^2 + C$.

(c) $2x^4 + C$.

(d) $x^3 + C$.

13. The function $y = 2x^2 - 5x + 3$ is :

(a) Quadratic.

(b) Linear.

(c) Cubic.

(d) Exponential.

14. Find the limit of the function $f(x) = \left(4x^2 - 5x + 1\right) / (3x - 2)$ as x approaches 1.

(a) 4.

(b) 5.

(c) 2.

(d) 1/3.

15. A square matrix A is invertible if and only if :

(a) Its determinant is zero.

(b) Its determinant is non-zero.

(c) It is a symmetric matrix.

(d) It is a diagonal matrix.

Part B (Very Short Answer Questions)

(15 × 1/5 = 3 weighta

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

16. Define an implicit function.

17. What is meant by the rank of a matrix ?

18. What is a definite integral ?

19. What is IRR used for ?

20. Define annuities.

21. State the Chain Rule of differentiation.

22. Define a Lower Triangular Matrix.

23. What is a Quadratic function ?

Part C (Short Answer Questions)

(5 × 1 = 5 weight

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

24. Find the characteristic roots of the matrix $A = [[2,3],[1,2]]$.

25. Solve the differential equation $\left(x^2 + y^2\right)dy = 2xydx$, given the initial condition $y(1) =$

26. Draw the graph for $y = 5 - 3x$.

27. Find the derivative of the function $f(x) = 3x^4 - 2x^3 + 5x^2 - 7x + 2$ using the power rule.

28. Consider a market with the demand function given by Q = 100 − 2P, where Q represents the quantity demanded and P represents the price. Calculate the consumer's surplus at the equilibrium price.

29. Solve the difference equation $y_{t+1} - 2y_t + y_{t-1} = 5$ given $y_0 = 2$ and $y_1 = 3$.

30. For the information given below, determine (a) the market price P_t in any time period, (b) equilibrium price P_e and (c) the stability of the time path.

31. A company sells a product at a price of Rs. 10 per unit. The company's total revenue function is given by $R(q) = 100q - 2q^2$, where q represents the quantity of units sold. Find the marginal revenue function and determine the quantity at which marginal revenue is maximized.

32. Distinguish between total and partial derivative.

33. A company is considering an investment project that requires an initial investment of Rs. 50,000. The project is expected to generate cash flows of Rs. 15,000 per year for the next five years. The company's discount rate is 10 %. Calculate the net present value (NPV) of the investment project.

(7 × 2 = 14 weightage)

Part D (Essay Type Questions)

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

34. Find the minimum value of the function $f(x, y, z) = x^2 + y^2 + z^2$ subject to the Constrain $x + y + y = 10$.

35. Obtain the optimum value of the function $z = x^2 + 3y^2$ subject to the constraint $2x + 5y = 10$ using the Lagrange multiplier method.

36. A firm has a production function given by $Q = 3K^2L + KL^2$, where Q represents the output K represents capital and L represents labour. The cost of each unit of capital is Rs. 15 and the cost of each unit of labour is Rs. 10. The firm has a fixed budget of Rs. 3,000. Determine the levels of capital and labour that maximize the output and find the maximum output.

37. Solve the following system of equations using Cramer's rule :

$$\begin{aligned} 3x - 4y + 2z &= 7 \\ 2x + 5y - 3z &= -4 \\ x - 2y + 4z &= 3. \end{aligned}$$

(2 × 4 = 8 weightage)