D1AEC2504 **(4 Pages)** **Name.............................**
Reg. No..........................

FIRST SEMESTER M.A. DEGREE EXAMINATION, NOVEMBER 2025
(Regular/Improvement/Supplementary)

ECONOMICS
FECO1C04- QUANTITATIVE METHODS FOR ECONOMIC ANALYSIS I

Time: 3 Hours **Maximum Weightage: 30**

Part A: Multiple choice questions. Answer *all* questions. Each carries $^1/_5$ weightage.

1. Which of the following is the graph of a quadratic function?
   a) A straight line b) A parabola
   c) An exponential curve d) A logarithmic curve

2. If the demand function is given by $Q_d = 100 - 2P$, what is the demand when price $P = 20$?
   a) 40 b) 60 c) 100 d) 20

3. If the determinant of a matrix A is zero, then:
   a) A is invertible.
   b) The rank of A is full.
   c) A is singular.
   d) The system AX= B always has a unique solution.

4. The derivative of $f(x) = e^{2x}$ is ……..
   a) $2e^{2x}$ b) e^{2x} c) $2xe^{2x}$ d) e^x

5. At the maximum point of a differentiable function *f(x)*, which of the following is true?
   a) $f'(x) > 0, f''(x) > 0$
   b) $f'(x) = 0, f''(x) > 0$
   c) $f'(x) = 0, f''(x) < 0$
   d) $f'(x) < 0, f''(x) < 0$

6. $\lim_{x \to 0} \frac{\sin x}{x}$ is ……….
   a) 0 b) 1 c) ∞ d) does not exist

7. If $z = x^2 y + e^y$, then $\frac{\partial z}{\partial y}$ is ……….
   a) $x^2 + e^y$ b) $2xy + e^y$ c) $x^2 y + ye^y$ d) $2x + e^y$

8. For the function $f(x,y)=x^2+y^2$, the point $(0,0)$ is ………

a) maximum b) minimum c) saddle point d) none of the above

9. The area under the curve $y= x$ from $x= 0$ to $x= 2$ is ……….

a) 1 b) 2 c) 4 d) 8

10. A first order differential equation is an equation that involves:
a) only derivatives of order two or higher.
b) only derivatives of order one.
c) no derivatives at all.
d) infinite order derivatives.

11. The Cobweb model is used to explain:
a) Long-run economic growth.
b) Short-run equilibrium in markets with lagged supply response.
c) General equilibrium in macroeconomics.
d) Stability of exchange rates.

12. In economics, a first-order differential equation is often used to model:
a) Marginal cost and average cost relationship.
b) Population growth and decay processes.
c) Consumer surplus estimation.
d) Matrix determinant evaluation.

13. The n^{th} term of an arithmetic sequence is given by $a_n = a_1 + (n-1)d$. If $a_1 = 5$ and $d = 3$, what is a_{10}?

a) 32 b) 35 c) 38 d) 40

14. A sum of 10,000 is invested at simple interest at 5% per annum for 4 years. The interest earned is:

a) ₹2,000 b) ₹2,500 c) ₹3,000 d) ₹4,000

15. When market interest rates rise, the price of existing bonds generally:

a) increases b) decreases c) remains the same d) becomes uncertain

(15 × $^1/_5$= 3 weightage)

Part B: Answer any *five* questions. Each carries *one* weightage.

16. Define rank of a matrix.

17. What do you mean by characteristic roots and vectors of a matrix?

18. Determine whether the function $f(x)=\dfrac{1}{x-3}$ is continuous at $x=3$.

19. What is the meaning of derivative in economics?

20. Define a first-order differential equation with an example.

21. Find $\dfrac{\partial}{\partial x}\left(x^2y+3xy^2\right)$.

22. State the purpose of Lagrange multipliers in constrained optimization.

23. Define simple interest.

(5 × 1 = 5 weightage)

Part C: Answer any *seven* questions. Each carries *two* weightage.

24. Find the adjoint and inverse of the matrix $\begin{bmatrix} 2 & 3 & -1 \\ 0 & 1 & -1 \\ 2 & 1 & 2 \end{bmatrix}$.

25. Find the rank of the matrix $\begin{bmatrix} 1 & 0 & 2 & 3 \\ 2 & 1 & 0 & 1 \\ 4 & 1 & 4 & 7 \end{bmatrix}$.

26. Find the maximum and minimum values of $y = 2x^3 - 3x^2 - 12x + 4$.

27. If the demand law is $p = \dfrac{10}{(x+1)^2}$, find the elasticity of demand in terms of x. If the quantity x is 4 units find the elasticity of demand.

28. Find the values of x and y for which $u = 6x^2 + y^2$ is minimum under the condition that $4x - y = 1$. Find the minimum value of u.

29. Find the partial derivatives $\dfrac{\partial y}{\partial x_1}$ and $\dfrac{\partial y}{\partial x_2}$ of the function $y = 2x_1{}^2 - 3x_1x_2{}^3 + x_2$.

30. Explain the economic applications of first-order differential equations with suitable examples.

31. Write a short note on Cobb Web model.

32. Define Net Present Value (NPV) and Internal Rate of Return (IRR). Explain how these concepts help in evaluating investment decisions.

33. Explain the difference between arithmetic and geometric series and describe their applications in financial calculations.

(7 × 2 = 14 weightage)

Part D: Answer any *two* questions. Each carries *four* weightage.

34. Solve by Crammer's rule: $2x - y + z = 6$, $x + 2y + 3z = 3$ and $3x + y - z = 4$.

35. a) The marginal revenue function of output x is $M.R = 3(x+1)^2 + 3$. Find the total revenue function and hence, the demand function.

b) Show that the function $y = x^3 - 3x^2 + 5$ has a maximum value at $x = 0$ and a minimum value at $x = 2$.

(P.T.O.)

36. a) Given $y = 4x_1x_2 + x_1^2$ where $x_1 = 3x_2 + 5$. Find out total derivative $\frac{dy}{dx_2}$.

b) Find the total derivative $\frac{dy}{dt}$ given $y = 2x_1^2 - 5x_1x_2 - 6x_2^2$,

where $x_1 = 3t^2$ and $x_2 = 5 - 2t$.

37. A manufacturer produces 1200 computers each week. After week 1, he increases production by:

Scheme I: 80 computers each week.
Scheme II: 5% each week.

a) i) Find the output in week 20 under each scheme.
ii) Find the total output over the first 20 weeks under each scheme.

b) Calculate for schemes I and II the week in which production first exceeds.

(2 × 4 = 8 weightage)