D 12972 (Pages : 6) Name.....

Reg. No.....

FIRST SEMESTER M.A./M.Sc. DEGREE (REGULAR) EXAMINATION, NOVEMBER 2020/2021

(CBCSS)

Econometrics

ECM 1C 01—MATHEMATICAL METHODS FOR ECONOMIC ANALYSIS

(2020 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *The instruction if any, to attend a minimum number of questions from each sub section / sub part / sub division may be ignored.*
4. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Part A (Multiple Choice Questions)

Answer **all** *questions.*

Each question carries a weightage of 1/5.

1. Find a_{10} for the Arithmetic Progression, A = 1, 3, 5,...

   a) 15. b) 17.

   c) 19. d) 21.

2. Which of the following values of x and y make the following pair of matrices equal ?

$$\begin{pmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{pmatrix} = \begin{pmatrix} 5 & y-2 \\ 8 & 4 \end{pmatrix}$$

   a) $x = -1/3, y = 7.$ b) No possible solution.

   c) $x = -2/3, y = 7.$ d) $x = -1/3, y = -2/3.$

3. Find Marginal Cost (MC), when the cost function is given by :

$C(q) = q^3 + 4q^2 + 3q + 5$

a) $3q^2 + 8q + 3 + 5$.

b) $3q^2 + 4q + 3$.

c) $3q^2 + 8q + 3$.

d) $6q^2 + 8q + 3$.

4. Suppose the price of a product increases from £50 to £70 and the quantity supplied rises from 40 a day to 80. What is the price elasticity of supply ?

a) 1.

b) 1.5.

c) 2.0.

d) 2.5.

5. Suppose $H(t) = t^2 + 5t + 1$. Find $\lim_{t \to 2} H(t)$:

a) 15.

b) 9.

c) 6.

d) 8.

6. The simple interest when rate of interest ($r = 2\%$), time ($t = 10$) and principle amount ($P = 100$) is :

a) 2.

b) 20.

c) 200.

d) 2000.

7. A matrix that remains unchanged when it is multiplied by itself any number of times is referred to as :

a) Idempotent matrix.

b) Null matrix.

c) Singular matrix.

d) Horizontal matrix.

8. The roots of $2x^2 - 5x = 3$ are :

a) 3, 4.

b) 0, 3.

c) –1/2, 3.

d) 0, 0.

9. Which out of the following is an increasing function ?

a) $y = 2x + 3$.

b) $y = 3$.

c) $y = -x^2$.

d) $y = 1 - x$.

10. Solve the following integral :

$\int \theta d\theta$

a) 1.

b) 0.

c) $\theta + c$.

d) $\frac{\theta^2}{2} + c$.

11. Find the $|A|$: $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$

a) 4. b) 5.

c) 2. d) – 2.

12. If $f(x) = \ln(x) + 5x$, find $f'(x) = ?$

a) $ln\ (x)$. b) $ln\ (x) + 5$.

c) $\frac{1}{x} + 5$. d) None of the above.

13. If any two rows or any two columns in a determinant are identical (or proportional), then the value of the determinant is ————.

a) 1. b) 0.

c) Not defined. d) ∞.

14. $f(x) = x^2 + 3x + 4$ is a :

a) Linear function. b) Quadratic function.

c) Cubic function. d) None of the above.

15. Sum of first n natural numbers is given by :

a) n. b) $\frac{n+1}{2}$.

c) $\frac{n(n+1)}{2}$. d) $\frac{n(n-1)}{2}$.

(15 × 1/5 = 3 weightage)

Part B (Very Short Answer Questions)

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

16. What do you understand by sets of "ordered pairs" ?

17. Find the total profit when $q = 5$ with the total cost function as $C(q) = 10q + 5$ and total revenue function as $r(q) = q^2 + 20q$.

18. Compute the first difference $(i.e,\ \Delta y = y_t - y_{t-1})$ of the following equation :

$y_t = a + bx_t$.

19. Find the sum of first 10 numbers of the following arithmetic progression, A = 2, 4, 6, 8,...

20. What is a budget set and how is different from a budget line ? Specify the budget line equation with prices of good 1 and 2 as Rs. 20, Rs. 10 and income M.

21. Find the order and degree of the following differential equation :

$$\left(\frac{d^2y}{dx^2}\right)+x\left(\frac{dy}{dx}\right)^3=0.$$

22. Is the function $f(x)=|x|$ differentiable at $x = 0$? If yes or no, state the reason.

23. Find the Compound Interest (CI) with the following specification :

- Time period, $t = 10$
- Rate of interest, $r = 5\%$
- Principle amount, P = 1000

If yes or no, state the reason.

(5 × 1 = 5 weightage)

Part C (Short Answer Questions)

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

24. Find the derivative of the following function :

$$h(y)=y^{-4}-9y^{-3}+8y^{-2}+12.$$

25. Find the profit maximizing output and price for the monopolist with total cost function $c(q) = 20q + 5$ and inverse demand function $p = 100 - q$.

26. Find the derivative of the following function :

$y = xe^x$.

27. Define rank of a matrix. Determine the rank of matrix A :

$$A=\begin{pmatrix}1 & 2 & 0\\ 2 & 3 & 0\\ 2 & 1 & 0\end{pmatrix}.$$

28. Consider a profit-maximizing firm that produces a single output with a single input. Denote its (differentiable) production function by f, the price of the input by w, and the price of the output by p. Suppose that its profit-maximizing input when the prices are w and p is $z(w, p)$, so that its maximized profit is :

$$\pi(w, p) = pf\left(z(w, p)\right) - wz(w, p).$$

Find the derivative of π with respect to w.

29. Graph the indifference curve that passes through the point $(x, y) = (1, 1)$ that corresponds to the following utility function (i.e, $x, y > 0$):

$u(x, y) = x^2 + y^2$.

30. Solve the following definite integral :

$$\int_0^x e^{-rt} dt$$

where $r > 0$ is a constant.

31. Find the optimal utility of the consumer when the consumers problem is given by, \

$$\max_{x_1, x_2} u(x, y) = xy$$
$$\text{s.t. } 2x_1 + 3x_2 = 100$$
$$x_1, x_2 \geq 0.$$

32. The supply function of certain commodity is $Q = a + bP^2 + \sqrt{R}$ where $a < 0, b > 0$ and R represents rainfall :

(a) Find the price elasticity of supply $\in_{QP}$.

(b) Find the rainfall elasticity of supply $\in_{QR}$.

33. Find the following $(for\ x \neq 0)$:

(a) $\int 16x^{-3}\, dx.$ (b) $\int 2e^{-2x}\, dx.$

(7 × 2 = 14 weightage)

Part D (Long Essay Questions)

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

34. Suppose a consumer wants to consume two goods which are available only in integer units. The two goods are equally priced at Rs 10 and the consumer's income is Rs. 40.

(a) Write down all the bundles that are available to the consumer.

(b) Among the bundles that are available to the consumer, identify those which cost her exactly Rs. 40.