FIFTH SEMESTER BA DEGREE EXAMINATION, NOVEMBER 2023

(Regular/Improvement/Supplementary)

ECONOMICS

GECO5B08T: MATHEMATICS FOR ECONOMICS

Time: 2 ½ Hours   **Maximum Marks: 80**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 25 Marks)

1. What is the meaning of degree of an equation? Explain with examples.

2. Solve the equation $\frac{X-2}{X-1}+\frac{X+2}{X+1}=0$.

3. Assume that the national income of an economy is Rs. 150000 Crore. It was found to grow 8% annually. Project the level of income after 5 years.

4. Distinguish between singular and non-singular matrix.

5. Find the rank of the following matrix.

$$\begin{bmatrix} 5 & -7 & 3 \\ -1 & 2 & -8 \\ 5 & -2 & 3 \\ 1 & 4 & -2 \end{bmatrix}$$

6. Compute the limit $\lim_{x \to 2} \frac{3X^2+3X-18}{x-2}$.

7. Differentiate $y = \frac{5}{\sqrt{10x^3 + 7x^2}}$.

8. Examine the nature of the function $y = x^2 - 4x + 25$ at x<2 and X>2.

9. Write a note on Jacobian determinant.

10. What is Lagrangian multipliler? How the value of Lagrangian multiplier is interpreted?

11. Write down the conditions of maxima under Hessian determinant.

12. Does the function $y = 4x^2 + 5x + 15$ possess an inflection point?

13. Check whether the function $y = \frac{1+x}{1-x}$ is a monotonic function.

14. Integrate the function $\int (3x^4 + 5x^2 + 2)\, dx$.

15. Evaluate the definite integrals $\int_0^5 (x + x^2)dx$.

(PTO)

SECTION B: Answer the following questions. Each carries *five* marks.

(Ceiling 35 Marks)

16. A company produces bags in two qualities, Basic and Premium. The estimated output of Basic quality bag is 50% higher than that of Premium quality bag. The profit per unit sold is Rs.1000 for Premium and Rs. 400 for Basic. If the profit target is Rs.1,80,000, how much of each of the two qualities must be produced?

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

$$3X_1 + 2X_2 + 5X_3 = 32$$
$$2X_1 + 5X_2 + 3X_3 = 31$$
$$2X_1 + 3X_2 - 2X_3 = 15$$

18. Differentiate $y = \frac{1+\sqrt{2x}}{1-\sqrt{2x}}$.

19. Determine whether the function F= $8x^3 + 2xy - 8x^2 + y^2 + 1$ possess either maximum or minimum value using Hessian determinant.

20. Find the total differential of $z = \frac{x+y}{x^2+y^2}$.

21. Suppose that the inverse demand supply curves for a particular commodity are $P = 200 - 0.2Q$ and the supply curve is $P = 0.1Q + 20$. Find the equilibrium price and also compute the consumer and producer surplus.

22. Evaluate the following integrals.

    a. $\int (x^2 + 20)^{50} 2x\, dx$

    b. $\int \frac{x^3}{(3x^2+5)^2}\, dx$

23. If $MR = 16 - x^2$, find the maximum total revenue, average revenue and the required demand function.

SECTION C: Answer any *two* questions. Each carries *ten* marks.

24. Solve the following system of equations using Matrix Inversion method.

$$3Y_1 + 2Y_2 + 4Y_3 = 19$$
$$6Y_1 + 2Y_2 + Y_3 = 37$$
$$Y_1 + 2Y_2 + 3Y_3 = 10$$

25. Suppose that the firm producing a steel bottle obtains a fixed price $P = 121$ per unit, and that the cost function is $C(Q) = 0.02Q3 - 3Q2 + 175Q + 500$. Find the output that maximise its profit.

26. State and prove major properties of determinants with examples.

27. Find the optimum value of the utility function $U = 48 - (x - 5)^2 - 3(y - 5)^2$ under the conditions that $x + 3y = 9$.

(2 x 10 = 20 Marks)