

D 53904

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Name.....

Reg. No.....

**FIRST SEMESTER P.G. DEGREE EXAMINATION
NOVEMBER 2023**

(CCSS)

Financial Economics

FEC 1C 03—MATHEMATICS FOR ECONOMICS

(2022 Admissions)

Time : Three Hours

Maximum : 50 Marks

Part A (Multiple Choice Questions)*Answer all questions.**Each question carries 1 mark.*

1. The right hand side constant of a constraint in a primal problem appears in the corresponding dual as :

- (a) A co-efficient in the objective function.
- (b) A right hand side constant of a constraint in a dual problem.
- (c) An input-output co-efficient.
- (d) None of the above.

2. In which of the technology matrix, Hawkins-Simon conditions are satisfied :

- (a) $\begin{pmatrix} 0.2 & 0.9 \\ 0.8 & 0.1 \end{pmatrix}$.
- (b) $\begin{pmatrix} 0.7 & 0.3 \\ 0.2 & 1.2 \end{pmatrix}$.
- (c) $\begin{pmatrix} 1.02 & 0.5 \\ 0.6 & 0.8 \end{pmatrix}$.
- (d) $\begin{pmatrix} 0.3 & 0.2 \\ 0.1 & 0.5 \end{pmatrix}$.

3. For the demand and supply functions, $Q_d = 10 - P$, $Q_s = 3P - 2$, the equilibrium (P_0, Q_0) is :

- (a) $(6, 4)$.
- (b) $(5, 5)$.
- (c) $(7, 3)$.
- (d) $(3, 7)$.

Turn over

4. Compute the following limit :

$$\lim_{x \rightarrow 6} \frac{x^2 - 5}{x - 5}$$

- (a) 30. (b) 31.
(c) 3.1. (d) 37.
5. A differential equation is considered to be ordinary if it has :
- (a) One dependent variable.
(b) More than one dependent variable.
(c) One independent variable.
(d) More than one independent variable.

(5 × 1 = 5 marks)

Part B (Very Short Answer Questions)

Answer in one or two sentences each.

Answer any five questions.

Each question carries 1 mark.

6. Define Constant linear function.
7. Given

$$f(x) = \frac{5x^3}{4x + 3}.$$

Differentiate using Quotient rule

8. Given $y = \ln(x^2 + 6x + 2)$. Find the 1st order derivative.
9. Euler's theorem
10. The revenue function for a particular product is $R(x) = x(4 - .0001x)$. Find the largest possible revenue.
11. Find the second-order derivative.

12. Given

$$A = \begin{bmatrix} 8 & 3 & 2 \\ 6 & 4 & 7 \\ 5 & 1 & 3 \end{bmatrix}.$$

Find the rank of the matrix.

13. What is a closed input-output model ?

(5 × 1 = 5 marks)

Part C (Short Answer Questions)

*Answer any **six** questions.
Each question carries 4 marks.*

14. For the following data, find (a) the level of income Y_t for any period ; and (b) the warranted rate of growth.

$$I_t = 2.66 (Y_t - Y_{t-1}) \quad S_t = 0.16Y_t \quad Y_0 = 9000.$$

15. Given the demand function $P_d = 25 - Q^2$ and the supply function $P_s = 2Q + 1$. Assuming pure competition, find (a) The consumers' surplus ; and (b) The producers' surplus.

16. Optimize the function

$$z = 4x^2 + 3xy + 6y^2$$

subject to the constraint $x + y = 56$.

17. Use eigen values (characteristic roots, latent roots) to determine sign definiteness for the matrix given below :

$$A = \begin{bmatrix} 4 & 6 & 3 \\ 0 & 2 & 5 \\ 0 & 1 & 3 \end{bmatrix}.$$

Turn over

18. Consider the following problem faced by a production planner in a soft drink plant. He has two bottling machines A and B. A is designed for 8-ounce bottles and B for 16-ounce bottles. However, each can be used on both types with some loss of efficiency. The following data is available :

Machine	8-ounce bottles	16-ounce bottles
A	100/minute	40/minute
B	60/minute	75/minute

Each machine can be run 8-hours per day, 5 days per week. Profit on a 8-ounce bottle is 25 paise and on a 16-ounce bottle is 35 paise. Weekly production of the drink cannot exceed 3,00,000 ounces and the market can absorb 25,000 8-ounce bottles and 7,000 16-ounce bottles per week. The planner wishes to maximize his product subject, of course, to all the production and marketing restrictions. Formulate this as a linear programming problem.

19. Maximize profits π for a firm, given total revenue $R = 4000Q - 33Q^2$ and total cost $C = 2Q^3 - 3Q^2 + 400Q + 5000$, assuming $Q > 0$.
20. Use Cramer's rule to find the critical values of Q_1 and Q_2 , given the first-order conditions for constrained utility maximization : $Q_2 - 10\lambda = 0$, $Q_1 - 2\lambda = 0$, and $240 - 10Q_1 - 2Q_2 = 0$.
21. Solve the transportation problem using Vogel's approximation method :

		Destination			
		D1	D2	D3	D4
Source	01	3	1	7	4
	02	2	6	5	9
	03	8	3	3	2
	Demand :	250	350	400	200
		Supply			
		1200			

22. Find (1) The marginal ; and (2) The average functions for each of the following total functions. Evaluate them at $Q = 3$ and $Q = 5$.

$$TC = 3Q^2 + 7Q + 12$$

(6 × 4 = 24 marks)

Part D (Essay Type Questions)

*Answer any **two** questions.
Each question carries 8 marks.*

23. Use Matrix inversion to solve the following problem :

The equilibrium condition for three related markets is given by :

$$\begin{aligned} 11P_1 - P_2 - P_3 &= 31 \\ -P_1 + 6P_2 - 2P_3 &= 26 \\ -P_1 - 2P_2 + 7P_3 &= 24. \end{aligned}$$

Find the equilibrium price for each market.

24. Solve the following LPP :

Maximize $Z = 2x_1 - x_2 + x_3$
subject to the constraints

$$\begin{aligned} 3x_1 + x_2 + x_3 &\leq 60 \\ x_1 - x_2 + 2x_3 &\leq 10 \\ x_1 + x_2 - x_3 &\leq 20 \\ x_1, x_2, x_3 &\geq 0. \end{aligned}$$

25. Determine the total demand x for industries 1, 2, and 3, given the matrix of technical co-efficients **A** and the final demand vector **B** :

		Output industry				
		1	2	3		
A =	$=$	0.4	0.3	0.1	1 2 3	Input industry
		0.2	0.2	0.3		
		0.2	0.4	0.2		

$$\mathbf{B} = \begin{bmatrix} 140 \\ 220 \\ 180 \end{bmatrix}$$

Determine the new total demand X_2 if final demand increases by 30 for industry 1 and decreases by 15 and 35 for industries 2 and 3, respectively.

Turn over

26. For the data given below, determine :

- (a) The market price P_t in any time period ;
- (b) The equilibrium price P_e ; and
- (c) The stability of the time path.

$$Q_{dt} = 180 - 0.75P_t \quad Q_{st} = -30 + 0.3P_{t-1} \quad P_0 = 220 .$$

(2 × 8 = 16 marks)