STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086
(For candidates admitted from the academic year 2023 – 2024 & thereafter)

M.A. DEGREE EXAMINATION, NOVEMBER 2024
BRANCH III - ECONOMICS
FIRST SEMESTER

COURSE   :   ELECTIVE
PAPER   :   MATHEMATICS FOR ECONOMICS
SUBJECT CODE: 23EC/PE/ME15
TIME   :   3 HOURS   MAX. MARKS: 100

Q. No.	SECTION A PART - A (2 x 5=10) ANSWER TWO OUT OF THREE QUESTIONS IN 150 WORDS	CO	KL
1	If the matrix A is given by A = $\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$ prove that it satisfies the relation $A^2 - 4A + 3I = 0$ where I stands for the unit matrix of order 2	CO1	K1
2	The total cost function y for x units is given by $y = 3x \left[\dfrac{x + 7}{x + 5} \right] + 5$ Show that the marginal cost decreases continuously as the output increases.	CO1	K1
3	Determine the level of homogeneity and returns to scale for the following production function $Q = 0.9K^{0.2} L^{0.6}$		
	PART - B **(2 x 5=10)** **ANSWER TWO OUT OF THREE QUESTIONS IN 150 WORDS**		
4	There are 2 families A and B. There are 2 men, 3 women and one child in family A and one man, one woman and 2 children in family B. The recommended daily allowance for calories is men 2400; women 1900; children 1800 and for proteins men 55 gms, women 45 gms and children 33 gms. Represent the above information by matrices. Using matrix multiplication, calculate the total requirements of calories and proteins for each of the two families.	CO2	K2

5	Find the characteristic roots of $A =$ $\begin{bmatrix} -5 & 1 & 2 \\ 0 & -2 & 0 \\ 4 & 2 & -3 \end{bmatrix}$	CO2	K2
6	Under a monopoly, the quantity sold and market price are determined by the demand function. If the demand function for a profit maximizing monopolist is $P = 275 - Q^2$ and $MC = 4 + 3Q$, find the consumer surplus.		
Q. No.	**SECTION B** **PART - A** **(2 x 8 = 16)** **ANSWER TWO OUT OF THREE QUESTIONS IN 40 WORDS**	**CO**	**KL**
7	Define rank of a matrix. Determine the rank of $\begin{bmatrix} 2 & -1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 5 & 11 & 6 \end{bmatrix}$	CO3	K3
8	Given the demand function $Qd = c + bP$ and the supply function $Qs = g + hP$, the equilibrium price is $P = \dfrac{(c-g)}{(h-b)}$. Assume that the rate of change of price in the market dP/dt is a positive linear function of excess demand $Qd - Qs$ such that $dP/dt = m(Qd - Qs)$ $m = $ a constant > 0 Calculate the conditions for dynamic price stability in the market ie under conditions $P(t)$ will converge to P as t tends to infinity.	CO3	K3
9	Discuss the applications of linear programming to economics.		
	PART - B **(2 x 8 = 16)** **ANSWER TWO OUT OF THREE QUESTIONS IN 400 WORDS**		
10	State the Cayley Hamilton Theorem and verify for the following matrix $\begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$	CO4	K4

11	The efficiency of E of a small manufacturing concern depends on the number of workers W and is given by $$10E = \frac{W^3}{40} + 30W - 392$$ Find the strength of the workers which gives maximum efficiency.	CO4	K4
12	State two duality theorems and explain the formulation of the dual problem.		
Q. No.	**SECTION C** **PART - A** **(2 x 12 = 24)** **ANSWER TWO OUT OF FOUR IN 700 WORDS**	**CO**	**KL**
13	Suppose that the final demand for steel , coal and electricity in an economy consisting only of three sectors are Rs 10 crores, Rs 5 crores and Rs 6 crores respectively. It is given that a rupee worth of steel requires 20 paise, 40 paise and 10 paise worth of steel, coal and electricity respectively as inputs; a rupee worth of coal requires 30 paise, 10 paise and 30 paise worth of steel, coal and electricity respectively as inputs and that a rupee worth of electricity requires 20 paise worth of steel, coal and electricity each respectively as inputs. How much of steel, coal and electricity should be produced to satisfy both final and intermediate demands? Land and labour are used as two primary inputs, their coefficients for the three sectors are given as 0.3 0.2 0.5 0.4 0.1 0.2 If the wage rate and rent are Rs 50 and Rs 100 respectively, find the equilibrium prices for the three sectors	CO5	K5
14	Using Difference equations prove the Samuelson 's Multiplier Accelerator Model.	CO5	K5
15	(a) The demand functions for two related goods are given by $$X_r = \frac{4pi^2}{pr^2} \quad X_i = \frac{2pr^2}{pi^3}$$ (i) Find the four partial marginal demand functions and the direct and cross elasticities. (ii) Are the goods competitive or complementary? (b) A consumer has a utility function $u = x^a y^b$ where x and y are the quantities that he consumes of only two goods available to him, u is an index of utility and 0<a, b <1. (i) Show that there is diminishing marginal utility to the increased consumption of either commodity when the consumption of other is held constant. (ii) What happens to the marginal utility of x as y is increased?		

16	A monopolist produces 2 commodities X_1 and X_2 which have the following demand function: $P_1 = 100 - 2X_1$, $P_2 = 80 - X_2$ where P1 and P2 are their respective prices and X_1 and X_2 are their respective quantities. If the total cost function of the monopolist is $TC = 20(X_1 + X_2)$, find the prices and quantities that would maximize its profits.		
	PART - B **(2 x 12 = 24)** **ANSWER TWO OUT OF FOUR IN 700 WORDS**		
17	Use Differential equations to showcase the Harrod Domar and Solow Models	CO5	K6
18	A company produces two types of pens, say A and B. Pen A is a superior quality and pen B is a lower quality. Profits on pen A and pen B are Rs 5 and Rs 3 per pen respectively. Raw materials required for each pen A is twice as that of pen B. The supply of raw materials is sufficient only for 1000 pens of B per day. Pen A requires a special clip and 400 clips are available per day. For pen B only 700 clips are available per day. Find graphically the product mix so that the company can make maximum profit.	CO5	K6
19	A monopolist has the following demand function for each of his products X and Y; $x = 72 - 0.5P_x$ and $y = 120 - P_y$. The combined cost $C = x^2 + xy + y^2 + 35$ and maximum joint product is 40 ie $x + y = 40$. Find (i) the profit maximizing level of output and (ii) the price of each product, and (iii) the total profit.		
20	A discriminating monopolist is able to separate its customers into two markets with respective demand functions as $X_1 = 21 - 0.1P_1$ and $X_2 = 50 - 0.4P_2$, P_1 and P_2 being prices and X_1 and X_2 quantities demanded. The total cost function of the monopolist $TC = 10X + 2000$, where $X = (X_1 + X_2)$ is total output (1) Find the profit maximizing values of X_1 and X_2 (2) Find the prices charged in each market and the maximum profits. (3) Find the elasticities of demand in the two markets and verify that higher price will be charged in the market having the lower price elasticity of demand.		

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