K26P 1114

Reg. No. : .....

Name : .....

Second Semester M.A. Degree (C.B.C.S.S. – O.B.E. – Reg./Supple./Imp.) Examination, April 2026
(2023 Admissions Onwards)
ECONOMICS/DEVELOPMENT ECONOMICS/APPLIED ECONOMICS
MAECO02C08/MAACO02C08/MADCO02C08 : Quantitative Techniques for Economic Analysis – II

Time : 3 Hours

Max. Marks : 60

SECTION – I

Short Answer Questions (**Any 5**). **(5×3=15)**

1. What is a limit of a function ? Find the value of this $2x^3$ while x reaches the limit of 3.
2. How to find the maxima and minima of a function ? Illustrate with the function $y = 71x^2 + 112x - 54$.
3. Find the marginal revenue from a given demand function $P = 30 - 2Q$.
4. Define the basic framework of a Linear Programming Problem (LPP) and explain its essential components.
5. Outline the basic framework of a Game Theory model and describe its components.
6. Explain Karl Pearson's correlation coefficient how to interpret it ?

SECTION – II

Short Essay Questions (**Any 3**). **(3×6=18)**

7. From this total cost TC function ($TC = Q^3 + 5Q^2 + 60Q$), find (1)The average cost AC function, (2) The critical value at which AC is minimized, and (3) The minimum average cost.
8. Find the critical values for minimizing the costs of a firm producing two goods x and y when the total cost function is $c = 8x^2 - xy + 12y^2$ and the firm is bound by contract to produce a minimum combination of goods totalling 42, that is, subject to the constraint $x + y = 42$.

P.T.O.

9. A startup produces two types of solar gadgets: Solar Power Banks (x) and Solar Lanterns (y). To maintain production, they must navigate the following conditions: Each Power Bank requires 2kg of lithium, and each Lantern requires 1kg. The startup only has 100kg of lithium available this week (Resource Limit). To fulfil a pre-existing contract, they must produce at least 20 Lanterns (Market Demand). Both products are finished on a single assembly line. It takes 1 hour to finish a Power Bank and 1 hour for a Lantern. The line can only run for a maximum of 60 hours per week (Machine Time). They earn a profit of Rs. 300 per Power Bank and Rs. 150 per Lantern (Profit).

   Formulate this as a Linear Programming Problem (LPP) to maximize weekly profit.

10. Two friends, Ramesh and Suresh, are deciding on a movie to watch.
    Ramesh prefers Action (utility = 3) over Comedy (utility = 2).
    Suresh prefers Comedy (utility = 3) over Action (utility = 2).
    Both get 0 utility if they watch a movie alone.
    a) Construct the payoff matrix for this game.
    b) Identify all Pure Strategy Nash Equilibria.
    c) Explain why this is considered a "Coordination Game."
11. A researcher wants to know if a new vaccine is effective in preventing a specific flu strain. They track 200 participants and record the following data :

	Infected	Not Infected	Total
Vaccinated	20	80	100
Placebo (Unvaccinated)	40	60	100
Total	60	140	200

    Given that the critical value at a 5% significance level ($\alpha = 0.05$) with 1 degree of freedom is 3.84. State the Null Hypothesis (H_0) and the Alternative Hypothesis (H_1). Calculate the Expected Frequency (E) for the "Vaccinated and infected" cell. Calculate the Chi-Square (χ^2) statistic. Is the vaccine effective ?

SECTION – III

Essay Questions (**Any 3**). **(3×9=27)**

12. Find the derivative of this function $y = \frac{3x(2x-1)}{5x-2}$.
13. Find the profit-maximizing level of (a) output, (b) price, and (c) profit when
    $Q_1 = 5200 - 10P_1$
    $Q_2 = 8200 - 20P_2$ and
    $c = 0.1Q_1^2 + 0.1Q_1Q_2 + 0.2Q_2^2 + 325$
14. Matching coins game. Two players, Player A and Player B, are engaged in a zero-sum game. Each player simultaneously shows either a Head (H) or a Tail (T). If the coins match (HH or TT), Player A wins Rs. 100 from Player B. If the coins do not match (HT or TH), Player B wins Rs. 100 from Player A.
    a) Construct the payoff matrix for the game.
    b) Check if the game has a saddle point (Pure strategy).
    c) If no saddle point exists determine the optimal mixed strategy for both players and calculate the value of the game.
15. Maximize $Z = 3x_1 + 2x_2$
    Subject to : 1) $2x_1 + x_2 \leq 18$
    2) $2x_1 + 3x_2 \leq 42$
    3) $x_1, x_2 \geq 0$.
16. A researcher wants to know if the square footage(X) of a house is a significant predictor of its selling price(Y). After collecting 35 recently sold homes, the researcher runs a simple linear regression and obtains the following results : Estimated slope ($\hat{\beta}_1$):150.5, Standard error of the slope (SE):35.25, Sample size (n):35, Confidence level :95%(α=0.05).
    State the Null (H_o) and Alternative hypotheses to test if square footage has a significant effect on price. Calculate the t-value and test the hypotheses.

———————