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**47 C-N (MMEA)**

**[ 22-HKPD1SN-23A ]**

**M.A 1st Semester (New) Exam. 2022 (W)**

**ECONOMICS**

( *Mathematical Methods for Economic Analysis* )

[ PGEC S1-03 ]

*Full Marks* : 70/80

*Time* : 3 hours

*The figures in the right-hand margin indicate marks.*

**[ Learners admitted in and after 2020 need to answer only Q.No. 1 to Q.No. 4 (total 70 marks)]**

**1.** Answer any *five* from the following questions : $2 \times 5 = 10$

(*a*) Distinguish between diagonal and unit matrix.

(*b*) Distinguish between minor and cofactor.

(*c*) State any two importance of differentiation in the field of Economics.

(*d*) State the two conditions for convexity of indifference curve.

(*e*) What is meant by absolute extrema ?

(*f*) Distinguish between indefinite and definite integral.

**2.** Answer any *four* from the following questions : $3 \times 4 = 12$

(*a*) Put the following equations in matrix form and find the matrix of constant :

$$a_1x + b_1y + c_1z = d_1$$
$$a_2x + b_2y + c_2z = d_2$$
$$a_3x + b_3y + c_3z = d_3$$

(*b*) Prove that

$$\begin{vmatrix} 1 & x & y+z \\ 1 & y & z+x \\ 1 & z & x+y \end{vmatrix} = 0$$

(*c*) State the relationship between AR, MR and elasticity of demand.

(*d*) Distinguish between partial and total differentiation.

(*e*) State the problem and conditions of least-cost combination of inputs for a producer.

**3.** Answer any *four* from the following questions : $6 \times 4 = 24$

(*a*) Solve the following partial linear market model using matrix inversion :

$$Q_d = a - bp$$
$$Q_s = -c + dp$$
$$Q_d = Q_s$$

(*b*) State and explain the Euler's theorem.

(*c*) A firm has the following total cost function

$$C = Q^3 - 6Q^2 + 2Q + 50$$

Derive the average variable cost (AVC) function and show that when AVC is minimum, ACV = MC.

(*d*) Explain the condition for optimization in case of *m* explanatory variables.

(*e*) State any three economic problems where optimization with equality constraint is applicable.

4. Answer any *three* from the following questions : $8 \times 3 = 24$

(*a*) Given the market model

$$D = 100 - 5P$$
$$S = -10 + 2(P - t)$$
$$D = S$$

Where $D$, $S$, $P$, $t$ are demand, supply, price and tax rate, evaluate whether an increase in the rate of tax ($t$) will increase tax revenue ($T$).

(*b*) What is meant by producer's surplus ? The demand function for a commodity $P = 30 - 2D$. The supply function $P = 3D$. Find consumer's surplus. 2+6 = 8

(*c*) Write short note on the following : 4+4 = 8

(*i*) Order and degree of a differential equations.

(*ii*) Distinguish between difference and differential equation with the help of suitable examples.

(*d*) If we have a objective function $y = f(x_1, x_2, x_3)$ subject to $g(x_1, x_2, x_3) = c$, then form the Lagrange function and state the 1st and 2nd order condition for extremum. 2+6 = 8

**( Q. No. 5 is only for learners admitted before 2020 )**

5. Answer any *one* from the following questions : $10 \times 1 = 10$

(*a*) A monopolist produces his product in two different plants and his total cost functions are given by

$$TC_1 = 20 - 4Q_1 + \frac{1}{2}Q_1^2$$
$$TC_2 = 40 - 8Q_2 + Q_2^2$$

If the average revenue function is given by $AR = 40 - Q$ where $Q = Q_1 + Q_2$. Find profit maximising output.

(*b*) Evaluate

5+5 = 10

(*i*) $\int_1^3 x^2 \log x \, dx$

(*ii*) $\frac{d}{dx}\log\left(5e^{3x} - 2x^2 + 12\right)$

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