UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Supplementary Examination, December-23

Course: Mathematical Economics-I	**Semester: III**
Program: BA, Economics (Hons.)	**Course code: ECON2026**
Time: 03 Hours	**Max. Marks: 100**

SECTION A

1. Each Question will carry 2 Marks
2. Instruction: Select the correct answer(s)

		CO

Q1	Find the domains of the functions defined by the following equations:
	
	   a. $y = \sqrt{5-x}$
	   b. $y = \frac{2x-1}{x^2-x}$
	   c. $y = \sqrt{\frac{x-1}{(x-2)(x+3)}}$
	   d. $y = \frac{3x+6}{x-2}$
	   e. $y = \frac{3x+6}{x-2}$
	Find the derivative of each of the following functions:
	
	   a. $y = x^{1/2}$
	   b. $y = 63$
	   c. $y = 7x^5$
	   d. $w = 3u^{-1}$
	   e. $w = -4u^{\frac{1}{2}}$
			CO1

SECTION B

1. Each question will carry 5 marks
2. Instruction: Write short / brief notes

Q11.	Find the equilibrium price and quantity for the following.
	   a. $D = 60 - 4P, S = -10 + P$
	   b. $D = 200 - 1/2P, S = -100 + 1/2P$
		CO2

Q12.	Compute the following limits:
	   a. $lim_{x \to 2}(x^2 + 3x - 5)$
	   b. $lim_{v \to -1}(3v + 5/v + 2)$
		CO2

Q13.	Compute the following: $$\begin{vmatrix} u & v & w \\ 0 & x & y \\ 0 & 0 & z \end{vmatrix}$$	**CO2**
Q14.	Find $\frac{d^2y}{dx^2}$ when $y = x^{2a} + x^{-2a}$	**CO2**

SECTION-C

1. Each Question carries 10 Marks.

	2. Instruction: Write long answer	

Q 15.	For the following equations, find dy/dx by implicit differentiation:
	  a. $3y + 12x + 17 = 0$
	  b. $x^2 + 6x - 13 - y = 0$
	  c. $y^6 = x^5$
	  d. $2x^2 + 6xy + y^2 = 18$
		CO3

Q16.	Find the extreme value (s) of the following functions, and determine whether they are maxima or minima:
	  a. $C = L^2 + LK + 2K^2 + 3$
	  b. $Q = -L^2 - K^2 + 6L + 2K$
		CO3

Q17.	Given $Q = LK + L + 2K + 2$ and $P_L = 4, P_K = 6$ and $C = 130$:
	  a. Write the Lagrangian function.
	  b. Find the optimal levels of purchase L^* and K^*?
	  c. Is the second-order sufficient condition for maximum satisfied?
		CO3

<div align="center">

SECTION-D

</div>

1. Each Question carries 15 Marks.
2. Instruction: Write long answer

Q18	Use Cramer's rule to solve the following system of equations:
	
	  a. $x_1 - x_2 + x_3 = 2$
	    $x_1 + x_2 - x_3 = 0$
	    $-x_1 - x_2 - x_3 = -6$
	  b. $x + 3y - 2z = 1$
	    $3x - 2y + 5z = 14$
	  c. $2x - 5y + 3z = 1$
		CO4

Q19	Let the IS equation be
	
	$$Y = \frac{A}{1-b} - \frac{g}{1-b}i$$
	
	Where $1 - b$ is the marginal propensity to save, g is investment sensitivity to interest rates, and A is an aggregate of exogenous variables. Let the LM equation be
	
	$$Y = \frac{M_0}{k} + \frac{l}{k}i$$
	
	Where k and l are income and interest sensitivity of money demand, respectively, and M_0 is the real money balances.
	
	If $b = 0.7, g = 100, A = 252, k = 0.25, l = 200,$ and $M_0 = 176,$ then
	
	  a. Write the $IS - LM$ system in matrix form.
	  b. Solve for Y and i by matrix inversion.
		CO4