

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: IMSc
BRANCH: QEDS

SEMESTER : I
SESSION : MO/2023

SUBJECT: ED105 INTRODUCTION TO ECONOMICS & ESSENTIAL MATHEMATICS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

		Marks	CO	BL
Q.1(a)	<p>Show that the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ is non-singular. Hence, solve the system of equations $Ax = b$, where $b = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ by Cramer's rule.</p>	[5]	1	
Q.1(b)	<p>Show that the determinant of the matrix $A_{4 \times 4} = \begin{bmatrix} a & -b & -a & b \\ b & a & -b & -a \\ c & -d & c & -d \\ d & c & d & c \end{bmatrix}$ is $4(a^2 + b^2)(c^2 + d^2)$.</p>	[5]	1	
Q.2(a)	Identify the intervals on which the function $f(x) = x^{\frac{1}{3}}(x - 4)$ is increasing and decreasing, and hence find the local and absolute extreme values, if exist.	[4]	2	
Q.2(b)	Use Lagrange multiplier method to find the maximum and minimum values, if exist, for the function $f(x, y) = x^2 + 2y^2$ subject to $x + y = 3$.	[6]	2	
Q.3(a)	What are the characteristics of a perfectly competitive market? What do we mean when we say that price acts as an invisible hand in a free market economy?	[3+2]	3	
Q.3(b)	In what (any) three situations the government needs to intervene where the invisible hand fails to ensure the market gives the desired outcome?	[5]	3	
Q.4(a)	Differentiate between Giffen and inferior goods. If a 3 % increase in the price of corn flakes causes a 6% decline in the quantity demanded, what is the elasticity of demand?	[3+2]	4	
Q.4(b)	Consider the following events: Scientists reveal that consumption of oranges decreases the risk of diabetes and, at the same time, farmers use a new fertilizer that makes orange trees more productive. Illustrate and explain what effect these changes have on the equilibrium price and quantity of oranges.	[5]	4	
Q.5	<p>The supply and demand for air coolers are described by the following equations: Supply: $Q_S = 4P + 80$ Demand: $Q_D = 100 - 2P$.</p> <p>i) Graph the supply curve and the demand curve and find the equilibrium price and quantity</p> <p>ii) Suppose there is a demand hike for air coolers in Ranchi during the summer months such that now $Q_D = 200 - 2P$. Find out the new equilibrium and explain in detail the mechanism through which market attains that new equilibrium.</p>	[4+6]	5	