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B.A. (Honours) Examination, 2023

Semester—II (CBCS)

Subject: Economics

Course-CC-4(Mathematical Methods for Economics)

Time: 3 hours **Full Marks: 60**

Questions are of value as indicated in the margin

UNIT-I

Answer any two questions from the following: **15x2=30**

Qs1. (i) Find x, y, z , t where $3\begin{bmatrix} x & y \\ z & t \end{bmatrix} = \begin{bmatrix} x & 6 \\ -1 & 2t \end{bmatrix} + 4\begin{bmatrix} 4 & x+y \\ z+t & 3 \end{bmatrix}$

(ii) Suppose $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$ and $g(x) = x^2 + 3x - 10$, then show that A is zero of the polynomial g(x).

(iii) Show that the inverse of the matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is equal to $B = \frac{1}{\det A}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ 4 + 5 + 6 = 15

Qs.2. (i) Suppose A is a square matrix. Write A as the sum of a symmetric and a skew-symmetric matrix.

(ii) Let A be an arbitrary 2x2 orthogonal matrix. Prove that if (a, b) is the first row of A then $a^2 + b^2 = 1$ and $A = \begin{bmatrix} a & b \\ -b & a \end{bmatrix}$ or $A = \begin{bmatrix} a & b \\ b & -a \end{bmatrix}$.

(iii) Find a 2x2 orthogonal matrix P whose first row is a multiple of (3, -4). 5 + 5 + 5 = 15

Qs.3. (i) Compute the Adjoint of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 5 \\ 1 & 5 & 12 \end{bmatrix}$.

(ii) Solve the given equations by Matrix method: $3x - 2y = 4$, $4x - 3y = 5$.

(iii) Is the system of equations; $x + y + z = 4$, $2x + 5y - 2z = 3$, $x + 7y - 7z = 5$ solvable? 6 + 5 + 4 =15

Qs.4. (i) Show that $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ b+c & c+a & a+b \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)$.

(ii) Solve the equation: $\begin{vmatrix} x+1 & -3 & 4 \\ -5 & x+2 & 2 \\ 4 & 1 & x-6 \end{vmatrix} = 0$

(iii) Solve by Cramer's rule: $x + 2y + 3z = 6$, $2x + 4y + z = 7$, $3x + 2y + 9z = 14$. 5 + 5 + 5 = 15

UNIT-II

Answer any two questions from the following: **15x2 = 30**

Qs.5. Define Saddle Point. Obtain the Linear and quadratic approximations of the following function near the point (0, 0):
$f(x,y) = Cosx + Sin2y$

2+13 = 15

Qs.6. (a)Suppose your objective function is $f(x,y) = 2x^2 + y^2$ and the constraint is $xy = 2$. Find the optimum values using Lagrange multiplier.

(b) Verify the envelop theorem in the function $f(x) = 2x^2 + 8kx + 3k^2$, where 'k' is a parameter 8+7 = 15

Qs.7. Suppose a consumer maximizes its utility $Q = X^{\alpha}Y^{1-\alpha}$ subject to her budget $M = P_xX + P_yY$ where all symbols follow their usual meanings. Derive the maximum value function and then prove the Euler's theorem. Find the critical point(s) of the given objective function.

7+5+3 = 15

Qs.8. Find the critical point(s) of the following functions, and use the second partials test to obtain any local extrema or saddle point(s):

$$f(x,y) = 2x^2 + 6y^2 + 12x - 24y + 30$$

3+12 = 15