

MASTER OF ARTS (ECONOMICS)

Term-End Examination

June, 2007

MEC-003 : QUANTITATIVE METHODS

Time : 3 hours

Maximum Marks : 100

Note : Answer **two** questions from Section A, **four** from Section B and **two** from Section C.

SECTION A

Answer any **two** questions from this section. 2×20

1. (i) What is a first order linear differential equation ?
When would you like to make use of such an equation ? List the steps you would follow for obtaining solutions to homogenous and non-homogenous differential equations.

- (ii) Find general and particular solution of the equation

$$\frac{dy}{dt} + 10y = 15; y(0) = 0$$

2. The production function of a firm is given as

$$Q = 40x_1 + 2x_2 - 2x_1^2 + 2x_1x_2 - x_2^2$$

where Q = output, x_1 and x_2 = inputs. Price of output is Rs. 3 while that of inputs, x_1 and x_2 , are Rs. 30 and Rs. 18. Use these pieces of information to write the profit maximisation conditions by taking $\frac{\partial \pi}{\partial x_1}$ and $\frac{\partial \pi}{\partial x_2}$.

Determine the profit maximising values of x_1 and x_2 . Write the Hessian matrix that helps examine the second order condition and determine its value.

3. (i) Why is it said that Poisson distribution is a limiting case of binomial distribution? How do you prove this?
- (ii) A firm is found to have registered on an average 4 accidents per month. What is the probability that in a given year there will be less than 4 accidents? (It is given that $e^{-4} = 0.01832$)
4. (i) Explain the procedure of testing for the significance of the difference between mean of two samples by using student's t-test.
- (ii) A sample of 25 bags was picked up at random, which showed a mean weight of 49.7 kg of wheat per bag. You want to find a 90% confidence interval for the mean weight with the help of a t-test. In what interval do the two mean limits lie? (t-statistic with 24 degrees of freedom for 90% confidence interval is given as ± 1.711).

SECTION B

Answer any **four** questions from this section. 4×10

5. Find the Taylor's series for $f(x) = x^3 - 10x^2 + 6$ about $x = 3$.

6. Find the inverse of the matrix

$$A = \begin{bmatrix} 1 & 0 & -2 \\ 4 & 1 & 0 \\ 1 & 1 & 7 \end{bmatrix}$$

7. The technology matrix (A) gives the inter-industry transactions among clothing, construction and farming industries. If the technology matrix A is

$$\begin{bmatrix} 0.25 & 0.24 & 0.8 \\ 0.15 & 0.05 & 0.08 \\ 0.10 & 0.18 & 0.04 \end{bmatrix}, \text{ and final demand vector is given as}$$

$$D = \begin{bmatrix} 50 \\ 79.9 \\ 85.4 \end{bmatrix}, \text{ find the output levels of the three industries.}$$

8. From the following data, obtain the two regression equations Y on X and X on Y.

X	2	4	6	8	10
Y	5	7	9	8	11

9. If two cards are drawn at random from a deck of 52 cards, find the probability that one is a king and the other a queen.

10. What do you mean by sampling with replacement and sampling without replacement ? Discuss the difference of results these procedures will bring about.

SECTION C

Answer any **two** questions from this section. 2×10

11. (i) Roll a fair die and let X be the number obtained.
What is variance of X ?
- (ii) Determine if the following matrix is positive definite :

$$\begin{pmatrix} 2 & -1 \\ -1 & 1 \end{pmatrix}$$

12. Write short notes on :

- (i) Jacobian determinant
- (ii) χ^2 distribution

13. Differentiate between any **two** of the following :

- (i) Primal and Dual programming formulations
- (ii) Type I and Type II errors
- (iii) Difference and Differential equations