14 (ECO–2) 2036

2022

ECONOMICS

Paper : ECO–2036

(Quantitative Tools)

Full Marks : 50+30=80

Time : Three hours

The figures in the margin indicate full marks for the questions.

Write the answers to the ***Two Parts*** *in* ***Seperate Books.***

PART–I

Full Marks : 50

Time : Two hours

1. Answer the following : 4×3=12

   (a) Outline the general formulation of a problem of optimal control describing the equations.

   (b) State with an example how the technique of linear programming can be applied by an individual for financial management.

(c) Distinguish between cooperative and non-cooperative games. State whether prisoner's dilemma is a cooperative game and why ? 2+2=4

2. Answer ***any three*** from the following : 8×3=24

(a) (i) If AR is equal to MR for all levels of output, show that the AR remains constant.

(ii) If T is the total cost of output Q and it is known that marginal cost always equals average cost, show that average cost is constant. 3+5=8

(b) Explain the Pontryagin's maximum principle. 8

(c) Discuss the limitations of the linear programming technique.

Suppose that a firm has 3 warehouses in different locations where it stores its final products. The firm supplies these products from the warehouses to 2 different markets by different routes. Representing the total supply capacity of the firm by A and the total demand for the products by B, formulate a transportation linear programming problem. 3+5=8

(d) Two firms producing a product has two strategies each : 'Advertise' and 'not Advertise'. If both firms adopt 'Advertise', pay-off to firms I and II are Rs. 10 and Rs. 5 crores respectively. If both adopt 'not Advertise', pay-off become Rs. 10 and Rs. 2 crores respectively. If firm I adopts 'Advertise' but firm II does not, pay-off become Rs. 15 and 0 crores whereas if firm I adopts 'not Advertise' but firm II adopts 'Advertise', pay-off become Rs. 6 and Rs. 8 crores respectively.

(i) Model the situation as a strategic game and find the optimal strategies for the firms.

(ii) Find Nash equilibrium with justification. 4+4=8

(e) Differentiate between finitely repeated games and infinitely repeated games. Illustrate 'tit-for-tat' strategy using the given pay-off matrix : 2+6=8

Firm 2

Firm 1	Cooperation	Defection
Cooperation	2, 2	0,3
Defection	3,0	1,1

3. Answer ***any one*** from the following : 14×1=14

(a) *(i)* Find a solution for the equation

$$y_{t+1} = \frac{y_t}{1+y_t}$$

(ii) Explain the Harrod's model of growth.

(iii) If the balance $A(t)$ of an account varies with time so that the rate of increase is proportional to the amount. If the initial balance (i.e., the principal P) is positive, find the equation of the balance amount at time t. 3+5+6=14

(b) *(i)* State the rules of deriving a dual problem from a given linear programming problem.

(ii) Find the dual problem of the following problem :

Maximise : $\lambda = 6x_1 + 12x_2$

subject to : $x_1 + 2x_2 \leq 10$

$2x_1 - 5x_2 \leq 20$

$x_2 \leq 15$

$x_1 \geq 0,\ x_2 \geq 0$

(iii) A furniture manufacturing shop makes desks and benches using two machines A and B. Making a desk requires 3 hours in Machine A and 5 hours in Machine B whereas making a bench needs to be processed for 5 hours in machine A and 2 hours in Machine B. The shop has 15 hours and 10 hours of machine time available in Machine A and B respectively. If selling prices of benches and desks are Rs. 3 and Rs. 5 respectively, find the sales revenue maximising quantities of desks and benches.

4+2+8=14

PART – II

Full Marks : 30

Time : One hour

1. Answer the following questions : 4×2=8

(a) Give a brief outline of the maximum likelihood method of estimation of a parameter.

(b) In an anti-malaria campaign in a certain area, quinine was administered to 812 people out of a total population of 3248. The number of fever cases reported is shown below :

Treatment	Fever	No fever	Total
Quinine	20	792	812
No quinine	220	2216	2436
Total	240	3008	3248

Calculate the expected frequencies of the cells of the about contingency table.

2. Answer ***any two*** of the following : 11×2=22

(a) (i) Explain the concepts of sampling distribution and standard error of a statistic. 5

(ii) Describe the method of least squares as applied to the estimation of parameters. 6

(b) (i) How is the critical region of a test statistic related to the level of significance ? Discuss. 5

(ii) The mean breaking strength of the cables supplied by a manufacturer is 1800 with a standard deviation of 100. By a new technique in the manufacturing process, it is claimed that the breaking strength of the cables has increased. In order to test this claim, a sample of 50 cables is tested. It is found that the mean breaking strength is 1850. Can we support the claim at 0.01 level of significance ? 6

(c) (i) Describe the steps followed in the testing of a statistical hypothesis. 4

(ii) Twelve students were given intensive coaching and five tests were conducted in a month. The scores of tests 1 and 5 are given below :

No. of students	1	2	3	4	5	6	7	8	9	10	11	12
Marks in Test 1	50	42	51	26	35	42	60	41	70	55	62	38
Marks in Test 5	62	40	61	35	30	52	68	51	84	63	72	50

Test whether there is any significant difference in the marks obtained. 7