ECON 7002	**QUANTITIVE METHODS IN ECONOMICS**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Under Graduate Level Mathematics				
Co-requisites	, Microeconomics, Macroeconomics				

Course Objectives

The objectives of this course are:

a) To understand optimization and its application in energy economics.
b) To know the procedure of dynamic analysis and its application in energy economics
c) To know linear programming problems and its application in energy economics
d) To know game theory and its application in energy economics

Course Outcomes

Upon successful completion of the course a student will be able to:

CO1: give **conceptual clarity** of the quantitative methods in Economics.

CO2: **apply** the quantitative methods in energy economics

CO3: **comprehend** various quantitative methods and its energy sector application.

CO4: **formulate** models using quantitative methods in economics

Catalog Description

Basic knowledge of mathematics is essential for effective understanding of economic theories. Specifically, mathematical concepts such as differentiation, integration and differential equation are necessary to understand basic principles of micro- and macro-economics. The optimization technique is crucial to understand the behavior of both consumers and producers. Classroom activities will be designed to encourage students to play an active role in the construction of their own knowledge and in the design of their own learning strategies. We will combine traditional lectures with other active teaching methodologies, such as assignments, group discussions, and cooperative group solving problems. Class participation is a fundamental aspect of this course. Students will be encouraged to actively take part in all group activities.

Course Content

Module: 1 Comparative Static Analysis **(6 lecture hours)**

- Comparative statics, concept of Derivative and their use in comparative statics
- Comparative statics analysis of general- function models

Module: 2 Optimization **(6 lecture hours)**

- Maxima and Minima
- Optimization with two or more choice variables
- Exponential and logarithmic functions
- Optimization with equality constraints

Module: 3 Dynamic Analysis **(7 lecture hours)**

- Economic Dynamics and Integral calculus
- First and higher order differential equations

Module: 4 Linear Programming, Integer Programming and Goal Programming

(3 lecture hours)

- General concept and formulation of LPP
- Convex set
- Simplex method: Finding the extreme and optimal extreme points
- Integer programming
- Goal programming

Module: 5 Game Theory **(10 lecture hours)**

- Game theory: Concept and Definitions of games
- Dominance Game, Nash-equilibrium and Mixed strategies
- Extensive Games with Perfect Information
- Extensive Games with Imperfect Information
- Strictly Competitive Games and Maxminimization
- Repeated Games: The Prisoner's Dilemma
- Zero-sum games and computation

Text Books

- Chiang, A. C. (1984). Fundamental methods of mathematical economics.
- Taha, H. A. (2005). Operations research: An introduction (for VTU). Pearson Education India.
- Pan, Z. (2010). Introduction to game theory.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Test	Assignment	Project Report	Presentation	ESE
Weightage (%)	10	10	10	20	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Programme Outcomes**
CO1	give **conceptual clarity** of the quantitative methods in Economics.	PO 1,2, 3,4,7,8,9,10, 11,13, 14
CO2	**apply** the quantitative methods in energy economics	PO 1,2, 3, 7,8,9,10, 11,14
CO3	**comprehend** various quantitative methods and its energy sector application.	PO 1,2, 3,6 8,9,10, 11, 13,14
CO4	**formulate** models using quantitative methods in economics	PO 4,5, 8,12,13, 14

Program Outcome / Course Outcome mapping

CO	CO 1	CO 2	CO 3	CO 4
PO 1	3	3	3	
PO 2	3	3	3	
PO 3	3	3	3	
PO 4	3			3
PO 5				3
PO 6			2	
PO 7	3	3		
PO 8	3	3	3	3
PSO 9	3	3	3	
PSO 10	3	3	3	
PSO 11	3	3	3	
PSO 12				3
PSO 13	3		3	3
PSO 14	3	3	3	3

PO 1	Students will be able to develop and evaluate alternate managerial choices and identify optimal solutions.	2
PO 2	Students will demonstrate effective application capabilities of their theoretical understanding of economics theories – Microeconomics, Macroeconomics and trade theories to the renewable and non-	2
PO 3	Students will exhibit effective decision-making skills, employing analytical and critical thinking ability.	2
PO 4	Students will demonstrate effective oral and written communication skills in presenting frameworks, models and regulations of the energy	2
PO 5	Students will be able to work effectively in teams and demonstrate team-working capabilities.	1
PO 6	Students will exhibit leadership and networking skills.	1
PO 7	Students will demonstrate sensitivity towards ethical and moral issues and have ability to address them in energy economics.	2
PO 8	Students will demonstrate employability traits in line with the needs of	3
PSO 9	Students will demonstrate strong conceptual knowledge of economic theory in the context of renewable and non-renewable energy sectors.	2
PSO 10	Students will demonstrate effective understanding of economics as it is applicable to energy markets, energy pricing, energy trading and risk	2
PSO 11	Students will demonstrate analytical skills in designing solutions for energy efficiency.	2
PSO 12	Students will exhibit the ability to evaluate working of energy policies.	1
PSO 13	Students will have domestic and global perspective towards legal frameworks and environmental regulations with respect to energy sectors.	2
PSO 14	Students will exhibit deployable skills pertinent to the renewable and non-renewable energy sectors.	3
Course Code	**MECQ 721**	
Course Title	QUANTITIVE METHODS IN ECONOMICS	

1 – Weakly mapped
2 – Moderately mapped
3 – Strongly mapped

Model Question Paper

Name:

Enrolment No:

UPES

End Semester Examination-Dec. 2017

Program/course: MA Economics (Energy Economics) **Semester : III**
Subject: QUANTITIVE METHODS IN ECONOMICS **Max. Marks : 100**
Code : ECON 7002 **Duration : 3 Hrs**

Section A (attempt all)

Q1. Fill in the blanks

i.	i. $\frac{d}{dx}(x^0) =$ ___	**[2]**	**CO1**
ii.	$\frac{d}{dx}x^n =$ ______	**[2]**	**CO1**
iii.	$\frac{d}{dx}(x^5 + 3x^2 + 7) =$ _______	**[2]**	**CO1**
iv.	If $R = PQ$ and $P = 20\text{-}Q$, then $\frac{dR}{dQ} =$ ___________	**[2]**	**CO1**
v.	$\frac{d}{dx}\left[\frac{z(x)}{v(x)}\right] =$ ___________________.	**[2]**	**CO1**
vi.	$\frac{dR}{dL} = \frac{dR}{dQ} \cdot$ ______	**[2]**	**CO1**
vii.	If $Q = 96K^{0.2}L^{0.8}$ then $MPP_K =$ ____________________.	**[2]**	**CO1**
viii.	Let $y = f(x_1, x_2)$. Then the total differential is: $dy =$ ___________.	**[2]**	**CO1**
ix.	While solving a LP model graphically, the area is bounded by the__________. a) Infeasible region b) Feasible Region c) Unbounded solution d) None of these	**[2]**	**CO1**

x.	Constraints in a model represents________________. a) Limitations b) Balancing c) Requirements d) All the above	**[2]**	**CO1**
	SECTION B **Answer any four questions** 5 X4= 20		
Q2.	Using implicit function rule find $\frac{dy}{dx}$ of the following function. $F(x, y) = 3x^2 + 2xy + 4x^3 = 0$	**[5]**	**CO3, CO4**
Q3.	Describe Prisoners' dilemma with example.	**[5]**	**CO3, CO4**
Q4.	If the marginal cost (MC) of a firm is the following function of output, $C'(Q) = 2e^{0.2Q}$ and if the fixed cost is $C_F = 90$, find the total cost function $C(Q)$.	**[5]**	**CO3, CO4**
Q5.	Find the total differential, given, $U = \frac{G_1}{G_1 + G_2}$	**[5]**	**CO3, CO4**
Q6.	If the marginal propensity to save (MPS) is the following function of income, $S'(Y) = 0.3 - 0.1Y^{-0.5}$, and if the aggregate saving S is nil when income Y is 81 find the saving function $S(Y)$.	**[5]**	**CO3, CO4**
	SECTION C **Answer any two questions** 2 X 15 = 30		
Q7.	A local travel agent is planning a charter trip to a major sea resort. The eight/seven night package includes the fare for board and lodging and selected tour options. The charter trip is restricted to 200 persons and post experience indicates that there will not be any problem for getting 200 persons. The problem for the travel agent is to determine the no. of deluxe, standard and economy tour packages to offer for this charter. These three plans each differ according to seating and service for the flight, quality of accommodations, meal plans and other tour options. The following table summarizes the estimated prices for the three packages and corresponding expenses for the travel agent. The travel agent has hired an aircraft for the flat fee of Rs. 2,00,000 for the entire trip.	**[15]**	**CO1, CO4**

Prices and costs for tour packages per person

Tour plan	price(Rs.)	Hotel cost (Rs.)	meal& other expenses in (Rs.)
Deluxe	10,000	3,000	4,750
Standard	7,000	2,200	2,500
Economy	6,500	1,900	2,200

In planning the trip, the following consideration must be taken into account:

i. At least 10% of the packages must be deluxe

ii. At least 35% but no more than 70% must be standard

iii. At least 30% must be of the economy type.

iv. The maximum no. of deluxe packages available in any aircraft is restricted to 60

v. The hotel desires that at least 120 of the tourists should be on deluxe and standard packages together.

The travel agent wishes to determine the no. of packages to offer in each type so as to maximize the total profit.

Formulate the above problem as LP model

Q8. Considering two players, describe dominant strategy equilibrium and examine why dominating strategy equilibrium is worse for both the players than non-equilibrium situation. **[15]** **CO3, CO4**

Q9. Find the partial total derivatives $\frac{\delta w}{\delta u}$ and $\frac{\delta w}{\delta v}$ if $w = ax^2 + bxy + cu$, where $x = \alpha u + \beta v$ and $y = \gamma u$. **[15]** **CO3, CO4**

Section D

Answer any one question 1 X 30 = 30

Q10. Given $U = (x+2)(y+1)$ and $Px = 4, \quad Py = 6, \quad and \quad B = 130$: **[30]** **CO1, CO3, CO4**

i. Write the Lagrangian function.

ii. Find the optimal level of purchase $x* \quad and \quad y*$.

iii. Is the second order sufficient condition for maximum satisfied?

Q11.	Write out bordered Hessian for a constrained optimization problem with four choice variables and two constraints. Then state specifically the second-order sufficient condition for a maximum and a minimum of z respectively.	**[30]**	**CO1, CO3, CO4**