The LNM Institute of Information Technology

Electronics and Communication Engineering Department

Game Theory in Wireless Communication Networks (ECE)

Degree: *B.Tech,* **Programme:** ECE

Academic Year: 2019 **Mid Term (Self Study)** **Semester:** EVEN

Time: 90 minutes **Date:** 29/02/2020 **Maximum Marks:** 50

	CO1	CO2	CO3	CO4	CO5
Questions	*1,2,3*	*4,5b*	*5b*	-	-
Marks	*30*	*10+5*	*5*	-	-
Marks/Max Marks(%)	*60*	*15*	*10*	-	-

Write all parts of a question in sequence

Q1. The first game is the game of Prisoner's Dilemma. Suppose N = {1, 2}. These players are prisoners. Because of lack of evidence, they have been questioned in separate rooms and made to confess their crimes. If they both confess, then they each achieve a payoff of 1. If both of them do not confess, then they can achieve higher payoffs of 2 each. However, if one of them confesses, but the other one does not confess, then the confessed player gets a payoff of 3 but the player who does not confess gets a payoff of 0.

a) What are the strategies in this game?
b) Write the payoffs from the four strategy profiles in a matrix form.
c) Compute the payoff for each action and state how the choice of the action will be made?

[3+2+(3+2)=10]

Q2. a)In the Vickrey auction, it is a weakly-dominant strategy for every buyer to bid his value.

b) Consider Joint competitive spectrum bidding and service pricing in IEEE 802.22 networks.

i) Formulate the game.
ii) Draw or explain the system model
iii) Explain the auction strategy with an example.

[3+3+4=10]

Q3.a) A wireless communication system contains two firms, one whose cost function is $TC(y) = 30y$ and another whose cost function is $TC(y) = y^2$. The inverse demand function for the firms' output is $p = 120 - Q$, where Q is the total output. What are the firms' outputs in a Nash equilibrium of Cournot's model?

b)In the sealed bid auction where the players' valuations are independently uniformly distributed on [0, 1] the unique BNE is:

$$f_1^*(v_1) = \frac{v_1}{2} \quad f_1^*(v_2) = \frac{v_2}{2}$$

[5+2+3=10]

Q4 a) Consider the scenario of cooperative sensing in Cognitive Radio system. Write expression for payoff and Replicator dynamics

b) Write expression for average pay off for the scenario cooperate and deny .

c) Find the expression to obtain evolutionary stable strategies.

d) State the condition for a strategy s to be called evolutionary stable and illustrate with an example.

[2+2+2+4=10]

Q5. a) A mixed strategy profile $\boldsymbol{\sigma}^*$ is a Mixed strategy Nash equilibrium, if for each player i, we have $u_i(\sigma_i^*, \sigma_{-i}^*) \geq u_i(\sigma_i, \sigma_{-i}^*)$ for all $\sigma_i \in \sum_i$.

b) If $S^*$is a NE in the multi-radio channel allocation game, then $d_{x,y} \leq 1$ *for all* $x, y \in C$.

[5+5=10]