**NRU HSE-2020, Microeconomics Class-13**

# Externalities

**1.** Consider a society with 2 agents. Agent 1 takes an action  where . Action  generates utility of  for agent 1. This action also affects agent 2. The utility of agent 2 if 1 takes action  is given by .

**(a)** Let  denote the individually optimal level of  for agent 1 and  denote the socially optimal level of . Calculate  and . Produce graphical solution. Compare  and . Explain the result.

**(b)** Suppose the government imposes a proportional tax of  on  on agent 1. Calculate the value of  for which  is equal to .

**(c)** Suppose the government allocates the property right on the action to agent 1, so that 1 can now ask 2 for a payment in order to reduce . Show that 1 would optimally adopt  in this case.

**(d)** Would the adopted level of  be different if the property right is allocated to agent 2? Explain.

**2.** Consider two farmers that produce tomatoes and a nearby factory producing good . The cost functions are: and for farmer 1 and 2 correspondingly, where is the amount of tomatoes produced by farmer and is the amount of fertilizers used in the production process by farmer . Fertilizers pollute water that is used by the nearby factory making the production of good more expensive. The cost of production of good is . Both goods are sold at perfectly competitive markets at prices and .

**(a)** Find the equilibrium level of production of each good and the fertilizers used by each firm.

**(b)** Explain, why the outcome of part (a) is not socially efficient and provide graphical solution. Derive the value of society loss.

**(c)** Suppose that factory that produces good has a legal right for clean water. Factory is ready to sell its right fully or partially to the farmers at a per unit price . Assuming that all the agents are price-takers at this new market, find the equilibrium value of . Is the resulting allocation efficient?