Microeconomics: Theory of consumer behaviour, theory of production, market structure under perfect competition, monopoly, price discrimination, duopoly with Cournot and Bertrand competition (elementary problems) and welfare economics.

Macroeconomics: National income accounting, simple Keynesian Model of income determination and the multiplier, IS-LM Model, models of aggregate demand and aggregate supply, Harrod-Domar and Solow models of growth, money, banking and inflation.

Sample questions for PEB (Economics), 2014

1. Consider a firm that can sell in the domestic market where it is a monopolist, and/or in the export market. The domestic demand is given by $p = 10 - q$, and export price is 5. Suppose the firm has a constant marginal cost of 4 and a capacity constraint on output of 100.

   (a) Solve for the optimal production plan of the firm. [**15 marks**]

   (b) Solve for the optimal production plan of the firm if its constant marginal cost is 6. [**5 marks**]

2. (a) Consider a consumer who can consume either A or B, with the quantities being denoted by a and b respectively. If the utility function of the consumer is given by

   $$-\left[(10 - a)^2 + (10 - b)^2\right].$$

   Suppose prices of both the goods are equal to 1.

      i. Solve for the optimal consumption of the consumer when his income is 40. [**10 marks**]

      ii. What happens to his optimal consumption when his income goes down to 10. [**5 marks**]

   (b) A monopolist faces the demand curve $q = 60 - p$ where p is measured in rupees per unit and q in thousands of units. The monopolist's total cost of production is given by $C = \frac{1}{2}q^2$.

      i. What is the deadweight loss due to monopoly? [**3 marks**]

      ii. Suppose a government could set a price ceiling (maximum price) that the monopolist can charge. Find the price ceiling that the government should set to minimize the deadweight loss. [**2 marks**]

3. (a) A cinema hall has a capacity of 150 seats. The owner can offer students a discount on the price when they show their student IDs. The demand for tickets from students is

$$D_s = 220 - 40P_s,$$

where P_s is the price of tickets for students after the discount. The demand for tickets for non-students is

$$D_n = 140 - 20P_n,$$

where P_n is the price of tickets for non-students.

      i. What is the maximum profit the owner can make? [**8 marks**]

      ii. What is the maximum profit he could make if the demand functions of students and non-students were interchanged? [**4 marks**]

(b) There are 11 traders and 6 identical (indivisible) chickens. Each trader wants to consume at most one chicken. There is also a (divisible) good called "money". Let D_i equal to 1 indicate that trader i consumes a chicken; 0 if he does not. Trader $i's$ utility function is given by $u_i D_i + m_i$, where u_i is the value he attaches to consuming a chicken, m_i is the units of money that the trader has. The valuations for the 11 traders are:

$u_1 = 10$; $u_2 = 8$; $u_3 = 7$; $u_4 = 4$; $u_5 = 3$; $u_6 = 1$; $u_7 = u_8 = 3$; $u_9 = 5$; $u_{10} = 6$; $u_{11} = 8$.

Initially each trader is endowed with 25 units of money. Traders $6, 7, 8, 9, 10, 11$ are endowed with one chicken each.

      i. What is a possible equilibirum market price (units of money per chicken) in a competitive market? [**4 marks**]

ii. Is the equilibrium unique? [**4 marks**]

4. (a) Consider a monopolist who faces a market demand for his product:

$$p(q) = 20 - q,$$

where p is the price and q is the quantity. He has a production function given by

$$q = \min\left\{\frac{L}{2}, \frac{K}{3}\right\},$$

where L denotes labour and K denotes capital. There is a physical restriction on the availability of capital, that is, $\overline{K}$. Let both wage rates (w) and rental rates (r) be equal to 1. Find the monopoloy equilibrium quantity and price when (i) when $\overline{K} = 24$; (ii) $\overline{K} = 18$. [**12 marks**]

(b) Define Samuelson's Weak Axiom of Revealed Preference (WARP). [**2 marks**]

(c) Prove that WARP implies non-positivity of the own-price substitution effect and the demand theorem. [**6 marks**]

5. Consider two firms: 1 and 2, with their output levels denoted by q_1 and q_2. Suppose both have identical and linear cost functions, $C(q_i) = q_i$. Let the market demand function be $q = 10 - p$, where q denotes aggregate output and p the market price.

(a) Suppose the firms simultaneously decide on their output levels. Define the equilibrium in this market. Solve for the reaction functions of the two fims. Using these, find the equilibrium. [**10 marks**]

(b) Suppose the firms still compete over quantities, but both have a capacity constraint at an output level of 2. Find these reaction functions and the equilibrium in this case. [**10 marks**]

6. (a) Suppose the government subsidizes housing expenditures of low-income families by providing them a rupee-for-rupee subsidy for

their expenditure. The Lal family qualifies for this subsidy. They spend Rs. 250 on housing, and receive Rs. 250 as subsidy from the government.

Recently, a new policy has been proposed to replace the earlier policy. The new policy proposes to provide each low income family with a lump-sum transfer of Rs. 250, which can be used for housing or other goods.

   i. Explain graphically if the Lal family would prefer the current program over the proposed program. [**6 marks**]

   ii. Can they be indifferent between the two programs? [**3 marks**]

   iii. Does the optimal consumption of housing and other goods change compared to the subsidy scheme? If yes, how? [**3 marks**]

(b) A drug company company is a monopoly supplier of Drug X which is protected by a patent. The demand for the drug is

$$p = 100 - X$$

and the monopolist's cost function is

$$C = 25 + X^2$$

   i. Determine the profit maximizing price and quantity of the monopolist. [**2 marks**]

   ii. Suppose the patent expires at a certain point in time, and after that any new drug company can enter the market and produce Drug X, facing the same cost function. What will be the competitive equilibrium industry output and price? How many firms will be there in the market? [**6 marks**]

7. Assume that an economy's production function is given by

$$Y_t = K_t^\alpha N_t^{1-\alpha}$$

where Y_t is output at time t, K_t is the capital stock at time t and N is the *fixed* level of employment (number of workers), $\alpha \in (0, 1)$ is the

share of output paid to capital. The evolution of the capital stock is given by

$$K_{t+1} = (1 - \delta) K_t + I_t$$

where I_t is investment at time t and $\delta \in [0, 1]$ is the depreciation rate.

(a) Derive an expression for $\frac{Y}{N}$. [**5 marks**]

(b) How large is the effect of an increase in the savings rate on the steady state level of output per worker. [**10 marks**]

(c) What is the savings rate that would maximize steady state consumption per worker? [**5 marks**]

8. In an IS-LM model, graphically compare the effect of an expansionary monetary policy with an expansionary fiscal policy on investment (I) in (1) the short-run and (2) the medium run (where the aggregate supply and aggregate demand curves adjust). Assume that

$$I = I(i, Y),$$

where i is the interest rate and Y is the output. Also, $\frac{\partial I}{\partial i} < 0$ and $\frac{\partial I}{\partial Y} > 0$. [**15 marks**]

Under which policy (expansionary monetary or fiscal), is the investment higher in the medium run? [**5 marks**]

9. Suppose the economy is characterized by the following equations:

$$C = c_0 + c_1 Y_D$$
$$Y_D = Y - T$$
$$I = b_0 + b_1 Y,$$

where C is consumption, Y is the income, Y_D is the disposable income, T is tax, I is investment, and c_0, c_1, b_0, b_1 are positive constants with $c_1 < 1, b_1 < 1$. Government spending is constant.

(a) Solve for equilibrium output. [**5 marks**]

(b) What is the value of the multiplier? For the multiplier to be positive, what condition must $c_1 + b_1$ satisfy? [**5 marks**]

(c) How will equilibrium output be affected when b_0 is changed? What will happen to saving? [**5 marks**]

(d) Instead of fixed T, suppose $T = t_0 + t_1 Y$, where $t_0 > 0$ and $t_1 \in (0, 1)$. What is the effect of increase in b_0 on equilibrium Y? Is it larger or smaller than the case where taxes are autonomous? [**5 marks**]

10. Consider an economy where a representitive agent lives for three periods. In the first period, she is young - this is the time when she gets education. In the second period, she is middle-aged and with the level of education acquired in the first period, she generates income. More specifically, if she has h units of education in the first period, she can earn $\overline{w}h$, in the second period, where $\overline{w}$ is the exogenously given wage rate.

The agent borrows funds for her education when she is young and repays with interest when she is middle aged. If in the first period, the agent borrows e, then the human capital h at the beginning of the second period becomes $h(e)$, where $\frac{dh}{de} > 0$ along with $\frac{d^2 h}{de^2} < 0$.

In the third period of her life, she consumes out of her savings made in the second period, that is, when she was middle aged. Assume that the exogenous rate of interest (gross) on saving or borrowing is $\overline{R}$. For simplicity, assume that an agent does not consume when she is young and, thus, the life time utility is $u(c^M) + \beta u(c^O)$, where c^M and c^O are the level of consumption when they are middle-aged and old respectively and $\beta \in (0, 1)$ is the discount factor.

(a) Write down the utility maximization problem of the agent and the first order conditions. [**10 marks**]

(b) How does the optimal level of education vary with the wage rate and the rate of interest? [**10 marks**]