

**ENTRANCE EXAMINATION, 2015**

M.Phil./Ph.D.

**INTERNATIONAL TRADE AND DEVELOPMENT**

[ Field of Study Code : ITDP (106) ]

Time Allowed : 3 hours

Maximum Marks : 70

Question Nos. 1 and 2 are compulsory. In addition, attempt *any three* questions from the rest, i.e., from Question Nos. 3 to 7. All the parts of the chosen questions should be answered.

1. Five students from India, viz., A, B, C, D and E are being considered for a three-member delegation to represent India in an International Students' Meet. Each student has an equal probability of being selected.

- (a) Construct the sample space.
- (b) Find the probability that
- (i) A is selected;
  - (ii) D is not selected;
  - (iii) either B or C (but not both) is selected;
  - (iv) C is selected given that E is selected.

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2. Define what are meant by eigenvalues and eigenvectors of a matrix. Prove that if  $X$  is an eigenvector of the non-singular matrix  $A$  with corresponding eigenvalue  $\lambda$ , then  $X$  is also an eigenvector of  $A^{-1}$  with corresponding eigenvalue  $\lambda^{-1}$ .

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3. (a) A consumer has the utility function  $u(x_1, x_2) = x_1 x_2^2$ , where  $x_1$  and  $x_2$  denote the quantity of good 1 and good 2, respectively. Let prices of the two goods be denoted by  $p_1$  and  $p_2$ . Derive the consumer's Hicksian demand functions by setting up the expenditure minimization problem.

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- (b) Consider a world with  $N$  identical countries, each of which emits a pollutant that damages the environment. Each country's abatement benefit depends on the global abatement denoted as  $Q$ . Country  $i$ 's benefit from abatement is given by

$$B_i(Q) = \frac{\left[ b \left( aQ - \frac{Q^2}{2} \right) \right]}{N}$$

Each country's abatement costs are assumed to depend on its own abatement level, given by  $C_i(q_i) = \frac{cq_i^2}{2}$ , where  $C_i(q_i)$  is  $i$ 's abatement cost and  $q_i$  is  $i$ 's abatement level. Parameters  $a$ ,  $b$  and  $c$  are positive parameters. [ $Q = \sum q_i$ ]

- (i) Find country  $i$ 's abatement level in non-cooperative Nash equilibrium.
- (ii) Find the full cooperative solution, i.e., the level of abatement that maximizes the sum of the net benefits of all the countries.

Compare the two.

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4. (a) What is the steady-state condition in the Solow growth model? Discuss the impact of an exogenous rise in the saving rate on (i) steady-state capital per worker, and (ii) steady-state consumption per worker. Explain graphically as well as mathematically.

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- (b) How does the open-economy Keynesian multiplier differ from the closed-economy multiplier? Which is larger? Explain the intuition behind the formula for the open-economy multiplier.

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5. We want to measure the effect of  $X_i$  on  $Y_i$ . The true relationship between the variables is  $Y_i = \beta_0 + \beta_1 X_i + u_i$  with our standard ordinary least square (OLS) assumptions. Let  $\text{var}[u_i | X_i] = \sigma_u^2$  and  $\text{var}[X_i] = \sigma_X^2$ .

- (a) Now assume that we do not observe  $Y_i$ , but instead we observe a proxy for  $Y_i$  called  $Y_i^*$  that is measured with error,  $Y_i^* = Y_i + \varepsilon_i$  with  $\varepsilon_i$  distributed independently of  $Y_i$  and  $X_i$ . Additionally  $\varepsilon_i$  has a finite fourth moment. Are the OLS assumptions satisfied for the following model?

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$$Y_i^* = \beta_0 + \beta_1 X_i + v_i$$

- (b) For what value is the estimator  $\hat{\beta}_1$  consistent in the model from part (a)? Are there any problems with having measurement error in the dependent variable?

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- (c) Now assume that we have measurement error in  $X_i$  instead of  $Y_i$ . We do not observe  $X_i$ , but instead we observe a proxy for  $X_i$  called  $X_i^*$  that is measured with error,  $X_i^* = X_i + \eta_i$ , where  $\eta_i$  is distributed independently of  $Y_i$  and  $X_i$ , and  $\text{var}[\eta_i | X_i] = \sigma_\eta^2$ . Additionally  $\eta_i$  has a finite fourth moment. Are the OLS assumptions satisfied?

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- (d) For what value is the  $\hat{\beta}_1$  estimator consistent in the model from part (c)? Are there any problems with having measurement error in the independent variables? 4
- (e) Can you think of a way to obtain consistent estimates when we have inconsistency due to measurement error? Explicitly state the assumptions needed for your solution to work. 4
6. (a) "Assumptions of trade theory are generally sufficient but not necessary for the theorem to hold." Illustrate this in the case of the assumptions in the Heckscher-Ohlin theory of trade of (i) non-factor intensity reversal between countries, and (ii) constant returns to scale in production. 10
- (b) If consumer preferences were non-homothetic, what would happen to the pattern of trade predicted by the Ricardian and Heckscher-Ohlin theorems of trade? 10
7. Happyland is a small developing country with a rapidly growing population. Dairy farming and cultivation of wheat are the main occupations, although in recent years industrial production has been expanding. Assume that dairy farming requires more female labour and that wheat cultivation is carried out by male labour. The government of Happyland has hired you to explain the following :
- (a) Compare Becker's model and Leibenstein's model of demographic changes. 10
- (b) An increase in the exports of dairy products increases the demand for female labour and thus raises the wages of women relative to men. Would this have an impact on fertility? Explain using Becker's model. 10

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