

EGT2
ENGINEERING TRIPOS PART IIA

Monday 6 May 2024 9.30 to 11.10

Module 3E1

BUSINESS ECONOMICS

*Answer not more than **two** questions.*

All questions carry the same number of marks.

*The **approximate** percentage of marks allocated to each part of a question is indicated in the right margin.*

*Write your candidate number **not** your name on the cover sheet.*

STATIONERY REQUIREMENTS

Single-sided script paper

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM

CUED approved calculator allowed.

10 minutes reading time is allowed for this paper at the start of the exam.

You may not start to read the questions printed on the subsequent pages of this question paper until instructed to do so.

You may not remove any stationery from the Examination Room.

1 Consider the concrete industry operating under the assumption of perfect competition in a market.

(a) Discuss the conditions for the concrete industry to meet the criteria for perfect competition. [10%]

1. **Many Firms:** Numerous cement manufacturers exist globally, each operating independently.
2. **Identical Products:** Cement from different manufacturers is generally perceived as homogeneous in terms of quality and characteristics.
3. **Ease of Entry and Exit:** New firms can enter the cement market without significant barriers, and existing firms can exit if they find it unprofitable.
4. **Perfect Information:** Information about cement prices, production techniques, and market conditions is readily available to all participants.
5. **Price-Taking Behavior:** Individual cement manufacturers have no influence over the market price; they accept the prevailing market price for cement.

(b) Suppose total long-run monthly costs for a typical cement producing firm is given by $TC(q) = 20q^2 + 100q + 8,000$, where q is the number of pallets of concrete mix bags (1 pallet contains 100 concrete mix bags) produced per month. Demand for pallets is given by $Q(P) = 3,700 - 3P$, where Q is the quantity demanded of pallets per month and P is the price per concrete mix pallet. Determine the long-run equilibrium quantity produced by each firm in this market. What is the long run price and aggregate quantity? How many firms operate in equilibrium? [40%]

$$AC(q) = 20q + 100 + 8000/q$$

$$MC(q) = 40q + 100$$

Setting $AC(q) = MC(q)$ obtains $q = 20$ as the individual firm quantity, which minimizes average costs. When $q = 20$, $AC(20) = 900$. In the long run, price equals minimum AC , so equilibrium price is 900.

The aggregate quantity is obtained from the demand function:

$$Q = 3700 - 3(900) = 1000 \text{ units.}$$

Since each firm produces 20 units, there are $N = 1000/20 = 50$ firms in the market.

(c) A large infra-structure project in the area causes a sudden increase in the demand for concrete mix. The new aggregate demand is given by $Q(P) = 4,200 - 3P$. How many firms enter or exit the market? [20%]

The new aggregate quantity would be $Q = 4200 - 3(900) = 1500$ units, and $N = 1500/20 = 75$ firms in the market. Thus, 25 firms would enter the market.

(d) A business economics student notes that in reality firms in the industry offer a wide variety of types of concrete mix bags (post mix, multi-purpose, rapid, insulating,...). Explain why this is the case and what model would be better suited to characterise the industry? [30%]

Discuss the monopolistic competition model in the short and long-run and incentive to product differentiate.

2 Suppose that two competing firms, A and B, produce a homogeneous good. Both firms have a marginal cost of $MC = £40$. Describe what would happen to output and price in each of the following situations if the firms are at (i) Cournot equilibrium, (ii) collusive/cartel equilibrium, and (iii) Bertrand equilibrium. You may include diagrams in your answer.

(a) Because Firm A must increase wages, its MC increases to £60. [30%]

(i) In a Cournot equilibrium you must think about the effect on the reaction functions. When Firm A experiences an increase in marginal cost, its reaction function will shift inwards. The quantity produced by Firm A will decrease and the quantity produced by Firm B will increase. Total quantity produced will decrease and price will increase.

(ii) In a collusive equilibrium, the two firms will collectively act like a monopolist. When the marginal cost of Firm A increases, Firm A will reduce its production to zero, because Firm B can produce at a lower marginal cost. Because Firm B can produce the entire industry output at a marginal cost of £40, there will be no change in output or price. However, the firms will have to come to some agreement on how to share the profit earned by B.

(iii) Before the increase in Firm A's costs, both firms would charge a price equal to marginal cost ($P = £40$) because the good is homogeneous. After Firm A's marginal cost increases, Firm B will raise its price to £59.99 (or some price just below £60) and take all sales away from Firm A. Firm A would lose money on each unit sold at any price below its marginal cost of £60, so it will produce nothing.

(b) The marginal cost of both firms increases. [30%]

(i) The increase in the marginal cost of both firms will shift both reaction functions inward. Both firms will decrease quantity produced and price will increase.

(ii) When marginal cost increases, both firms will produce less and price will increase, as in the monopoly case.

(iii) Price will increase to the new level of marginal cost and quantity will decrease.

(c) The demand curve shifts to the right. [30%]

(i) This is the opposite of the case in part (b). In this situation, both reaction functions will shift outward and both will produce a higher quantity. Price will tend to increase.

(ii) Both firms will increase the quantity produced as demand and marginal revenue increase. Price will also tend to increase.

(iii) Both firms will supply more output. Given that marginal cost remains the same, the price will not change.

(d) In which situations are models (i), (ii) and (iii) used in the real world. Provide examples of real world settings. [10%]

Cournot – simultaneous choice of quantity. Bertrand - simultaneous choice of price. Cartel monopolist behaviour. Examples.

3

(a) Discuss two pricing strategies that managers with market power could adopt to increase profitability? How they affect consumer, producers and society? [50%]

Price discrimination (1st, 2nd and 3rd), Bundling, Peak Load pricing...discuss pre-conditions, implementations and how it affects surplus.

(b) Cement is a key ingredient to make concrete. Cement accounts for as much as 90% of concrete mix greenhouse emissions. Decarbonising concrete plants has been advocated as part of many climate goal setting agencies. Discuss three economic solutions that could address climate impact resulting from concrete plant emissions along with limitations. How is the issue of pollution connected with game theory? [50%]

Discuss bargaining, taxation, cap and trade solutions and limitations. Game theory – prisoner dilemma situation. Describe how a cooperative solution could be potentially achieved with an infinitely repeated game.

END OF PAPER