

EGT2

ENGINEERING TRIPOS PART IIA

Thursday 8 May 2025 14.00 to 15.40

Module 3E10

OPERATIONS MANAGEMENT FOR ENGINEERS

*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

Write on single-sided 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 CollabSpace is a newly launched collaborative workspace located in a business district catering to remote workers, freelancers and small business teams. It offers a convenient, welcoming alternative to traditional office spaces in the area. The surrounding neighbourhood lacks coworking spaces, with the nearest option a 15-minute drive away.

CollabSpace is designed as a comfortable environment for professionals to work, network and hold meetings. With 30 workstations, there is seating for up to 30 customers, the average workstation turnover time is one hour. Operating hours are Monday through Thursday from 9:00 AM to 7:00 PM and Friday and Saturday from 10:00 AM to 5:00 PM. Membership options include day passes, monthly plans, and private office bookings. Amenities include high-speed internet, coffee, printing services, and access to meeting rooms. Members check in at the reception desk, receive a workstation assignment, and settle into their chosen space.

CollabSpace operates with a small, efficient team: Two receptionists manage check-ins, membership inquiries and meeting room bookings. Three facility coordinators handle workspace assignments, customer assistance and cleaning. Three IT and facility technicians ensure that all equipment and amenities are functional.

On average: It takes a receptionist 3 minutes to check in a customer. A facility coordinator spends 4 minutes per customer assisting and cleaning workspaces. An IT technician requires 6 minutes per customer resolving minor technical issues.

All staff report directly to the CollabSpace manager and are trained in health and safety standards, workspace operations and customer service. However, staff are typically assigned specific roles during each shift.

The interior of CollabSpace is styled to create a modern, professional atmosphere with dedicated work zones, quiet spaces, and open areas for collaboration. Members often rearrange seating to accommodate group projects. On Fridays and Saturdays, community events are held, such as guest speaker sessions, workshops, and networking events.

CollabSpace quickly became popular with the local professional community. However, its popularity introduced challenges. On Fridays and Saturdays, demand often exceeded capacity, forcing staff to turn away potential customers. Another concern is staff workload. To prevent burnout, the manager aims to keep employee utilisation below 80%. Managing these issues while maintaining CollabSpace's welcoming and efficient service has become a priority.

- (a) What are the order qualifiers for the CollabSpace? Which qualifier do you think is the order winner? [25%]
- (b) Identify the structural and infrastructural decisions made in establishing the CollabSpace. Do these decisions support each other and align to support the overall order winner? [25%]
- (c) At a peak hour for the CollabSpace, what is the capacity utilisation of each type of employee? Which type of employee is the bottleneck? How would you recommend addressing this bottleneck? Justify your recommendations. [30%]
- (d) How could technology improve the efficiency and effectiveness of CollabSpace? [20%]

2 InnoChip is a supplier of microchips for a large computer manufacturer located 50 miles away. The company produces three different models of microchip. The monthly demand for microchips from the computer company equals 125 for Model 1, 150 for Model 2 and 175 for Model 3.

Each model of microchip follows the same process flow: preparation, assembly step 1, assembly step 2, assembly step 3, inspection, baking and packaging. Assembly builds up inventory early in the month to make certain that a buffer stock is always available. Inventory between each step in the process is held in carts. The holding cost for a microchip is £500 a year regardless of model. The setup cost for switching between model types is £5,000 for Model 1, £10,000 for Model 2 and £16,000 for Model 3.

Parts are sourced from about 100 vendors and delivered at random times. Microchips have 40 different part numbers and inventory turns twice yearly. Further information: quality defects are about 10 percent for a production run, employees are paid on day rate, employee turnover is 25 percent per year, and net profit from operations is steady at 5 percent per year. Maintenance is performed as needed.

The operations manager of InnoChip has been contemplating installing a new MRP system to help control inventories and to “keep the carts filled”. (The manager’s view is that two days of work in front of a workstation motivates the worker to produce at top speed.) The operations manager is also planning to add three inspectors to resolve the quality problem and setting up a rework line to speed up repairs. While pleased with the high utilisation of most of the equipment and labour, the operations manager is concerned about the idle time of the baking machine. Finally, the industrial engineering department are looking into high-rise shelving to store parts coming from the preparation stage.

- (a) Calculate the economic order quantity (EOQ) for each of the three models of microchip. Calculate the total inventory costs based on the EOQ for each model. [25%]
- (b) Discuss the assumptions of the EOQ model and the validity of using the EOQ model at InnoChip. [25%]
- (c) For each of the changes being considered by the operations manager of InnoChip, do they support or contradict a lean production philosophy? Give reasons for your conclusions. [25%]
- (d) Explain why eliminating waste is one of the most important parts of lean production. Identify three sources of waste in the InnoChip company. [25%]

- 3 (a) Inventory placed in the supply chain is known as a “decoupling point”. What is the main consequence for the processes in the supply chain of having such a decoupling point? Discuss advantages and disadvantages of using decoupling points. [25%]
- (b) You are the operations manager of a medium-sized aerospace supplier based in the UK. You are considering the outsourcing of several business functions. Outline the key advantages and disadvantages of outsourcing. As an alternative to outsourcing, the Board suggests offshoring some of your UK manufacturing operations to a low-cost country. Would the strategic risks be different for offshoring, compared to outsourcing? [25%]
- (c) Describe the “bullwhip effect”, and outline why global supply chains are more susceptible to this phenomenon. [25%]
- (d) A company is launching a new line of customisable phone cases. Discuss how Fisher’s supply chain matrix would help them determine the appropriate supply chain strategy. Consider the challenges they might face in implementing this strategy and suggest potential solutions. [25%]

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