Loughborough University

LEAN AND AGILE MANUFACTURING

23WSP233

Semester 2 | In-Person Exam paper

This examination is to take place in-person at a central University venue under exam conditions. The standard length of time for this paper is **2 hours.**

You will not be able to leave the exam hall for the first 30 or final 15 minutes of your exam. Your invigilator will collect your exam paper when you have finished.

Help during the exam

Invigilators are not able to answer queries about the content of your exam paper. Instead, please make a note of your query in your answer script to be considered during the marking process.

If you feel unwell, please raise your hand so that an invigilator can assist you.

Answer **ALL** questions.

Questions carry the marks shown.

Begin the answer to each question on a new page.

Use of a calculator is permitted - It must comply with the University's Calculator Policy for In-Person exams, in particular that it must not be able to transmit or receive information (e.g. mobile devices and smart watches are not allowed).

1.

a) Discuss the applicability of systems thinking and systematic thinking in analysing and creating efficient and effective solutions to problems in manufacturing operations and supply chains [10 marks]

b) Explain how the profitability of a manufacturing firm can be achieved through cost reduction and productivity improvement using the Toyota Production System as an example [10 marks]

2.

a) An automotive production line is required to produce 10,000 Type A cars in 20 days for a planning period ending 31st December 2024. The Type A cars consist of 5000 sedans, 2500 hardtops and 2500 wagons. During an eight-hour shift of operations with a duration of 480 minutes, all 500 units must be manufactured.

i. Determine the average daily number of each kind of the car to be produced

ii. Calculate the unit cycle time or the average time required to produce one vehicle of any Type A cars.

iii. Work out the maximum time to produce one Type A sedan car?

iv. Work out the maximum time to produce one Type A wagon or hardtop car?

v. What is the production sequence to achieve smoothing of production line using cycle time.

[10 marks]

b) Walter, John, Michael, Paul and Cheryl work in a Quality Control and Assurance Department of an elite Sports bike manufacturing company. They have been scheduled based on their preferred working days of the week. The department works every day of the week throughout the year. Each staff must work 5 days in a week and have 2 days off. All staff must work on Tuesdays, Wednesdays, and Thursdays. Only Walter and John cannot work on Monday and Sunday. Michael prefers not to work on Saturday and Sunday. Paul and Cheryl prefer not to work on Friday and Saturday.

i. Create a staff schedule for one week that can be rolled over every week using the above information. [5 marks]

ii. How many staff must be scheduled to work each day of the week? [5 marks]

3.

a) The emerging artificial intelligence (AI) tools will ultimately facilitate lean and agile manufacturing in the future. Discuss five ways that AI tools can facilitate effective supply chain management within the context of industry 4.0. [10 marks]

b) Describe five major phases/stages of supply chain risk management in a typical manufacturing company [10 marks]

4. The manufacturing philosophy of ***Lean*** and ***Six Sigma*** are described as being complementary. Initially describe each of the philosophies. Then comment on how you feel that two philosophies complement each other when merged within a ***Lean-Six Sigma*** manufacturing framework.

[20 marks]

C Ogbonnaya
A Rees