

**UNIVERSITY OF RUHUNA**

**Faculty of Engineering**

End-Semester 5 Examination in Engineering: December 2020

**Module Number: ME 5204**

**Module Name: Production Planning and Control  
[Three Hours]**

**[Answer all questions, marks are indicated for all the questions]**

Note: If required, you can make necessary assumptions and justify in answering the questions.

- Q1. a) What are key Production Planning and Control (PPC) Decisions? [2.0 Marks]
- b) What are the challenges that created by COVID-19 for manufacturing organizations with reference to key PPC decisions? [4.0 Marks]
- c) What are the challenges that created by COVID-19 for service sector organizations with reference to key PPC decisions? [4.0 Marks]
- Q2. a) The Figure Q2-1 illustrates the apparel imports by USA in the time frame of January 2014 to November 2020.
- (i) Provide your view on this demand variation pattern. [2.0 Marks]
- (ii) Describe, how do you use qualitative and quantitative forecasting techniques to overcome the current demand variations created by COVID-19? [4.0 Marks]
- b) As listed in the table Q2-1 demand observations were recorded from the central bank report with regards to the importing wheels to Sri Lanka.
- (i) Calculate the Demand forecast for January-2020 by using 3 month moving average method. [2.0 Marks]
- (ii) Calculate the Demand forecast for January-2020 by using 5 month moving average method. [2.0 Marks]
- (iii) "If a manufacturer is keen to setup wheel manufacturing industry in Sri Lanka, it is required to undertake qualitative forecasting as well". Explain your view about this statement. [2.0 Marks]

Table Q2-1: Demand variation of imported wheels

Month	Demand
January (2019)	24374
February	25968
March	19658
April	22766
May	16258
June	14585
July	12589
August	14785
September	14579
October	23587
November	26587
December	24587
January (2020)	?

- Q3.
- a) What are covid-19 induced issues in materials supply chain and what strategies can be used to overcome them? [2.5 Marks]
  - b) Describe the COVID-19 induced issues for human resource requirement planning for Sri Lankan industrial sector. [2.5 Marks]
  - c) Figure Q3-1 illustrates the main processes associated with tire manufacturing process [2.5 Marks]
    - (i) Identify all the necessary departments required for a tire manufacturing facility. [2.0 Marks]
    - (ii) Draw a suitable plant layout for a tire manufacturing facility. [3.0 Marks]
    - (iii) Justify your plant layout and individual department location selection by considering the main principles in plant layout design. [2.0 Marks]

Q4. a)

X Company produces two products: A and B. The raw material requirement, space needed for storage, production rates, and selling prices for these products are listed in Table Q4-1.

- The total amount of raw material available per day for both products is 1575Kg.
- The total storage space for all products is 1500m<sup>3</sup>.
- Maximum of 7 hours per day can be used for production.

All products manufactured are shipped out from the storage area at the end of the day. Therefore, the two products must share the total raw material, storage space, and production time.

Determine how many units of each product to produce per day to maximize its total income by using linear programming method.

[8.0 Marks]

Table Q4-1: Production details of X company

	Product		
	A	B	
Storage Space	m <sup>3</sup> per unit	4	5
Raw Material Requirement	kg per unit	5	3
Production Rate	units per hour	60	30
Selling Price	\$ per unit	13	11

b)

A manufacturing company purchase 9000 material units to satisfy its annual production requirements. A single unit costs \$20. The ordering cost per order is \$15 and carrying charges per year is 15% of the average value of the inventory.

Currently the company is ordering this material on monthly basis. You have been assigned to suggest a more economical purchase policy for the company. What should be the most optimum purchasing frequency and how much would it save the company per year? You may use the analytical method and indicate the suitable assumptions.

[4.0 Marks]

Q5. a)

Why Aggregate Planning is important for an organization

[2.0 Mark]

b)

Discuss the challenges for scheduling due to COVID-19 induced situation by providing an example/s

[2.0 Mark]

c)

A group of engineering graduates decided to startup a new company for producing desktop computers. They have started to their project plan and made the following conclusions with regards to their proposal.

A. The following three product categories should be considered for the manufacturing assembly plant for catering different needs of the customers.

- Low-performance desktop computers
- Mid-performance desktop computers
- High-performance desktop computers

B. They decided that the most suitable layout type is Product layout

C. They have decided that “output of a production line” should be 100 units per hour.

No.	Element Description	T <sub>e</sub> (mins)	Preceded by
1	Check each internal component (Power Supply, Motherboard, CPU, GPU, RAM, Hard Disk, CD/DVD Drive)	1.2	-
2	Check each external component (Display, Keyboard, Mouse, Speaker/Subwoofer)	1	-
3	Coupling the motherboard to the casing.	0.8	1
4	Coupling the power supply to the casing.	0.6	1,3
5	Mounting the CPU on the motherboard.	0.45	1,3,4
6	Mounting the Heat Sink and CPU Cooling Fan.	0.55	5
7	Mounting RAM into the motherboard.	0.3	6
8	Mounting GPU (if necessary) into the motherboard.	0.35	6
9	Coupling CD/DVD Drive to the casing.	0.65	7,8
10	Coupling Hard Disk to the casing.	0.7	7,8
11	Plugging connectors within internal components.	0.5	9,10
12	Connecting External Devices (Display, Keyboard, Mouse)	0.4	2,11
13	Packaging of the PC for the shipment or storage	0.75	12

D. Table Q5-1 presents the work elements, element processing times and immediate predecessors identified for the assembly line

- (i) Do you agree with their product category selection, Explain?  
[2.0 Mark]
- (ii) What is the desired cycle time?  
[1.0 Mark]
- (iii) What is the theoretical number of workstations in above assembly line?  
[1.0 Mark]
- (iv) Find the efficiency and the balance delay of this assembly line.  
[3.0 Marks]
- (v) Assuming the status of manual assembly process, calculate how many individuals should be employed to archive desired production rate  
[3.0 Marks]

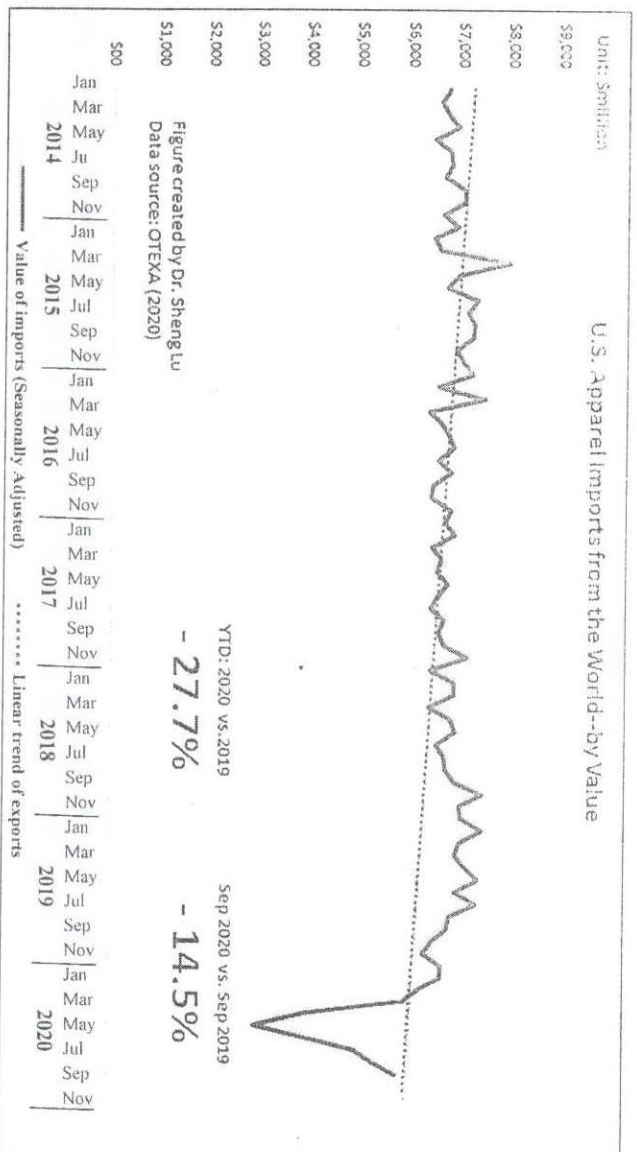


Figure Q2-1 : United States Apparel Imports from the world by value (YTD - Year to Date import value)

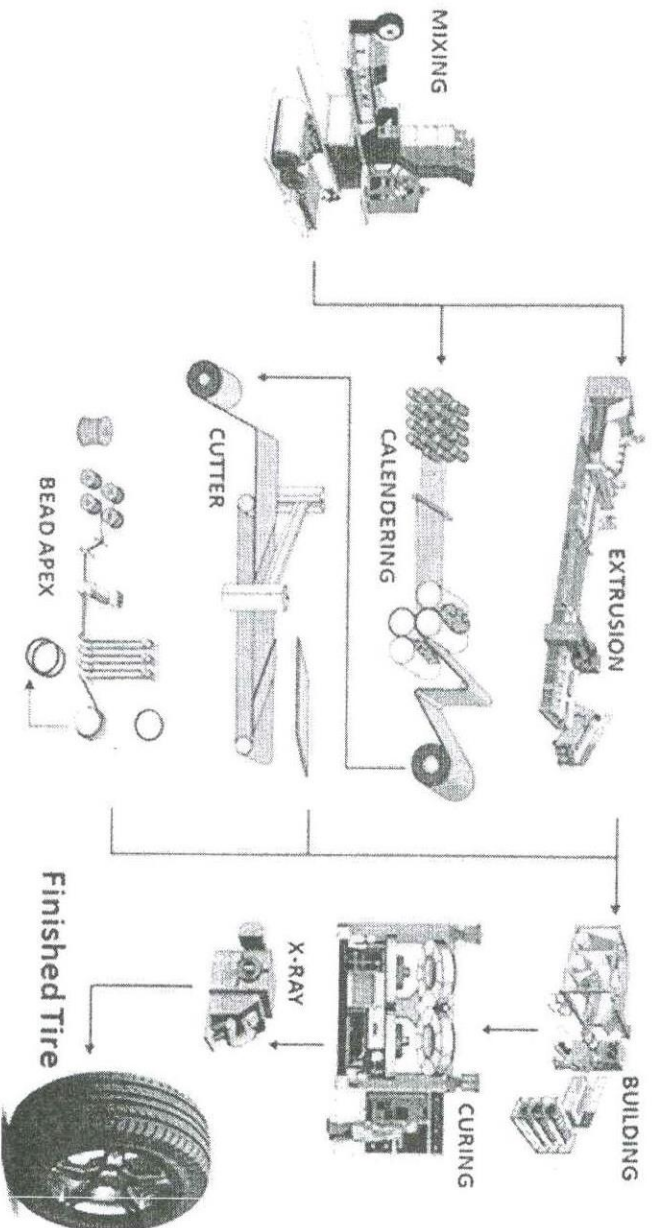


Figure Q3-1: Main Process for the Tire Manufacturing Process