First Semester Examination
2022/2023 Academic Session

February 2023

EPM 321 – Manufacturing System
(Sistem Pembuatan)

Duration: 3 hours
(Masa: 3 jam)

Please check that this examination paper consists of SIX (6) pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi ENAM (6) muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: Answer ALL **FIVE (5)** questions.

*[**Arahan**: Jawab **LIMA (5)** soalan]*

...2/-

1. (a) As shown in Figure Q1 (a), products can be made by going through six processes in a conventional batch of 100 units. The factory is running 8 hours per day and 5 days per week. The management team is debating which processes should be upgraded in order to improve weekly production capacity and production lead time.

(i) Determine which of the two processes will have the highest level of work-in-process (WIP) accumulation in between.

(ii) Assess the impact to production lead time (in term of percentage change) if the setup time of Process 1 drops to 2 min.

(iii) Assess the impact to weekly production capacity (in term of percentage change) if Process 3 is removed and hence Process 1 is directly connected to Process 5.

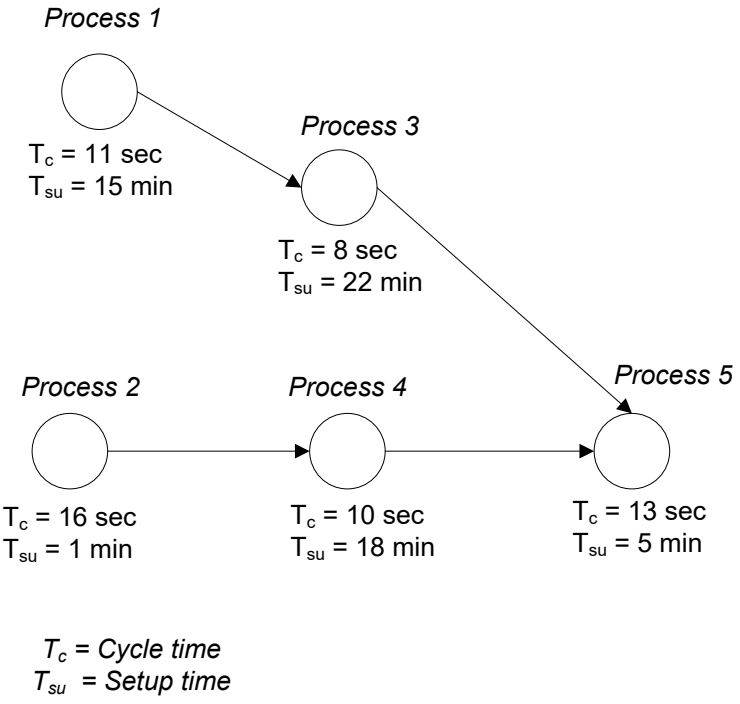

Figure Q1 (a)

(50 marks)

(b) The machine log as shown in Table Q1 (b), obtained from 8:20 in the morning to 18:10 in the evening.

(i) Calculate the machine availability.

(ii) Determine the impact on machine availability if previously undisclosed information reveals that a product changeover time of 10 minutes has been included as part of the processing time.

(iii) Explain the significance of availability onto organization wishing to attain "World Class Overall Equipment Effectiveness".

Table Q1(b)

Start time	End time	Event
8:20	10:50	Process Order with Product ID X45B, planned quantity 1500 units, defect 20 units
10:50		Machine jam
10:50	11:10	Machine repair
13:00	15:10	Process Order with Product ID JO11B, planned quantity 6000 units, defect 190 units
15:10	17:10	Process Order with Product ID K45B1, planned quantity 3000 units, defect 15 units
17:10		Machine jam
17:10	18:10	Machine repair

(50 marks)

2. (a) Company XYZ wishes to setup a mixed model assembly line for its automotive final assembly.

(i) Explain TWO (2) benefits of running assembly in mixed model mode.

(ii) Describe TWO (2) production situations whereby mixed model assembly might NOT be suitable for the automotive final assembly.

(40 marks)

...4/-

(b) Mohd & Sons Bhd. is planning to set up an assembly line to assemble 50 units per hour, and 57 minutes per hour are productive. A repositioning time of 6 sec is imposed. The time to perform each work element and the precedence relationships between each work element are shown in Table Q2 (b).

(i) Sketch the precedence diagram.

(ii) Balance this line using Rank Positional Weight (RPW) method.

(iii) Calculate the balance efficiency based on the solution obtained in Q2 [b] (ii).

Table Q2 [b]

Work element	Time to perform (min.)	Preceding work element
A	0.52	--
B	0.50	A
C	0.92	B
D	0.59	B
E	0.80	B
F	1.10	B
G	0.60	C, D, E
H	0.13	G, F
I	0.29	H

(60 marks)

3. (a) Siew Mei ran a catering service in her kitchen during the Pandemic lockdown. Every day, 300 lunches (each includes one of the five standard dishes) were cooked and delivered based on different customer orders placed a day ago. Figure Q3[a] depicts the arrangement of the kitchen. She now intends to grow her business to meet the increasing demand for 700 lunches across 20 dishes.

(i) Determine the manufacturing layout that corresponds to the kitchen layout.

(ii) Evaluate the kitchen layout in light of the strengths and weakness of manufacturing layout determined in Q3 [a] (i).

...5/-

(iii) Suggest and justify if new manufacturing layout is required to the kitchen to accommodate the increased demand and diversity of dishes. Alternatively, if you believe that the manufacturing layout should not be changed, please explain why.

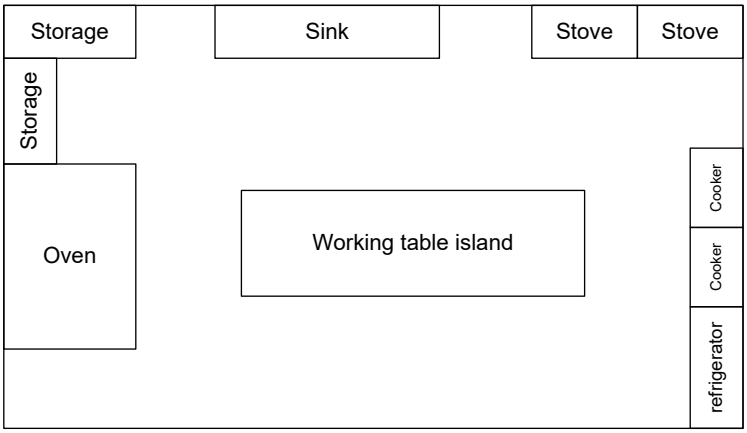

Figure Q3 [a]

(50 marks)

(b) There are THREE (3) main control functions in an Automated Production Line. For each control function, predict ONE (1) situation that can possibly occur if the control functions breakdown.

(50 marks)

4. (a) Justify the need of buffer storage for each of the following manufacturing systems:

(i) Cellular Manufacturing
(ii) Automated Production Line
(iii) Automated Assembly Line

(40 marks)

(b) Compare Cellular Manufacturing, Automated Production Line and Automated Assembly Line in a table based on the following criteria:

(i) Type of machine
(ii) Type of operation
(iii) Product type
(iv) Product volume
(v) Manufacturing production method

(60 marks)

...6/-

5. (a) A manufacturing company wants to apply a Cellular Manufacturing concept. Table Q5[a] contains the information of the components and the machines that are used in the production shop floor. Apply the Rank Order Clustering Technique to produce machine cells sequence.

Table Q5 (a)

Component	Machine
A	1 & 5
B	3 & 7
C	1 & 6
D	4 & 6
E	2, 3 & 5
F	4 & 7

(50 marks)

(b) There are four Group Technology (GT) cells i.e. G1, G2, G3 and G4 owned by C19 Bhd. Based on production flow analysis, Table Q5 [b] was produced.

Table Q5 (b)

	TO			
FROM	***G1***	***G2***	***G3***	***G4***
G1	0	0	20	10
G2	20	0	20	15
G3	20	0	0	0
G4	10	0	0	0

(i) Determine the sequence of the four GT cells by using the information given in Table Q5[b].

(ii) Calculate the performance of the cell based on the following criteria: Repeating moves, in-sequence moves, by-passing moves and back-tracking moves.

(iii) Evaluate the performance achieved in Q5 [b] (ii).

(50 marks)

- oooOOOooo -