First Semester Examination
2019/2020 Academic Session

December 2019 / January 2020

EPM321 – Manufacturing System
[Sistem Pembuatan]

Duration : 3 hours
Masa : 3 jam

Please check that this examination paper consists of <u>SEVEN</u> [7] printed pages before you begin the examination.

[Sila pastikan bahawa kertas soalan ini mengandungi <u>TUJUH</u> [7] mukasurat bercetak sebelum anda memulakan peperiksaan.]

<u>**INSTRUCTIONS**</u> : Answer **ALL FIVE [5]** questions.
*[<u>ARAHAN</u> : Jawab **SEMUA LIMA [5]** soalan.]*

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]

1. [a] **Compare product and process layouts in terms of**
   Bandingkan susun atur produk dan proses dari segi

   (i) **Layout appearance (with sketch)**
   Penampilan susun atur (dengan lakaran)

   (ii) **Product range, demand type and volume**
   Kepelbagaian produk, jenis dan isipadu permintaan

   (iii) **Equipment and machinery used**
   Peralatan dan jentera yang digunakan

   (iv) **Worker skill requirement**
   Keperluan kemahiran pekerja

   (v) **Material handling**
   Pengendalian bahan

   (vi) **Storage space requirement**
   Keperluan ruang simpanan

   (vii) **Production planning and control**
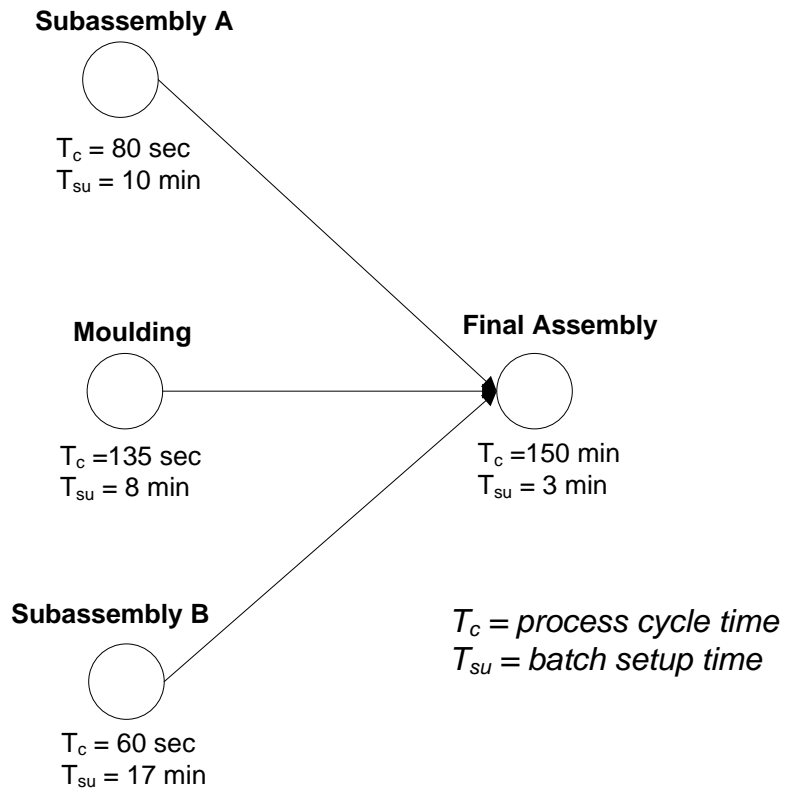   *Perancangan dan kawalan pengeluaran*

   (50 marks/*markah***)**

   [b] **An air vent product was manufactured in a batch of 100 units by going through four processes as depicted in Figure 1[b]. Please verify through calculation, the following claims made by production supervisor.**

   Produk pengaliran udara boleh dibuat dalam kelompok 100 unit melalui empat proses seperti yang digambarkan dalam Rajah 1[b]. Sila sahkan melalui pengiraan, tuntutan berikut yang dibuat oleh penyelia pengeluaran.

   (i) **The production rate of Subassembly A is more than 95 sec.**
   Kadar pengeluaran proses "Subassembly A" adalah lebih daripada 95 saat.

   (ii) **The bottleneck of the production system is at Final Assembly.**
   Cerutan sistem pengeluaran adalah pada "Final Assembly".

   (iii) **The average number of work-in-process is five batches.**
   Bilangan purata kerja dalam proses adalah sebanyak lima kelompok.

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Subassembly A

$T_c = 80$ sec
$T_{su} = 10$ min

Moulding

$T_c = 135$ sec
$T_{su} = 8$ min

Final Assembly

$T_c = 150$ min
$T_{su} = 3$ min

Subassembly B

$T_c = 60$ sec
$T_{su} = 17$ min

$T_c = $ process cycle time
$T_{su} = $ batch setup time

Figure 1
Rajah 1

(50 marks/*markah***)**

2. **[a] Explain THREE (3) capabilities that a manufacturing system must possess in order to be flexible.**

    Terangkan TIGA (3) keupayaan yang mesti dimiliki oleh sistem perkilangan untuk menjadi anjal.

    (20 marks/*markah***)**

    [b] State FIVE (5) material handling functions that must be provided in a manufacturing system.

    Nyatakan LIMA(5) fungsi pengendalian bahan yang mesti disediakan dalam sistem perkilangan.

    (30 marks/*markah***)**

[c] **A sneaker contract manufacturer sets up a manual assembly line to assemble 15 units of Nike Air Max sneaker per hour. The time to perform each work element and the precedence relationships between each work element are shown in Table Q4[c]. Line efficiency is 0.9 and repositioning efficiency is 0.95. Balance this line using Ranked Positional Weight method and calculate balance efficiency.**

Pengeluar kontrak kasut sukan menyediakan satu barisan pemasangan manual untuk memasang 15 unit kasuk sukan Nike Air Max setiap jam. Maklumat mengenai masa perlaksanaan elemen kerja dan hubungan pendahuluan pemprosesan antara elemen-elemen kerja terdapat di Jadual S4[c]. Kecekapan barisan = 0.90 dan kecekapan reposisi = 0.95. Imbangkan barisan pemasangan tersebut dengan menggunakan kaedah "Ranked Positional Weight" dan kirakan kecekapan keseimbangan.

Table 4[c]
Jadual 4[c]

Work element	*Time to perform (min)*	*Preceding work element*
A	1.7	--
B	1.5	--
C	0.3	A
D	0.6	--
E	2.2	C,D
F	2.7	--
G	0.8	B
H	1.8	G
I	2.0	F
J	0.8	I
K	1.5	E,H,J

(50 marks/*markah***)**

3. **[a]** **Explain production setup and its common stages. Give reasons why production setup is needed and discuss production setup in the context of Lean management.**

Terangkan persediaan pengeluaran dan peringkat umumnya. Berikan sebab-sebab persediaan pengeluaran diperlukan dan bincangkan persediaan pengeluaran dari segi pengurusan kejat.

(40 marks/*markah***)**

[b] Two electronics valve models, VC and VM, are to be produced on a mixed model assembly line consisted of six workstations. Hourly production rate and work content time for model VC are 6 units/hr and 25.0 min, respectively; and for model VM are 3 units/hr and 30.0 min. Line efficiency = 1, balance efficiency = 0.90, repositioning efficiency = 0.95. Determine the fixed rate launching interval and the launch sequence of models VC and VM during one hour of production.

Dua model injap elektronik, VC dan VM, akan dihasilkan pada barisan pemasangan model campuran yang terdiri daripada enam stesen kerja. Kadar pengeluaran setiap jam dan masa kandungan kerja untuk model VC adalah masing-masing 6 unit / jam dan 25.0 min; dan untuk model VM adalah 3 unit / jam dan 30.0 min. Kecekapan barisan = 1, kecekapan keseimbangan = 0.90, kecekapan reposisi = 0.95. Tentukan selang kadar tetap pelancaran dan urutan pelancaran model VC dan VM dalam pengeluaran selama satu jam.

(60 marks/*markah***)**

4. **[a]** Justify the need of buffer storage for each of the following manufacturing system;

Justifikasikan keperluan stok penampan untuk setiap sistem pembuatan berikut;

    (i) **Cellular Manufacturing**
       Pembuatan Selular

    (ii) **Automated Production Line**
       Barisan Pengeluaran Automasi

    (iii) **Automated Assembly Line**
       Barisan Pemasangan Automasi.

(60 marks/*markah***)**

[b] Compare and discuss THREE (3) differences between Cellular Manufacturing, Automated Production Line and Automated Assembly Line.

Bandingkan dan bincangkan TIGA (3) perbezaan antara Pembuatan Selular, Barisan Pengeluaran Automasi dan Barisan Pemasangan Automasi.

(40 marks/*markah***)**

5.   **There are four Group Technology (GT) cells i.e. G1, G2, G3 and G4. Based on production flow analysis, Table 5 was produced.**

Terdapat empat sel "Group Technology" (GT) iaitu G1, G2, G3 dan G4. Berdasarkan analisa aliran pengeluaran, Jadual 5 telah dihasilkan.

Table 5
Jadual 5

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

[a]   **With an aid of network diagram and data tabulated in Table 5;**
Dengan bantuan rajah rangkaian dan taburan data di dalam Jadual 5;

(i)   **Determine the sequence of the four GT cells using Hollier method.**

Tentukan turutan keempat-empat sel GT menggunakan kaedah Hollier.

(ii) **Identify the final component output by number of batches and the quantity for each batch.**

Kenal pasti keluaran akhir komponen berdasarkan jumlah kelompok dan kuantiti bagi setiap kelompok

(40 marks*/markah***)**

[b]   **Evaluate the performance of the GT cells sequence by observing "Repeating", "In-Sequence", "By-Passing" and "Back-Tracking" moves.**

Nilaikan prestasi turutan sel-sel GT tersebut dengan memperhatikan Pergerakan "Repeating", "In-Sequence", "By-Passing" dan "Back-Tracking"

(40 marks/*markah***)**

[c]   **Give your opinion of the GT cells performance based from the calculated "MOVES".**

Berikan pendapat anda tentang prestasi sel-sel GT berdasarkan pengiraan "PERGERAKAN".

(20 marks/*markah***)**

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