Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	INDUSTRIAL ENGINEERING
COURSE CODE	:	BDA 40703
PROGRAMME	:	4 BDD
TEST DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	PLEASE ANSWER **FIVE (5)** QUESTIONS **ONLY** FROM **SIX (6)** QUESTIONS PROVIDED

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) The term Industrial Internet of Things (IIOT) is often encountered in the manufacturing industries, referring to the industrial subset of the IIoT. IIoT in manufacturing would probably generate so much business value that it will eventually lead to the fourth industrial revolution, so the so-called Industry 4.0. It is estimated that in the future, successful companies will be able to increase their revenue through Internet of Things by creating new business models and improve productivity, exploit analytics for innovation, and improve workforce efficiency. The potential of growth by implementing IIoT will generate $12 trillion USD of global GDP by 2030.

(i) As an industrial engineer, briefly explain why IIoT is important for the future?

(4 marks)

(ii) An IIoT- enabled intelligent system of such cases has been demonstrated by the University Collaborative Research Center for Intelligent Maintenance Systems (IMS) at University of Cincinnati on a band saw machine. Band saw machines are not necessarily expensive, but the band saw belt expenses are enormous since they degrade much faster. However, without sensing and intelligent analytics, it can be only determined by experience when the band saw belt will actually break. In this particular case, how IIoT could help the engineer and management to overcome this situation? Support your idea with appropriate judgments.

(6 marks)

(b) Cumulative Trauma Disorder, or CTD, is a new threat to employees in the workplace that has developed into today's fastest growing occupational hazard. CTDs have affected workers across all industries, ranging from people who work white collar jobs in the office to people who work blue collar jobs out in the field, the factory, or in the warehouse.

(i) Briefly explain the causes of CTD.

(4 marks)

(ii) As an industrial engineer in your company, what are the interventions that you may introduce to reduce the risk of CTDs? Construct at least three (3) methods.

(6 marks)

Q2 (a) Using appropriate sketches, describe the advantages and disadvantages between Straight Line and U-Shape assembly line.

(5 marks)

(b) A supplier of mineral water is planning to open a new store in Johor. The manager of the company suggests three potential locations: Batu Pahat (BP), Pontian (PN) and Johor Bahru (JB). Table 1 and Table 2 show the transportation cost, demands and supplies for the existing and new potential location. Propose the most economic location. Support your proposal with suitable description.

(7 marks)

Table 1: Transportation cost (RM), demand and supplies for existing locations

	Shop A	**Shop B**	**Shop C**	**Store Capacity (Box/week)**
Store 1	0.5	0.7	0.8	700
Store 2	0.9	0.4	1.0	800
New Store				500
Shop Demand (Units/week)	850	550	600	

Table 2: Transportation cost (RM) for three potential locations of new store

From New Store	**To Shop A**	**To Shop B**	**To Shop C**
BP	0.4	0.7	1.0
PN	0.7	0.7	0.7
JB	1.0	0.7	0.4

(c) A remanufacturing company is planning to setup a new disassembly line to meet the demand of 4,000 products per week. The assembly line is running 8 hours per day and 5.5 days per week. Details subassembly data are summarized in Table 3.

Table 3: Subassembly line information.

Task	Description	Performance Time (second)	Immediate Predecessors
A	Dismantle cover	10	None
B	Dismantle part 1	15	A
C	Dismantle part 2	12	A
D	Dismantle part 3	14	A
E	Inspection part 1	10	B
F	Inspection part 2	25	C
G	Inspection part 3	10	D
H	Printing report	15	E,F,G

(i) Using a precedence diagram, determine the number of workstation and its group of task.

(5 marks)

(ii) Analyze the line efficiency and idle time.

(3 marks)

Q3 Time study was carried out on an assembly process of a certain furniture and the results are given in **Table 4.** Assuming an allowance of 10 percent of the normal time can be applied in the preliminary time study, compute the following:

(a) Estimate the standard assembly time per furniture?

(6 marks)

(b) If company is required to produce 2500 parts a week (5 days a week, 8 hours a day, 1 shift), propose the number of operators needed.

(4 marks)

(c) The company currently practices a scheduled maintenance and for the following month, 10% output will drop due to machine shut down for maintenance. If current capacity of the assembly line is capable of producing 10,000 units per month and the company has received 12,000 orders for the following month, evaluate the average overtime per hour per day that the company needs to allocate to workers if all workers are willing to work over time.

(10 marks)

Table 4: Time Study Data

Element	Observation (in minutes)					Performance Rating (%)
	1	2	3	4	5	
Element 1	5	6	3	5	6	110
Element 2	12	8	10	11	9	90
Element 3	8	8	10	10	12	80
Element 4	4	6	5	8	5	70

Q4 (a) The purpose of inventory is to provide a stock of goods to the customers. Describe **THREE (3)** types of inventory. Support your description with suitable examples.

(6 marks)

(b) Five specialty jobs at a Cemerlang Rekacipta Sdn Bhd, must be processed through two work centers (drill press and lathe). The time for processing each job as shown in **Table 5**.

Table 5: Processing time for each jobs (hours)

Job	Work Center 1 (drill press)	Work Center 2 (lathe)
A	5	2
B	3	6
C	8	4
D	10	7
E	7	12

(i) Determine the sequence of jobs to minimize the total processing time for the five jobs.

(4 marks)

(ii) Develop the time phase flow and determine the makespan time to complete the jobs.

(6 marks)

(iii) Calculate the total idle time at work center 2.

(2 marks)

(iv) If job C takes 8 hours in work center 2 (instead of 4 hours), propose the best sequence for this case.

(2 marks)

Q5 (a) Describe **TWO (2)** Garvin's quality dimensions. Support your description with suitable examples.

(4 marks)

(b) (i) Construct $\overline{X}$ control chart using data in **Table 6**. Use a suitable factor in **Table 7** to compute the control chart limits. Given that $\sum R = 0.055$ mm.

(14 marks)

(ii) Is the process in control? Justify your answer.

(2 marks)

Table 6: Silicon Wafer Thickness

Subgroup Number	Measurements (mm)			
	X_1	X_2	X_3	X_4
1	0.2500	0.2510	0.2490	0.2500
2	0.2510	0.2490	0.2490	0.2520
3	0.2510	0.2490	0.2510	0.2480
4	0.2490	0.2470	0.2520	0.2480
5	0.2500	0.2470	0.2500	0.2520
6	0.2510	0.2520	0.2490	0.2510
7	0.2510	0.2480	0.2500	0.2500
8	0.2500	0.2490	0.2490	0.2520
9	0.2500	0.2470	0.2500	0.2510
10	0.2480	0.2480	0.2510	0.2530
11	0.2500	0.2500	0.2500	0.2530
12	0.2510	0.2490	0.2510	0.2540
13	0.2500	0.2470	0.2500	0.2510
14	0.2500	0.2500	0.2490	0.2520
15	0.2500	0.2470	0.2500	0.2510

Table 7: Factors for Calculating $\overline{X}$ Control Chart

Size of sample (n)	Factor for UCL and LCL for $\overline{X}$ -chart (A_2)
2	1.880
3	1.023
4	0.729
5	0.577
6	0.483
7	0.419
8	0.373
9	0.337
10	0.308

Q6 (a) Just in Time (JIT) is a management philosophy of continuous and forced problem solving. Differentiate the pull and push system in JIT.

(4 marks)

(b) End item P is composed of three subassemblies: K, L, and W. K is assembled using 3 units of G and 4 units of H; L is made of 2 units of M and 2 units of N; and W is made of 3 units of Z. On hand inventories are 20 units of L, 40 units of G, and 200 units of H. Scheduled receipts are 10 units of K at the start of week 3, 30 units of K at the start of week 6, and 200 units of W at the start of week 3. One hundred Ps will be shipped at the start of week 6, and another 100 at the start of week 7. Lead times are two weeks for subassemblies and one week for components G, H, and M and Z. Final assembly of P requires one week.

(i) Construct a **product structure tree for P**.

(4 marks)

(ii) Prepare an MRP table for item **K using lot-for-lot ordering**.

(6 marks)

(iii) Prepare an MRP for **G using a lot size of 70** by completing the table below.

(6 marks)

- END OF QUESTION –

FINAL EXAMINATION

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EQUATIONS

$$f(x,y)=\sum_{i=1}^{n} w_i\left(|x-a_i|+|y-b_i|\right)$$

Average completion time = sum of total flow time / Number of jobs

Utilization = Total jobs processing time / sum of total flow time

Average number of jobs in the system = Sum of flow time/ Total processing time

$$UCL_R = D_4\overline{R} \qquad LCL_R = D_3\overline{R}$$

$$\mathrm{CL}_{\bar{x}} = \bar{\bar{x}} \pm A_2\,\overline{R} \qquad \bar{\bar{X}} = \frac{\sum \bar{X}}{g}$$

$$StdTime = \frac{TotalNormalTime}{1-Allowance} \qquad \overline{R} = \frac{\sum R}{g}$$

$$NormalTime = Average\ cycle\ Time \times Rating$$

Standard Time, ST

$$= \frac{\text{Total observation time}}{\text{Total output}} \times \text{Productive\%} \times \text{Rating} \times \frac{1}{1-\text{allowance}}$$

$$\text{TM} = \frac{\sum t}{c} \quad \text{Idle time} = nc - \sum t \quad \text{Efficiency} = \frac{\sum t}{nc}(100)$$