UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	INDUSTRIAL ENGINEERING & QUALITY MANAGEMENT
COURSE CODE	:	BNJ 20503
PROGRAMME	:	3BNL
EXAMINATION DATE	:	DECEMBER 2014/JANUARY 2015
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	SECTION A: PLEASE ANSWER **ALL** QUESTIONS IN THIS SECTION. SECTION B: PLEASE ANSWER **THREE (3)** QUESTIONS FROM FOUR (4) QUESTIONS PROVIDED IN THIS SECTION.

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

SECTION A

Please answer <u>all questions</u> in this section.

Q1 (a) Briefly explain the meaning of Industrial Engineering?

(4 marks)

(b) Discuss the roles of Industrial Engineer for the following areas:

(i) Manufacturing industry
(ii) Logistics industry
(iii) Service industry

(4 marks)

(c) Jobs involving computer use, working with tools, lifting and manual materials handling, or working in a laboratory may expose to the ergonomic problems if they include one or more of ergonomic risk factors at work place. Classify the **FIVE (5)** types of ergonomic risk factors at work place.

(5 marks)

(d) As an Industrial Engineer at Fujitsu Component (M) Sdn Bhd in Parit Raja, you are required to design the computer workstation for office employees that include the monitor, table, chair, footrest, document holder, keyboard, mouse etc. Using appropriate sketches, distinguish the concepts or tips of ergonomic computer workstation.

(12 marks)

SECTION B

Please answer THREE (3) questions out of four (4) questions provided in this section.

Q2 (a) Location identification is one of the important factors in the Facilities Planning process. Explain **FOUR (4)** factors that affecting the location identification.

(4 marks)

(b) Differentiate between product and process layout. Use proper layout illustrations to support your answer.

(6 marks)

(c) Nippon Paint (M) Sdn Bhd produces paints that offers total coating solutions for interior, exterior, wood and metal, wall sealers and protective coating. As an Industrial Engineer, Mr Abdullah need to design the process to provide comfort and compatible with the high production. There are 480 minutes available during the day, and the average daily demand has been 50 barrels of paint. The activities are shown in **Table 1**:

Table 1: Assembly line activities

Task	Time (minutes)	Predecessors
A	4	-
B	7	-
C	6	A,B
D	5	C
E	6	D
F	7	E
G	8	E
H	6	F,G

(i) Draw a precedence diagram of this operation.
(ii) Calculate the cycle time of this assembly.
(iii) Determine the theoretical minimum number of workstations
(iv) Assign tasks to workstations and calculate the efficiency of this assembly line.
(v) Calculate the balance delay

(10 marks)

(d) Yakult is a world pioneer in the field of probiotics drinking. The Yakult Malaysia owns factories in three towns (Seremban, Melaka and Shah Alam), which distribute to three Aeon Big retails in three other cities (A, B, and C). The following **Table 2** summarizes factory availabilities, projected stored demands and unit shipping costs for Yakult drinking. Calculate the total cost of transportation.

(5 marks)

Table 2: Transportation matrix for Yakult drinking

To / From	Aeon Big A	Aeon Big B	Aeon Big C	Supply
Seremban Factory	RM 1	RM 4	RM 3	50
Melaka Factory	RM 7	RM 6	RM 6	35
Shah Alam Factory	RM 2	RM 8	RM 5	50
Store demand	40	30	65	135

Q3 (a) List two (2) of the advantages for specialization in business for management and labor.

(4 marks)

(b) The successful job designs must be carried out by experienced personnel with the necessary training and background. Explain briefly the behavioral approaches to job design.

(6 marks)

(c) The company ABC is producing potato chips in Selangor. **Table 3** indicate a process of potato chips manufacturing. As a basis, Ahmad need to prepare a Process Chart for this potato chips manufacturing process. By using the Process Chart form provided in Appendix 1, generalize a process chart for this process.

(7 marks)

Table 3: Potato chips manufacturing process

#	Activity	Time (minutes)	Distance (m)
1	From raw material storage to storage bins at work cell	3	10
2	Storage bins		
3	Move to chipping machine	3	5
4	Chipping process	5	
5	Move to washing machine	3	5
6	Operation at washing machine	5	
7	Move to strainer	3	6
8	Water dripping process at strainer	5	
9	Move to frying bowl	3	10
10	Frying process	7	
11	Move to cooling strainer	3	1
12	Cooling process	15	
13	Quality inspection	3	10
14	Move to packaging section	5	30

(d) A time study has been conducted on the task of frying banana chips (**Table 4**). On the basis of the following observations, this company wants to develop a time standard for this task. The delay and fatigue allowance factor is 13%.

(i) Determine the normal time for each job element.

(6 marks)

(ii) Determine the standard time for the job.

(2 marks)

Table 4: Observation table

#	Activity	Observation (minutes)			Performance rating
	From raw material storage to storage bins at work cell	1	2	3	120
1	Storage bins	3	5	2	115
3	Move to chipping machine	3	5	3	100
4	Chipping process	5	4	6	105
5	Move to washing machine	3	5	9*	95
6	Operation at washing machine	5	4	4	100
7	Move to strainer	3	2	6	90
8	Water dripping process at strainer	5	6	5	85
9	Move to frying bowl	3	10*	4	100
10	Frying process	7	8	5	120
11	Move to cooling strainer	3	3	3	105
12	Cooling process	15	15	17	110
13	Quality inspection	3	5	5	115
14	Move to packaging section	5	3	5	110

Q4 (a) Explain what is Just-In-Time (JIT) and what does it do in achieving continuous improvement.

(4 marks)

(b) Hitachi Malaysia is a big manufacturer of electric and electronic component has approximately 5,000 units component per year in its inventory. The cost of each unit is RM150 and the inventory carrying cost is RM20 per unit per year. The average ordering cost is RM40 per order. Its takes about 5 days for an order to arrive, and the demand for 1 week is 120 units. There are 250 working days per year.

Calculate the following:

(i) The economic order quantity (EOQ)
(ii) The average inventory if the EOQ used
(iii) The optimal number of order per year
(iv) The optimal number of days in between any two order
(v) Annual cost of ordering and holding inventory
(vi) The reorder point (ROP)

(12 marks)

(c) Klinik Putra at Bandar Universiti have six pregnant woman patients waiting to be checked and scanned. The time required (in minutes) for each activity is given in **Table 5**.

Table 5: Operation processing time

Patient	Check up (min)	Scan (min)
Rosnah	5	0
May Ling	7	2
Sara	10	5
Karina	8	6
Ratna	3	5
Laila	4	3

Evaluate the total elapsed time and delay for these jobs. Illustrate graphically

(9 marks)

Q5 (a) Business Excellence Model (BEM) can be considered as a Total Quality Management Model and one example of Industrial Systems Model. Currently, BEMs are used in at least 83 countries as a key mechanism to help organisations to improve. Explain briefly two (2) benefits of using BEM.

(4 marks)

(b) Discuss and classify two situations in which the following basic Quality Control tools suitable to be used:

(i) Ishikawa Diagram
(ii) Control chart
(iii) Pareto Diagram

(6 marks)

(c) As a quality engineer at a silicon wafer manufacturer, you are required to construct a control chart to check whether the process is capable of producing wafers at consistent thickness. Every 15 minutes, four wafers are randomly measured. The data collected are shown in **Table 6**.

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

(12 marks)

(ii) Is the process in control? Briefly judge and support your answer.

(3 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

- END OF QUESTIONS –

Appendix I

FINAL EXAMINATION

SEMESTER / SESSION : SEMESTER I /2014/2015 PROGRAM : 3BNL
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Process Chart

Subject Charted : _____ Date : _____
Chart by : _____
Department : _____ Sheet no.: ___ of __

Distance in metre	Time in min.	Chart symbols	Process description
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
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		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	
		○ ⇨ □ D ▽	

○ = operation ⇨ = transport □ = inspect D = delay ▽ = storage

Appendix II

FINAL EXAMINATION

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EQUATIONS

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

$$\mathrm{CL}_{\bar{x}} = \bar{\bar{x}} \pm A_2 \bar{R}$$

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

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

$$\bar{\bar{X}} = \frac{\sum \bar{X}}{g} \qquad \bar{R} = \frac{\sum R}{g}$$

$$StdTime = \frac{TotalNormalTime}{1 - Allowance}$$

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

Standard Time, ST

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

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