Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESI 2014/2015

NAMA KURSUS	:	INDUSTRIAL ENGINEERING
KOD KURSUS	:	BDA 40102
PROGRAM	:	4 BDD
TARIKH PEPERIKSAAN	:	JUN 2015 / JULAI 2015
JANGKA MASA	:	2 HOURS
ARAHAN	:	ANSWER **FOUR (4)** QUESTIONS FROM SIX (6) QUESTIONS PROVIDED

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Nowadays, more companies are hiring industrial engineers and then promoting them into management positions for improving product quality, planning manufacturing resources or designing logistics distribution channels. Briefly explain **FOUR (4)** common objectives of hiring industrial engineers.

(4 marks)

(b) Describe **FOUR (4)** benefits achievable by companies that adopt ergonomic principles in their operations.

(4 marks)

(c) Using appropriate sketches, interpret the concept of ergonomics and anthropometric data that need to be considered related to office ergonomic design.

(12 marks)

Q2 (a) A manufacturer operates four (4) factories (M1 – M4) that ship the food to five (5) hypermarkets (H1 – H5). The shipping cost per unit food (in RM), in which capacity and demand are summarized in **Table 1** below.

(i) Assume that the overall demand is equivalent to overall capacity. Find the capacity of Factory M3 ($\mathbf{Q_{M3}}$).

(ii) Suggest the shipping schedule for minimizing the cost.

(iii) Determine the total shipping cost.

(10 marks)

Table 1: Food demand-capacity information

Hypermarket / Factory	H1	H2	H3	H4	H5	Capacity
M1	1	3	4	5	6	80,000
M2	2	2	1	4	5	60,000
M3	1	5	1	3	1	$\mathbf{Q_{M3}}$
M4	5	2	4	5	4	50,000
Demand	60,000	70,000	50,000	30,000	40,000	

(b) Industrial engineers in a watch industry have planned to change the assembly line. The standard time (ST) for the existing assembly line was 14.5 minutes. A new trial work cell has been designed and time study has been performed with the following results (refer to **Table 2**).

(i) Calculate ST for the new assembly line. Assume that the allowance for the whole assembly process is 18%.

(8 marks)

(ii) Suggest your decision, whether the new assembly line should be implemented or the existing line should be remained.

(2 marks)

Table 2: Result of time study

Assembly Work	Observation Time (second)				Performance Rating Factor (%)
	T1	T2	T2	T4	
Element A	2.6	2.3	3.1	2.9	1.0
Element B	4.9	4.8	5.1	4.7	1.1
Element C	2.2	2.0	2.1	2.3	0.9

Q3 (a) Using appropriate diagrams, briefly explain **TWO (2)** differences between Traditional Process Layout and Modified Layout (work cell).

(5 marks)

(b) A company is setting up an assembly line to produce 192 units per 8-hour shifts. The work elements, times, and immediate predecessors are identified in **Table 3**.

Table 3: Assembly line information.

Work Element	Performance Time (second)	Immediate Predecessors
A	40	None
B	80	A
C	30	D, E, F
D	25	B
E	20	B
F	15	B
G	120	A
H	145	G
I	130	H
J	115	C, I

(i). Create a precedence diagram of this assembly operation.

(4 marks)

(ii). Determine the cycle time.

(3 marks)

(iii). Based on grouping tasks into minimum numbers of workstations, determine the line efficiency, and balance delay.

(8 marks)

Q4 (a) Discuss the types of forecasts by horizon with the examples.

(6 marks)

(b) Malaysia Battery Supplier sells GP-brand batteries to car dealers and auto mechanics. The annual demand is approximately 2,000 batteries. The inventory carrying cost is RM12.50 per unit per year. It costs approximately RM25 to place an order (managerial and clerical costs). The supplier currently orders 150 batteries per month.

(i) Determine the annual cost of ordering and holding inventory for the current order quantity.
(ii) Determine the economic order quantity (EOQ).
(iii) Determine the average inventory if the EOQ used.
(iv) How many orders will be placed per year using the EOQ?
(v) Determine the annual cost of ordering and holding inventory for the EOQ. How has the costs changed? Justify your answer.

(14 marks)

Q5 (a) TQM implementation has the purposes to provide quality product to customers, to increase productivity and reduce cost. In achieving these purposes, TQM give high priority to the concept of employee involvement. Briefly explain the concept of employee involvement in TQM.

(4 marks)

(b) Briefly explain the usage of the following basic Quality Control tools:

(i) Pareto Diagram
(ii) Ishikawa Diagram

(4 marks)

(c) Mawaddah Plastic Sdn Bhd is a company that produces plastic container located in Parit Raja. **Table 4** shows the average and range in mililitres for volume tests conducted on the plastic container products. The sample size for each subgroup is 4.

(i) Determine upper and lower control limits for $\overline{X}$ -chart and R-chart. Use the factors in **Table 5** to compute the control chart limits.

(10 marks)

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

(2 marks)

Table 4: The average and range in mililitres for volume tests

Subgroup Number	X-bar	R	Subgroup Number	X-bar	R
1	485	29	14	482	26
2	490	25	15	498	25
3	464	22	16	464	24
4	469	27	17	484	24
5	474	22	18	476	32
6	482	22	19	466	24
7	500	23	20	484	42
8	496	23	21	466	26
9	478	25	22	470	24
10	484	24	23	494	24
11	500	23	24	486	28
12	476	25	25	496	23
13	488	24			

Table 5: Factors for Calculating $\overline{X}$ and R Control Charts

Size of sample (n)	Factor for UCL and LCL for $\overline{X}$ -charts (A_2)	Factor for LCL for R-charts (D_3)	Factor for UCL for R-charts (D_4)
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

Q6 (a) Distinguish between Push and Pull System in Just-In-Time (JIT).

(4 marks)

(b) Azizah's Alteration has 5 jobs to be completed and only one sewing machine (and sewing machine operator). Assume that the jobs will starts on today which day 1. Calculate the mean flow time, mean tardiness, maximum tardiness and number of jobs tardy for each sequence. Given the processing times and due dates as shown in **Table 6.** Prioritize the jobs by:

(i) First come first serve (FCFS)
(ii) Earliest Due Date (EDD)
(iii) Shortest Processing Time (SPT)
(iv) Which sequencing rule would you recommend? Justify your answer.

(16 marks)

Table 6: Processing times and due dates

Job	Processing Time(Days)	Due Date
A	9	18
B	8	20
C	6	10
D	4	25
E	11	15

- END OF QUESTIONS –

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COURSE : INDUSTRIAL ENGINEERING

PROGRAM : 3BDD
COURSE CODE: BDA40102

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

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

$$CL_{\bar{x}} = \bar{\bar{x}} \pm A_2\bar{R} \qquad \bar{\bar{X}} = \frac{\sum \bar{X}}{g}$$

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

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

Standard Time, ST

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

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