Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	INDUSTRIAL ENGINEERING
COURSE CODE	:	BDA 40703
PROGRAMME	:	4 BDD
EXAMINATION DATE	:	DECEMBER 2016/JANUARY 2017
DURATION	:	3 HOURS
INSTRUCTION	:	**SECTION A:** PLEASE ANSWER **ALL QUESTIONS** **SECTION B:** PLEASE ANSWER **FOUR (4) QUESTIONS** FROM **FIVE (5) QUESTIONS** PROVIDED IN THIS SECTION.

THIS PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Instruction: Please answer all questions in this section.

Q1 (a) Industrial engineers are often to figure out on how to do things better. The most distinctive aspect is the flexibility and versatility it can offer. Explain briefly why more and more companies are hiring Industrial Engineers and then promoting them into management positions.

(3 marks)

(b) Industrial engineers are applying in science, mathematics, and engineering methods to complex system integration and operations. Because of these systems are so large and complex, industrial engineers need to have knowledge and skills in a wide variety of disciplines, the ability to work well with people, and a broad, systems perspective. Differentiate the job scopes of the Industrial Engineers in manufacturing and logistics industry.

(5 marks)

(c) As an Industrial Engineer at CAD Semiconductor Industries, you are required to design and recommend the working posture of standing workstation for industrial employees as shown in **Figure Q1**. Using appropriate sketches, evaluate the design concepts for the best recommended working posture of standing workstation.

(12 marks)

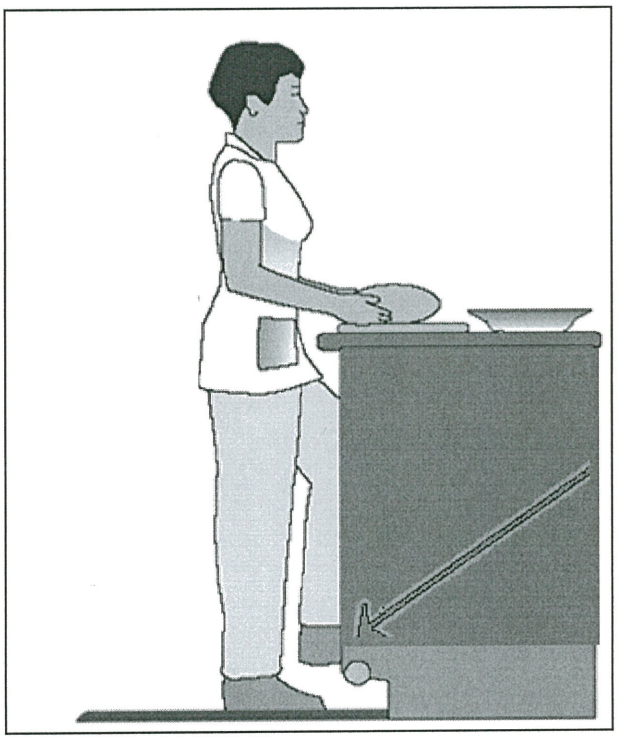

Figure Q1

SECTION B

Instruction: Please answer FOUR (4) questions from FIVE (5) questions provided in this section.

Q2 (a) Planning for facility location is important in starting a new business. Describe **THREE (3)** factors to be considered in selecting the facility location.

(6 marks)

(b) The assembly of a modern toy involves 9 tasks as summarized in **Table Q2(b)**. The production line need to produce 4,800 units of toys a week, whereby the operation time is 40 hours per week. Propose your decision plan on the cycle time, minimum number of workstation, line efficiency and idle time.

(14 marks)

Table Q2(b): Assembly tasks information

Task	Time Required (seconds)	Immediate Predecessors
A	12	-
B	6	A
C	6	A
D	5	-
E	11	D
F	12	D
G	13	B, C
H	9	E, F
I	7	G, H

Q3 A senior industrial engineer was briefed by his subordinates the results related to a time study involving the assembly process of a new component. The assembly process consists of four elements and the results of the time study is shown in **Table Q3**. The manufacturing process must strictly follow the sequence of A,B,C and D. Job element A is in full automatic mode and requires one operator. The worker at job element B was rated with 115% , the worker at job element C was rated with 110% while the worker at job element D was rated with 90%. The company practices standard allowances of 8% for fatigue, 4% for personnal, and 3% for delay. The normal operating hours is 8 hours per day, 22 days per month and average worker's wage (excluding over time pay) is RM64.00 per day.

Table Q3 : Average Processing Time (minutes)

Job Element	Description	Processing Time
A	Automatic	17
B	Manual	25
C	Manual	30
D	Manual	40

(a) Analyse the given information and determine the standard time for each job element.

(6 marks)

(b) If the company decided to produce 600 units per month, suggest the number of operators required for this task.

(4 marks)

(c) The company has decided to employ only 6 operators. At the same time the company has also decided to allow overtime work of 3 hours per day. Evaluate the situation and propose the number of operators that must be arranged to perform the overtime work daily in order to meet the production output of 600 units per month. Assume the overtime is executed 3 hours every day.

(10 marks)

Q4 (a) The JP Invention Sdn Bhd has been manufactures the container food court product based on recycle container from the Johor Port Harbour. The main product will be supplied for local entrepreneur in the Southern Region of Malaysia for modern business model on 'Halal' food. The marketing and production manager has planned an overtime schedule for the selected staff for every weekend (four days per month) with 8 hours per day to reduce the backlog on the popular container. **Table Q4** shows the scheduling data which involves an ordering time, processing time, and due date for the container delivery.

Table Q4: Ordering, Processing Time and Due Date Data

No. of Order (Container Type)	Estimated Processing Time (hours)	Due Date (Hours from now)
S	12	72
T	32	48
A	36	80
C	28	84
R	48	112
Z	24	40

(i) Analyze the schedules using First Come First Serve (FCFS), Early Due Date (EDD), and Shortest Processing Time (SPT) rules.

(6 marks)

(ii) Based on scheduling performance obtained in **Q4(a)(i)**, suggest your selection if Delivery Time is important.

(4 marks)

(b) HYATT Regency Hotel (HRH) is one of the popular hotel and accommodation among the travellers and tourists from Middle East country to Malaysia. Currently, available HRH branches has been 250 hotels around the world to meet the demand in tourism industry. In Malaysia, each HRH consists of 1000 rooms per hotel to meet the customer's requirement and demand. Each rooms need the shower gel bar and the hotel managers need to forecast on room service items, especially on the shower gel bar. The daily demands for the shower gel bar are 2000 bars. Ordering cost is RM5 and the inventory holding cost is RM 0.70 per bar per year. The delivery lead time from supplier is 5 days. The yearly room service is 365 days approximately.

(i) Estimate the Economic Order Quantity (EOQ) for the shower gel bar.

(5 marks)

(ii) Based on EOQ obtained in **Q4(b)(i)**, suggest the requirement for Annual Inventory Cost.

(5 marks)

Q5 (a) Statistical Process Control (SPC) has been widely implemented for quality control in manufacturing industry. Beside control chart, describe the other **THREE (3)** tools in SPC that involve variable data analysis.

(6 marks)

(b) A critical dimension in hard disc drive manufacturing is monitored and controlled using control chart. Each plot in the control chart is taken based on data of four (4) measurement samples as summarized in **Table Q5(b)**.

(i) If the central line for X-bar is 195, propose its control limits.
[Design parameter for X-bar is $A_2 = 0.729$]

(7 marks)

(ii) Based on the plotting of X-bar chart, discuss the quality condition of the critical dimension (in-control, out-of-control or others).

(7 marks)

Table Q5(b): Assembly tasks information

Number of Subgroup Samples	X_1	X_2	X_3	X_4
1	131.0	184.8	182.2	212.8
2	181.3	193.2	180.7	174.3
3	154.8	170.2	168.4	174.4
4	157.5	154.2	169.1	161.9
5	216.3	174.3	166.2	184.3
6	186.9	180.2	149.2	185.0
7	167.8	143.9	157.5	194.9
8	178.2	186.7	142.4	167.6
9	162.6	143.6	132.8	177.2
10	172.1	191.7	203.4	196.3

Q6 **Figure Q6** illustrates the Bill of Materials for product A. The Master Production Schedule for product A calls for 50 units in week 2, 65 units in week 5, and 80 units in week 8. Item C is produced to make product A and to meet the forecasted demand for replacement parts. Past replacement part demand has been 20 units per week (add 20 units per week to gross requirements of item C). The lead times for items F and C are 1 week, and for the other items the lead time is 2 weeks. No safety stock is required for items B, C, D, E, and F. The L4L lot-sizing rule is used for items B and F; the POQ lot-sizing rule (P=3) is used for item C. Item E has an FOQ of 600 units, and D has an FOQ of 250 units. On-hand inventories are 50 units of B, 50 units of C, 120 units of D, 70 units of E, and 250 units of F. Item B has a scheduled receipt of 50 units in week 2. Based on your analysis, develop a material requirements plan for the next 8 weeks for items B, C, D and E. (C4).

(20 marks)

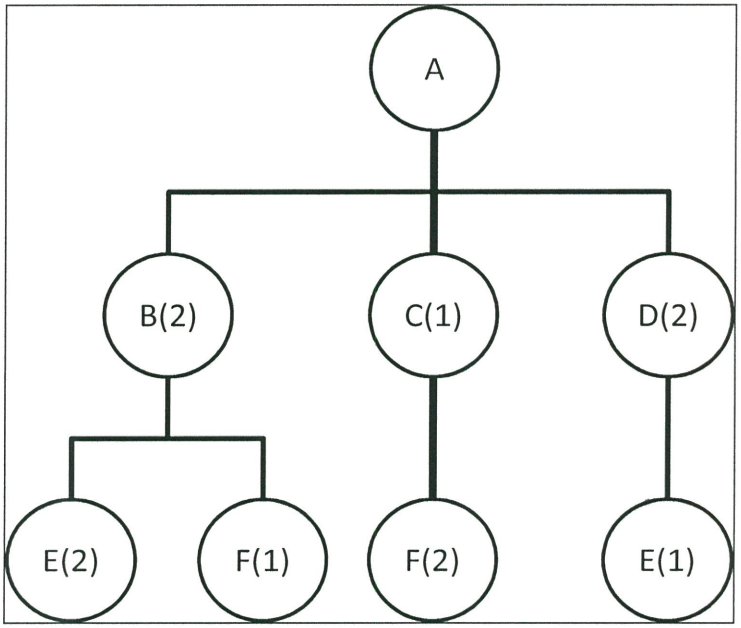

Figure Q6: Bill of materials for Product A

- **END OF QUESTIONS –**

FINAL EXAMINATION

SEMESTER / SESSION : SEMESTER I /2016/2017 PROGRAM : 4BDD
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EQUATIONS

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

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

$$UCL_R = D_4\overline{R} \qquad \mathrm{CL}_{\bar{x}} = \bar{\bar{x}} \pm A_2\,\overline{R} \qquad \bar{\bar{X}} = \frac{\sum \bar{X}}{g}$$

$$LCL_R = D_3\overline{R}$$

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

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

Standard Time, ST

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

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