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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER II  
SESSION 2020/2021**

COURSE NAME : INDUSTRIAL ENGINEERING  
COURSE CODE : BDA 40703  
PROGRAMME : BDD  
EXAMINATION DATE : JULY 2021  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ANY **FIVE (5)** FROM **SIX (6)**  
QUESTIONS PROVIDED

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

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- Q1** (a) As an Industrial Engineer, you are assigned to design the working posture of standing workstation for production operators as shown in **Figure Q1**. Using appropriate sketches, propose the design concepts for the recommended working posture of standing workstation. (10 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 describe 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? Apply **THREE (3)** methods. (6 marks)
- Q2** (a) A proper plan for layout design is crucial in facilities planning. Using schematic diagram, describe a characteristic of product layout design. Support your answer with an example. (6 marks)
- (b) A factory engineer is assigned to setup a production line to meet increased demand. The production line data are summarized in **Table 2**.

**Table 2:** Production line data

Task	Performance Time (minute)	Immediate Predecessors
P	6	None
Q	7	P
R	5	P
S	6	Q
T	5	Q
U	6	Q
V	8	R
W	6	S, T, U
X	11	V
Y	10	W, X

- (i) Sketch the precedence diagram of the dress production. (5 marks)

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- (ii) In production line, the cycle time was estimated at 13 minutes per unit. Propose the minimum number of workstation using numerical and feed forward grouping method. (6 marks)
- (iii) The effective operations time are 6 hours per day and 5 days per week. Estimate the weekly capacity of dress production line. (3 marks)

**Q3 (a)** The annual sales for the company for the recent year was 27000 unit and the company foresee a 8% increase in sales for the coming year. The normal operating time is 8 hours per day, 24 days per month while average worker’s wage is RM1550.00 per month. Currently the company employs 30 workers and are seriously considering to reduce them. Upon receiving an instruction from the manager, the assembly line supervisor collected the time study data as summarized in **Table 3**. The process sequence in the assembly line follows a specific route of processes A, B, C, D, and E respectively. Job element B is in full automatic mode and requires one operator at the workstation. Other job elements are in manual mode and were rated 105% for element A, 115% for element C, 90% for element D and 85% for element E. The company practices standard allowances of 8% for fatigue, 3% for personal, and 3% for delay. Estimate the standard time for the overall assembly process. (9 marks)

**Table 3:** Average processing time

<b>Job Element</b>	<b>Processing Time (in minutes)</b>
A	15
B	25
C	29
D	37
E	31

(b) A total of 6-day data was collected for a work sampling study at an assembly line. Each day, the line was operating for 10 hours. A total of 720 observations were conducted throughout the study period. The summary of the observations is shown in **Table 4**. The average monthly salary of the worker is RM 1450 per person and the factory is currently employing 55 workers with operation time of 24 days per month and is expecting to increase the line output to 20,000 units per month within next year. Determine a suitable standard time (in minute per unit) for the assembly process by applying the industrial engineering approach. (5 marks)

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**Table 4:** Work sampling data

Item	Data
Production in progress	85% observations
Production is stopped due to various reasons	15% observations
Total output over 6 days study	3880 units
Factory rating during the study	88%
Time study allowance	16%

- (c) The standard time for a purely manual assembled product is 40 minutes per unit. The company is currently employing 13 workers in first shift and 10 workers in second shift. The shift working period per day is 9 hours for first shift and 7 hours for second shift. Both shifts operates for 20 days per month and every month 5 workers from the first shift are arranged working 3 hour overtime for 15 days. The overtime pay rate is 50% more than the ordinary shift wage. The company is planning to reduce the output by 590 units per month. The decision priority is first to totally avoid overtime and followed by reduction of workers if necessary. Propose the number of operators to be terminated and decide at which shift.

(6 marks)

- Q4** (a) Differentiate between ‘Loading’ and ‘Sequencing’.

(2 marks)

- (b) Five jobs are waiting to be assigned at PMM manufacturing company. **Table 5** shows the scheduling data which involves the jobs (in the order they arrived), processing time, and due date for the job.

**Table 5:** Scheduling data

Engine block	Processing time (days)	Due date (days)
A	6	8
B	2	6
C	8	18
D	3	15
E	9	23

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

(9 marks)

- (ii) Based on schedules in **Q4(b)(i)**, justify the most appropriate sequencing rules if ‘Delivery Time’ is the main criteria.

(3 marks)

- (c) Tyra Hotel has 1000 rooms to be offered to the customers. Daily demand for the bar soaps at the hotel are two units for each room. Ordering cost is RM5 and the holding cost is RM 0.70 per unit per year. The delivery times from supplier are five days. The hotel operates 365 days every year.
- (i) Calculate the Economic Order Quantity (EOQ) for the bar soaps. (3 marks)
  - (ii) Based on EOQ obtained in **Q4(c)(i)**, estimate the optimal total annual inventory cost. (3 marks)

- Q5** (a) Majujaya Automotive Manufacturing Sdn. Bhd. produces car parts for local and ASEAN market. Currently, the company is having unnecessary movement, inefficient processing, excessive inventories, long waiting time, and high number of defects. The company intends to implement Lean concepts in the Manufacturing Planning and Control. As a consultant, recommend how the company should implement the lean concepts. Use illustrations and diagrams to support your recommendation. (8 marks)
- (b) The product tree structure in **Figure Q5** shows the components required to assemble one unit of product A. The assembly department to begin final assembly according to the following schedule: 100 units in week 2, 200 units in week 4, 120 units in week 6, 180 units in week 7, and 60 units in week 8. Inventory records are shown in **Table 6**. Analyze the material requirement planning for each item / component. (12 marks)

**Table 6:** Push and pull production

Data category	Item			
	B	C	D	E
Lot-sizing rule	POQ (P=3)	L4L	FOQ = 500	L4L
Lead time	1 week	2 week	3 week	1 week
Schedule receipt	None	200 (week 1)	None	500 (week 1)
Beginning (on hand) inventory	20	0	425	100

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**Q6** (a) Differentiate between product and service quality using Garvin’s quality dimensions. Support your comparison with suitable examples. (4 marks)

(b) Bandar Universiti collects the following recyclable waste from its residents: glass, plastic, paper, aluminum, yard waste, and iron. One of its primary aims for next year is to encourage residents to reuse the recyclables as much as possible before disposing of them. **Table 7** shows data regarding how much waste of each category was recycled during the previous year.

**Table 7:** Data related to recycled waste

No	Recycled Waste	Number of Tons (in hundreds)
1	Glass	200
2	Plastic	50
3	Paper	800
4	Aluminium	260
5	Yard waste	200
6	Iron	210

(i) You are required to identify the categories of waste that contribute the most to the total waste. Propose a suitable Quality Control Tool for graphically representing this situation. Support your recommendation by creating the appropriate quality control tool. (10 marks)

(ii) You should be able to identify category of recycled waste that contribute the most to the total waste in **Q6(b)(i)**. Recommend a suitable Quality Control Tool to create a snapshot of possible causes related to this main issue. Support your recommendation by creating the appropriate quality control tool. (6 marks)

- END OF QUESTION -

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FIGURE



FIGURE Q1 Working postures

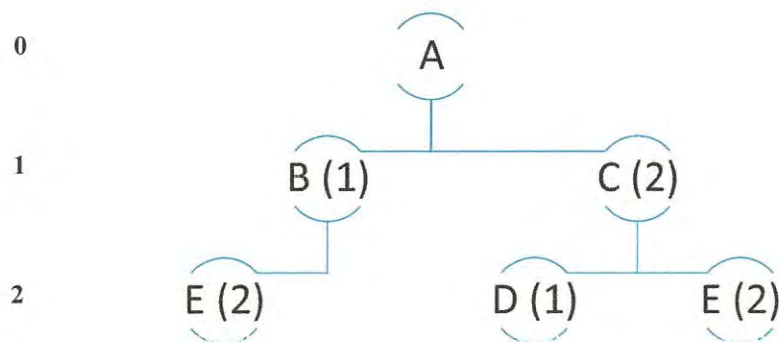


FIGURE Q5 Product tree structure

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