Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

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

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

Q1 (a) The rapidly spreading COVID-19 pandemic has affected many people worldwide. Due to the high infectivity, countries make calls to stay at home or take measures such as lockdowns to ensure that people are least affected by the virus. Meanwhile, infected people are getting treatments: people who are slightly affected are quarantined, and those who are heavily affected are treated in hospitals. Hence there is an excessive increase in the hospital workload. This causes physical fatigue in healthcare professionals. Along with the increasing workload, the fear of being infected and infecting the environment causes psychological problems in healthcare professionals. It is important to protect healthcare professionals and provide them with suitable working conditions. If you are required to manage the healthcare professionals in order to reduce their workloads, fatigue problems and shortage of staffs due to quarantined order, propose at least **THREE (3)** roles that can be performed by you to solve these problems.

(3 marks)

(b) One of the problems now confronting societies is the lack of equipment to successfully encounter this virus. This virus propagates rapidly, so any failure in dealing with its prevalence dramatically increases the number of infected people. If communities are faced with a shortage of medical/healthcare equipment, an increase in the number of infected people can initiate an irreparable and incredible catastrophe. The provision of some strategies and solutions to reduce the outbreak rate of this disease, and the coordinated management of infected people, can lead to the breakdown or deceleration of the virus chain since no definitive cure has been identified for the disease at this point. Healthcare equipment and services, such as coronavirus testing kits, masks, gloves, etc. are not available to all the people in the society. What do you need to do in order to ensure these supplies will be fulfilled the demand? Suggest at least **TWO (2)** initiatives.

(4 marks)

(c) A military field hospital was set up by the Malaysian armed forces at Tawau Sports Complex to reduce medical burden of Tawau Hospital; which was converted into fully Covid-19 hospital. Some of the medical equipment were flown by Malaysian Airforce from Kuala Lumpur. The field hospital, set up at the badminton courts of the Tawau Sports Complex, offers general medical treatment, orthopaedic care and health treatment for women and children. As one of the special team to set up this hospital, you are required to make some planning before the set up could be performed. If the sports complex is 80 metres long and 45 metres wide:

(i) Propose the floor plan of the hall which includes 4 medical wards. Assume that the hall is only for wards, without other facilities (operation theatre, examination room, toilets etc.).

(4 marks)

(ii) Determine the maximum number of beds that could be accommodated into the hall. You should identify and state which body dimensions in anthropometric data that you referred to.

(9 marks)

Q2 (a) ETTE Global provides delivery service around Selangor, Negeri Sembilan, Melaka and Johor. **Table 1** shows more than 400 trips of delivery to major customer locations per month. The operations cost is high since the delivery centre (DC) currently located at Location D. In order to optimize the operations cost, this company plans to find a new DC location

Table 1: Location and delivery data

Location	Coordinate X	Coordinate Y	Delivery Frequency
A	2	7	92
B	6	3	87
C	3	5	73
D	1	8	55
E	4	3	60
F	7	2	33
G	9	1	38

(i) Suggest the economic location using Minisum method.

(7 marks)

(ii) Based on the Minisum location in **Q2(b)(i)**, estimate the Delivery Frequency-Distance score.

(3 marks)

(b) Perfume Shop Company is considering several locations for their business centre. Annual fixed cost and variable cost are shown in **Table 2**. Based on 500 tanks of perfume as an expected maximum sales per year, analyze the production volume over which each location would be best. Use the plotting and numerical methods to determine the exact value.

(10 marks)

Table 2. Fixed cost and variable cost data

Location	Fixed Cost (RM)	Variable Cost (RM per tank)
A	1.6 million	3,800
B	1.0 million	4,600
C	1.4 million	3,200
D	2.0 million	2,600

Q3 (a) In some industries, work sampling is the common methods used to calculate and study the capacity and productivity of the production line. **Table 3** shows the data collected during a work sampling study at a special toy final assembly line. A total of 6 days was allocated for the study and each day, the plant was operating for 10 hours. A total of 360 observations were conducted over the study period. The average monthly salary of the worker is RM 1450 per person and the factory is currently employing 55 workers. In view of the unstable economic condition, the management has been recommended to revise the number of workers. Use the given information to determine a suitable standard time (in min per unit) for the final assembly process by applying the industrial engineering approach.

(5 marks)

Table 3: Work sampling data

Item	Data
Production in progress	306 observations
Production is stopped due to various reasons	54 observations
Total output over 6 days study	2852 units
Factory rating during the study	90%
Time study allowance	15%

(b) As a young engineer in a company, you are requested to evaluate the current production planning issue and propose the number of operators that must be arranged to perform the overtime work daily in order to meet the production output. The company is assemblying classic wooden music box which is done purely using manual assembly process. The standard time for the product is 51 min per unit. The company is currently employing 9 workers and having a working period of 8 hours per day with 22 days per month. The company is planning to produce 2080 units of output per month. The arrangement of overtime in the company is limited to only 12 days per month and it is executed 4 hours every day over the 12 day period.

(9 marks)

(c) The standard time for a purely manual assembled product is 30 minutes per unit. The company is planning to produce 5000 units per month. The company implements minimum number of worker and the management allows 6 workers for overtime within a total of 10 days per month and limited to 3 hours per worker per day. The company is in operations for 20 days permonth and the regular working time excluding the overtime is 9 hours perday. Evaluate the situation and propose the number of operators to be employed by the company.

(6 marks)

Q4 (a) Explain **THREE (3)** important elements should contain in a good production schedule?

(3 marks)

(b) In production line, five engine blocks are waiting for re-bore process as recorded in **Table 4**. The company has appointed technical consultant in diagnosing engine problems, estimating processing times and negotiating with customers

Table 4: Task and work center

Engine block	Processing time (hours)	Due date (hours)
A	8	10
B	6	12
C	15	20
D	3	18
E	12	22

(i) Arrange the schedule for the technical consultant by using EDD and SPT rules.

(4 marks)

(ii) Propose the sequence rule based on average tardiness analysis.

(3 marks)

(c) DKing Industry stocks large quantity of split type air conditioning units to regional suppliers, contractors and retailers. Demand is 15,000 unit per year, Order Quantity is 600 unit per order based on present order, Holding Cost is RM1.50 per unit per year, and Ordering Cost is RM12.00 per order. The firm is operating 250 days in a year and production rate – 100 unit.

(i) Determine the annual inventory cost saving if EOQ model is applied.

(7 marks)

(ii) How frequent should the order placed to meet the demand?

(3 marks)

Q5 (a) Differentiate and populate in the **Table 5**, Push Production, Hybrid Production and Pull Production based on the items below:

Table 5: Push and Pull production

	Item	Push Production	Hybrid Production	Pull Production
1	Production strategy			
2	Based on demand type			
3	Use when demand is			
4	Use when customers requirement			

(6 marks)

(b) ASW Pte. Ltd. offers a number of standard products to encourage writing outside of the classroom, including clipboards, lapdesks, lapboards, and pencil boxes. Rising costs and inventory levels have prompted the company to install a computerized planning and control system called Materials Requirement Planning (MRP). The Master Production Schedule (MPS) and bill of material modules are up and running. Before going live with the MRP module, Asmawi Sdn Bhd has asked for a manual demonstration. Since manual calculations can be quite tedious, you have decided to prepare MRP matrices for only three items—the clipboard and lapdesk, and a common component, pressboard. The master production schedule, abbreviated product structure diagrams, and inventory information are given in **Table 6**, **Table 7** and **Figure Q5**.

(i) Analyze the MRP for each item / component.

(12 marks)

(ii) Construct a Planned Order Report from the Planned Order Release.

(2 marks)

Table 6: Master production schedule

	1	2	3	4	5
Clipboard	85	95	120	100	100
Lapdesk	0	60	0	60	0

Table 7: Item master file

	Clipboard	Lapdesk	Pressboard
On hand	25	20	150
On order (sch receipt)	175 (period 1)	0	0
LLC	0	0	1
Lot size	L4L	Multi 50	Min 100
Lead time	1	1	1

Q6 **Table 8** shows the measurement of six samples of vials in a pharmaceutical company.

(a) Explain **TWO (2)** sources of variation.

(2 marks)

(b) Determine upper and lower control limits for $\overline{X}$ chart and R chart. Use two decimal points. Refer the information in **Table 9** to compute the control limits.

(8 marks)

(c) Draw X and R control charts.

(8 marks)

(d) Based on control charts in **Q6(c)**, evaluate whether the process is in-control. Justify your answer.

(2 marks)

Table 8: Measurement of vials

Subgroup Number	Measurement (gram)					
	X_1	X_2	X_3	X_4	X_5	X_6
1	52.22	52.85	52.41	52.55	53.10	52.47
2	52.25	52.14	51.79	52.18	52.26	51.94
3	52.37	52.69	52.26	52.53	52.34	52.81
4	52.46	52.32	52.34	52.08	52.07	52.07
5	52.06	52.35	51.85	52.02	52.30	52.20
6	52.59	51.79	52.20	51.90	51.88	52.83
7	51.82	52.12	52.47	51.82	52.49	52.60
8	52.51	52.80	52.00	52.47	51.91	51.74
9	52.13	52.26	52.00	51.89	52.11	52.27
10	51.18	52.31	51.24	51.59	51.46	51.47
11	51.74	52.23	52.23	51.70	52.12	52.12
12	52.38	52.20	52.06	52.08	52.10	52.01
13	51.68	52.06	51.90	51.78	51.85	51.40
14	51.84	52.15	52.18	52.07	52.22	51.78
15	51.98	52.31	51.71	51.97	52.11	52.10
16	52.32	52.43	53.00	52.26	52.15	52.36
17	51.92	52.67	52.80	52.89	52.56	52.23
18	51.94	51.96	52.73	52.72	51.94	52.99
19	51.39	51.59	52.44	51.94	51.39	51.67
20	51.55	51.77	52.41	52.32	51.22	52.04
21	51.97	51.52	51.48	52.35	51.45	52.19
22	52.15	51.67	51.67	52.16	52.07	51.81

Table 9: 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	2.574
4	0.729	0	2.282
5	0.577	0	2.114
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

- END OF QUESTION -