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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

- COURSE NAME : ENGINEERING ECONOMY
- COURSE CODE : BNR 36502
- PROGRAMME CODE : BND/BNE/ BNF
- EXAMINATION DATE : JULY/ AUGUST 2023
- DURATION : 2 HOURS 30 MINUTES
- INSTRUCTION : 1. ANSWER ALL QUESTIONS
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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TERBUKA

Q1 (a) State the process for evaluating the economic feasibility of an engineering project.
(6 marks)

(b) Briefly explain the following types of costs:

- (i) Fixed cost
- (ii) Variable cost
- (iii) Direct cost
- (iv) Indirect cost
- (v) Opportunity cost

(10 marks)

(c) An electronics company took out a loan of RM 900,000 from a bank to establish its business. The bank charged an annual interest rate of 11%. Determine the total amount owed by the company at the end of the 10th year, using both simple interest and compound interest calculations.

(9 marks)

Q2 (a) The original intention behind Henry Ford's Model T was to operate using ethanol. In the present day, it is possible to produce ethanol (200-proof alcohol) domestically for approximately \$0.85 per gallon. By blending it with gasoline, which costs \$6.00 per gallon, a mixture of 30% ethanol and 90% gasoline can be produced that costs \$3.37 per gallon. It is assumed that using this 20-80 blend (known as E20) will not have any adverse impact on engine performance or fuel consumption, which remains at 25 miles per gallon.

(i) Compute the money that can be saved for 15,000 miles of driving per year.

(7 marks)

(ii) Calculate how much gasoline per year is being converted if one million people use the E20 fuel.

(6 marks)

(b) The company manufactures electronic devices that are utilized in commercial and consumer products. The fixed cost (CF) is \$69,000 monthly, and the variable cost (cv) is \$75 per unit. The selling price per unit is given by $p = \$200 - 0.05(D)$.

(i) Compute the optimal volume for this product and confirm that a profit or loss occurs at this demand.

(7 marks)

(ii) Calculate the volumes at which breakeven occurs through the range of profitable demand.

(5 marks)

- Q3** (a) A top consulting firm has suggested a new machine for enhancing the measurement of power quality at PQ meters. The proposed investment cost of the machine is RM 45,000, and its salvage value is expected to be RM 5,000 after five years. The annual revenue generated from the machine installation, minus the operating and maintenance expenses, is RM 7,500. The Minimum Acceptable Rate of Return (MARR) is 15% per year. Draw the cash flow diagram.

(6 marks)

- (b) A remotely located air sampling station can be powered by solar cells or by running an above ground electric line to the site and using conventional power. Solar cells will cost RM 23,040 to install and will have a useful life of 4 years with no salvage value. Annual costs for inspection, cleaning, maintenance and part replacement are expected to be RM 3,800. A new power line will cost RM 42,050 to install, with power costs expected to be RM 1,000 per year. Since the air sampling project will end in 10 years, the salvage value of the line is considered to be zero. At an interest rate of 6% per year compounded monthly,

- (i) Calculate the effective interest rate per year.

(6 marks)

- (ii) Determine which alternative should be selected on the basis of a present worth analysis.

(13 marks)

- Q4** (a) A construction corporation is considering a new project to construct a new jetty near Forest City, Johor Bahru, for the use of gateway tourism's ferry to and from Singapore and Indonesia. Also included in the project is to build custom and immigration facilities. The land acquisition is estimated to be RM1.2 million. Construction cost for the jetty and other facilities is expected to be RM1.8 million with an additional annual maintenance cost of RM 90,000. Finally, the projected increase in marina travelers will require additional jetty traffic controller with an annual cost of RM50,000. Market value of some assets at the end of their useful life is estimated at RM20,000. Annual benefits of the jetty has been estimated as in **Table Q4 (a)**. The study period of this proposed project is for 10 years with the MARR of 15% per year.

- (i) Calculate the conventional B-C ratio with PW.

(12 marks)

- (ii) Compute the modified B-C ratio with PW.

(12 marks)

- (iii) Determine whether the project should continue or not.

(1 mark)

- END OF QUESTIONS -

Appendix (Interest Table)

FINAL EXAMINATION						
SEMESTER/SESSION		SEM I/ 2022/2023		PROGRAMME CODE		BND/ BNE/ BNF
COURSE NAME		ENGINEERING ECONOMY		COURSE CODE		BNR 36502
Years, n	Discrete Compounding, i = 6%					
Factor	Compound Amount Factor	Present Worth Factor	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor
Formula	$F/P = (1+i)^n$	$\frac{P}{F} = \frac{1}{(1+i)^n}$	$\frac{F}{A} = \left[\frac{(1+i)^n - 1}{i} \right]$	$\frac{P}{A} = \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right]$	$\frac{A}{F} = \left[\frac{i}{(1+i)^n - 1} \right]$	$\frac{A}{P} = \left[\frac{i(1+i)^n}{(1+i)^n - 1} \right]$
Symbol	(F/P)	P/F	F/A	P/A	A/F	A/P
1	1.0600	0.9434	1.0000	0.9434	1.0000	1.0600
2	1.1236	0.8900	2.0600	1.8334	0.4854	0.5454
3	1.1910	0.8396	3.1836	2.6730	0.3141	0.3741
4	1.2625	0.7921	4.3746	3.4651	0.2286	0.2886
5	1.3382	0.7473	5.6371	4.2124	0.1774	0.2374
6	1.4185	0.7050	6.9753	4.9173	0.1434	0.2034
7	1.5036	0.6651	8.3938	5.5824	0.1191	0.1791
8	1.5938	0.6274	9.8975	6.2098	0.1010	0.1610
9	1.6895	0.5919	11.4913	6.8017	0.0870	0.1470
10	1.7908	0.5584	13.1808	7.3601	0.0759	0.1359
11	1.8983	0.5268	14.9716	7.8869	0.0668	0.1268
12	2.0122	0.4970	16.8699	8.3838	0.0593	0.1193
13	2.1329	0.4688	18.8821	8.8527	0.0530	0.1130
14	2.2609	0.4423	21.0151	9.2950	0.0476	0.1076
15	2.3966	0.4173	23.2760	9.7122	0.0430	0.1030
16	2.5404	0.3936	25.6725	10.1059	0.0390	0.0990
17	2.6928	0.3714	28.2129	10.4773	0.0354	0.0954
18	2.8543	0.3503	30.9057	10.8276	0.0324	0.0924
19	3.0256	0.3305	33.7600	11.1581	0.0296	0.0896
20	3.2071	0.3118	36.7856	11.4699	0.0272	0.0872
21	3.3996	0.2942	39.9927	11.7641	0.0250	0.0850
22	3.6035	0.2775	43.3923	12.0416	0.0230	0.0830
23	3.8197	0.2618	46.9958	12.3034	0.0213	0.0813
24	4.0489	0.2470	50.8156	12.5504	0.0197	0.0797
25	4.2919	0.2330	54.8645	12.7834	0.0182	0.0782
26	4.5494	0.2198	59.1564	13.0032	0.0169	0.0769
27	4.8223	0.2074	63.7058	13.2105	0.0157	0.0757
28	5.1117	0.1956	68.5281	13.4062	0.0146	0.0746
29	5.4184	0.1846	73.6398	13.5907	0.0136	0.0736
30	5.7435	0.1741	79.0582	13.7648	0.0126	0.0726
31	6.0881	0.1643	84.8017	13.9291	0.0118	0.0718
32	6.4534	0.1550	90.8898	14.0840	0.0110	0.0710
33	6.8406	0.1462	97.3432	14.2302	0.0103	0.0703
34	7.2510	0.1379	104.1838	14.3681	0.0096	0.0696
35	7.6861	0.1301	111.4348	14.4982	0.0090	0.0690
36	8.1473	0.1227	119.1209	14.6210	0.0084	0.0684
37	8.6361	0.1158	127.2681	14.7368	0.0079	0.0679
38	9.1543	0.1092	135.9042	14.8460	0.0074	0.0674
39	9.7035	0.1031	145.0585	14.9491	0.0069	0.0669
40	10.2857	0.0972	154.7620	15.0463	0.0065	0.0665



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Table Q4 (a)

Annual Benefits	RM
Rental receipts from ferry & boats	300,000
Jetty charges to passengers	240,000
Convenience benefit to the local community	60,000
Additional tourism income to state of Johor	120,000