Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	ENGINEERING ECONOMY
COURSE CODE	:	BDA 40902
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	FEBRUARY 2023
EXAMINATION PERIOD	:	2 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS IN **SECTION A** AND SELECT ONLY **ONE (1)** QUESTION IN **SECTION B** 2. THIS FINAL EXAM IS CONDUCTED VIA **CLOSED BOOK** 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

SECTION A: Answer ALL questions

Q1 (a) State the diffence between sequential and concurrent engineering and list out **THREE (3)** benefits of concurrent engineering concept.

(5 marks)

(b) A university lab is a research contractor to MOSTI for in-space fuel cell systems that are hydrogen and methanol-based. During the lab research, three equal-service machines need to be evaluated economically. The MARR is 10% per year.

Table Q1(b)

Items	Electric-Powered	Gas-Powered	Solar-Powered
First cost, RM	-4,500	3,500	-600
Annual operating cost (AOC), RM/year	-900	-700	-50
Salvage value, RM	200	350	100
Life, years	8	8	8

(i) Draw a cash-flow diagram for each of the fuel cell system

(9 marks)

(ii) Determine the present worth (PW) analysis for each of the fuel system with the costs shown above in **Table Q1(b)**.

(9 marks)

(iii) Justify which fuel cell systems is preferred

(2 marks)

Q2 (a) Identify each of the following cash flow to indicate whether it is a benefit, a disbenefit, or a cost.

(i) Most Malaysian eat a diet rich in heavily processed foods which have been made from synthetic ingredients, and packed with fat, sugar, sodium, chemicals, preservatives, food dyes and other additives which may be detrimental to your overall health and well-being.

(1 mark)

(ii) Last month's floods led to about RM2.6 billion in damage to houses, household possessions and vehicles, the department of statistics said.

(1 mark)

(iii) No matter what type of trail you find yourself on, hiking is a great whole-body workout from head to toe and everything in between.

(1 mark)

(iv) Playing badminton boosts up the muscle strength making you strong and fit,

(1 mark)

(v) Highways displace hundreds of families and tens of thousands of acres of farmland and may end up splitting some communities in two.

(1 mark)

(b) A new project has been proposed by UTHM management to develop UTHM Aeronautic Technology Center at Tanjung Laboh, Batu Pahat Johor, for teaching and learning (T&L) courses related to Bachelor of Aeronautical Engineering Technology (Professional Piloting) with Honours. The land acquisition is estimated to be RM 0.7 million. Construction cost for the Aeronautic Technology Center is expected to be RM 1.2 million with an additional annual maintenance cost of RM 80,000. Finally, the Aeronautic Technology Center project will require an additional operation annual cost of RM 36,000. By realizing this, it is estimated that the number of students will increase and consequently giving more benefits via payment of student fees of RM 400,000/year. In addition, the center will also be benefited from the research grand awarded worth RM 90,000/year as well as providing convenient research placed for UTHM community worth RM 35,000/year. Apply the B/C ratio method for both conventional and modified cases using PW and AW method with a study period of 10 years and MARR of 12% per year to justify whether the Aeronautic Technology Center should be initiated or not.

(i) Conventional B/C ratio with PW

(5 marks)

(ii) Modified B/C ratio with PW

(5 marks)

(iii) Conventional B/C ratio with AW

(5 marks)

(iv) Modified B/C ratio with AW

(5 marks)

Q3 (a) An asset which has a first cost of RM 40,000 is expected to have an annual operating cost of RM 15,000 per year. It will provide the needed service for a maximum of 6 years. If the salvage value changes as shown below in **Table Q3(a)**, determine the economic life of the asset at 20% per year.

Table Q3(a)

Year	Salvage Value, RM
0	0
1	10,000
2	8,000
3	5,000
4	5,000
5	3,000

(10 marks)

(b) A furniture company intends to evaluate whether they want to stick with the existing equipment (defender) or replace them with the new productive equipment (challenger). The details of the cost required are shown in **Table Q3(b)** below. Use an interest rate of 20% per year.

Table Q3(b)

Items	Defender	Challenger
Initial cost eight (8) years ago (RM)	450,000	-
Market value (RM)	25,000	700,000
Yearly handling cost (RM)	160,000	70,000
Life time (year)	5	10
Salvage value (RM)	0	50,000

(i) Use the replacement analysis to justify whether the existing equipment is required to be replaced with the new equipment.

(10 marks)

(ii) If the existing equipment (defender) could be sold in international market, determine how much is the minimum value of the defender so that the challenger could replace the defender now?

(5 marks)

SECTION B: Answer ONE question only

Q4 (a) Identify each of the following cash items whether it is fixed cost, variable cost, sunk cost, opportunity cost or implicit cost.

(i) You spend RM 30,000 to train your staff on how to use the new software you have installed on your company's computers.

(1 mark)

(ii) Fuel for a delivery business.

(1 mark)

(iii) Fuel for a food truck business.

(1 mark)

(iv) A student spends three hours and RM 20 at the movies the night before an exam.

(1 mark)

(v) Payments that you can earn from a rented property and annual cash flow from stock sales

(1 mark)

(b) Bridal Shoppe sells wedding dresses. The cost of each dress is comprised of the following cost items shown in **Table Q4(b).**

Table Q4(b)

COST ITEMS	RM
1. Selling price	1,000
2. Variable (flexible) cost	400
3. Fixed (capacity) cost	90,000

(i) Determine the Bridal Shoppe's total profit when 200 dresses are sold

(2 marks)

(ii) Determine how many dresses must Bridal Shoppe sell to yield a profit of RM60,000?

(2 marks)

(iii) Evaluate how will the company's viability if the sales price increases by RM100 per dresses (10 percent) but the demand for the dresses slightly drop by 20% from **Q4(b)(ii)** due to the increment of the price.

(6 marks)

(c) Star Symphony would like to perform for a neighboring city. Fixed costs for the performance total RM 5,000. Tickets will sell for RM 15 per person, and an outside organization responsible for processing ticket orders charges the symphony a fee of RM 2 per ticket. Star Symphony expects to sell 500 tickets.

(i) Determine how many tickets must Star Symphony sell to break even.

(3 marks)

(ii) Calculate how many tickets must the symphony sell to earn a profit of RM 7,000.

(3 marks)

(iii) Determine how much must Star Symphony have in sales to break even.

(2 marks)

(iv) Calculate how much must Star Symphony have in sales to earn a profit of RM 7,000?

(2 marks)

Q5 (a) Naza Automotive Manufacturing Sdn. Bhd. needs a RM 1 million balance in its contingency fund 3 years from now. The CFO (Chief Financial Officer) wants to know how much to deposit now into Naza's high-yield investment account. Determine the amount if it grows at a rate of 20% per year.

(i) Simple interest

(3 marks)

(ii) Compound interest

(4 marks)

(b) A design-build-operate engineering company in Pasir Gudang that owns a sizable amount of land plans to lease the drilling rights (oil and gas only) to a mining and exploration company. The contract calls for the mining company to pay RM 20,000 per year for 20 years beginning 3 years from now (Beginning at the end of year 3 and continuing through year 22) plus RM 10,000 six years from now and RM 15,000 sixteen years from now. If the interest rate is 15% per year,

(i) Draw a cash flow to represent the situation

(5 marks)

(ii) Calculate the total present worth in year 0

(7 marks)

(iii) Calculate the future worth in year 22

(6 marks)

- END OF QUESTION –

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LIST OF FORMULA

1	TC = FC + VC(Q)	9	Conventional B-C ratio with PW B-C = PW(B) ÷ [(I – PW(MV)) +PW(O&M)]
2	TR = P x Q	10	Conventional B-C ratio with AW B-C = AW(B) ÷ [CR + AW(O&M)]
3	$I_{effective} = \left(1 + \frac{r}{m}\right)^m - 1$	11	Modified B-C ratio with PW B-C = [PW(B) – PW(O&M)] ÷ [I – PW(MV)]
4	$p\,(1+i)^n$	12	Modified B-C ratio with PW B-C = [AW(B) – AW(O&M)] ÷ CR
5	$F = P\left(\frac{F}{P}, i, n\right) = P(1+i)^n$	13	$P = F\left(\frac{P}{F}, i, n\right) = F\left[\frac{1}{(1+i)^n}\right]$
6	$F = A\left(\frac{F}{A}, i, n\right) = A\left[\frac{(1+i)^n - 1}{i}\right]$	14	$A = F\left(\frac{A}{F}, i, n\right) = F\left[\frac{i}{(1+i)^n - 1}\right]$
7	$P = A\left(\frac{P}{A}, i, n\right) = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$	15	$A = P\left(\frac{A}{P}, i, n\right) = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$
8	CR_k = -P(A/P, i, k) + S_k(A/F, i, k)	16	AW_k = - CR_k - AOC

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INTEREST TABLE

10% Compound Interest Factors 10%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
	Find *F*	Find *P*	Find *A*	Find *A*	Find *F*	Find *P*	Find *A*	Find *P*	
	Given *P*	Given *F*	Given *F*	Given *P*	Given *A*	Given *A*	Given *G*	Given *G*	
n	***F/P***	***P/F***	***A/F***	***A/P***	***F/A***	***P/A***	***A/G***	***P/G***	n
1	1.1000	0.9091	1.0000	1.1000	1.0000	0.909	0.000	0.000	1
2	1.2100	0.8264	0.4762	0.5762	2.100	1.736	0.476	0.826	2
3	1.3310	0.7513	0.3021	0.4021	3.310	2.487	0.937	2.329	3
4	1.4641	0.6830	0.2155	0.3155	4.641	3.170	1.381	4.378	4
5	1.6105	0.6209	0.1638	0.2638	6.105	3.791	1.810	6.862	5
6	1.7716	0.5645	0.1296	0.2296	7.716	4.355	2.224	9.684	6
7	1.9487	0.5132	0.1054	0.2054	9.487	4.868	2.622	12.763	7
8	2.1436	0.4665	0.0874	0.1874	11.436	5.335	3.004	16.029	8
9	2.3579	0.4241	0.0736	0.1736	13.579	5.759	3.372	19.421	9
10	2.5937	0.3855	0.0627	0.1627	15.937	6.145	3.725	22.891	10
11	2.8531	0.3505	0.0540	0.1540	18.531	6.495	4.064	26.396	11
12	3.1384	0.3186	0.0468	0.1468	21.384	6.814	4.388	29.901	12
13	3.4523	0.2897	0.0408	0.1408	24.523	7.103	4.699	33.377	13
14	3.7975	0.2633	0.0357	0.1357	27.975	7.367	4.996	36.800	14
15	4.1772	0.2394	0.0315	0.1315	31.772	7.606	5.279	40.152	15
16	4.5950	0.2176	0.0278	0.1278	35.950	7.824	5.549	43.416	16
17	5.0545	0.1978	0.0247	0.1247	40.545	8.022	5.807	46.582	17
18	5.5599	0.1799	0.0219	0.1219	45.599	8.201	6.053	49.640	18
19	6.1159	0.1635	0.0195	0.1195	51.159	8.365	6.286	52.583	19
20	6.7275	0.1486	0.0175	0.1175	57.275	8.514	6.508	55.407	20
21	7.4002	0.1351	0.0156	0.1156	64.002	8.649	6.719	58.110	21
22	8.1403	0.1228	0.0140	0.1140	71.403	8.772	6.919	60.689	22
23	8.9543	0.1117	0.0126	0.1126	79.543	8.883	7.108	63.146	23
24	9.8497	0.1015	0.0113	0.1113	88.497	8.985	7.288	65.481	24
25	10.835	0.0923	0.0102	0.1102	98.347	9.077	7.458	67.696	25
26	11.918	0.0839	0.0092	0.1092	109.182	9.161	7.619	69.794	26
27	13.110	0.0763	0.0083	0.1083	121.100	9.237	7.770	71.777	27
28	14.421	0.0693	0.0075	0.1075	134.210	9.307	7.914	73.650	28
29	15.863	0.0630	0.0067	0.1067	148.631	9.370	8.049	75.415	29
30	17.449	0.0573	0.0061	0.1061	164.494	9.427	8.176	77.077	30

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12% Compound Interest Factors 12%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
	Find *F*	Find *P*	Find *A*	Find *A*	Find *F*	Find *P*	Find *A*	Find *P*	
	Given *P*	Given *F*	Given *F*	Given *P*	Given *A*	Given *A*	Given *G*	Given *G*	
n	***F/P***	***P/F***	***A/F***	***A/P***	***F/A***	***P/A***	***A/G***	***P/G***	n
1	1.1200	0.8929	1.0000	1.1200	1.000	0.893	0.000	0.000	1
2	1.2544	0.7972	0.4717	0.5917	2.120	1.690	0.472	0.797	2
3	1.4049	0.7118	0.2963	0.4163	3.374	2.402	0.925	2.221	3
4	1.5735	0.6355	0.2092	0.3292	4.779	3.037	1.359	4.127	4
5	1.7623	0.5674	0.1574	0.2774	6.353	3.605	1.775	6.397	5
6	1.9738	0.5066	0.1232	0.2432	8.115	4.111	2.172	8.930	6
7	2.2107	0.4523	0.0991	0.2191	10.089	4.564	2.551	11.644	7
8	2.4760	0.4039	0.0813	0.2013	12.300	4.968	2.913	14.471	8
9	2.7731	0.3606	0.0677	0.1877	14.776	5.328	3.257	17.356	9
10	3.1058	0.3220	0.0570	0.1770	17.549	5.650	3.585	20.254	10
11	3.4785	0.2875	0.0484	0.1684	20.655	5.938	3.895	23.129	11
12	3.8960	0.2567	0.0414	0.1614	24.133	6.194	4.190	25.952	12
13	4.3635	0.2292	0.0357	0.1557	28.029	6.424	4.468	28.702	13
14	4.8871	0.2046	0.0309	0.1509	32.393	6.628	4.732	31.362	14
15	5.4736	0.1827	0.0268	0.1468	37.280	6.811	4.980	33.920	15
16	6.1304	0.1631	0.0234	0.1434	42.753	6.974	5.215	36.367	16
17	6.8660	0.1456	0.0205	0.1405	48.884	7.120	5.435	38.697	17
18	7.6900	0.1300	0.0179	0.1379	55.750	7.250	5.643	40.908	18
19	8.6128	0.1161	0.0158	0.1358	63.440	7.366	5.838	42.998	19
20	9.6463	0.1037	0.0139	0.1339	72.052	7.469	6.020	44.968	20
21	10.804	0.0926	0.0122	0.1322	81.699	7.562	6.191	46.819	21
22	12.100	0.0826	0.0108	0.1308	92.503	7.645	6.351	48.554	22
23	13.552	0.0738	0.0096	0.1296	104.603	7.718	6.501	50.178	23
24	15.179	0.0659	0.0085	0.1285	118.155	7.784	6.641	51.693	24
25	17.000	0.0588	0.0075	0.1275	133.334	7.843	6.771	53.105	25
26	19.040	0.0525	0.0067	0.1267	150.334	7.896	6.892	54.418	26
27	21.325	0.0469	0.0059	0.1259	169.374	7.943	7.005	55.637	27
28	23.884	0.0419	0.0052	0.1252	190.699	7.984	7.110	56.767	28
29	26.750	0.0374	0.0047	0.1247	214.583	8.022	7.207	57.814	29
30	29.960	0.0334	0.0041	0.1241	241.333	8.055	7.297	58.782	30

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15% Compound Interest Factors 15%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
	Find *F* Given *P*	Find *P* Given *F*	Find *A* Given *F*	Find *A* Given *P*	Find *F* Given *A*	Find *P* Given *A*	Find *A* Given *G*	Find *P* Given *G*	
n	***F/P***	***P/F***	***A/F***	***A/P***	***F/A***	***P/A***	***A/G***	***P/G***	n
1	1.1500	0.8696	1.0000	1.1500	1.0000	0.870	0.000	0.000	1
2	1.3225	0.7561	0.4651	0.6151	2.150	1.626	0.465	0.756	2
3	1.5209	0.6575	0.2880	0.4380	3.473	2.283	0.907	2.071	3
4	1.7490	0.5718	0.2003	0.3503	4.993	2.855	1.326	3.786	4
5	2.0114	0.4972	0.1483	0.2983	6.742	3.352	1.723	5.775	5
6	2.3131	0.4323	0.1142	0.2642	8.754	3.784	2.097	7.937	6
7	2.6600	0.3759	0.0904	0.2404	11.067	4.160	2.450	10.192	7
8	3.0590	0.3269	0.0729	0.2229	13.727	4.487	2.781	12.481	8
9	3.5179	0.2843	0.0596	0.2096	16.786	4.772	3.092	14.755	9
10	4.0456	0.2472	0.0493	0.1993	20.304	5.019	3.383	16.979	10
11	4.6524	0.2149	0.0411	0.1911	24.349	5.234	3.655	19.129	11
12	5.3503	0.1869	0.0345	0.1845	29.002	5.421	3.908	21.185	12
13	6.1528	0.1625	0.0291	0.1791	34.352	5.583	4.144	23.135	13
14	7.0757	0.1413	0.0247	0.1747	40.505	5.724	4.362	24.972	14
15	8.1371	0.1229	0.0210	0.1710	47.580	5.847	4.565	26.693	15
16	9.3576	0.1069	0.0179	0.1679	55.717	5.954	4.752	28.296	16
17	10.761	0.0929	0.0154	0.1654	65.075	6.047	4.925	29.783	17
18	12.375	0.0808	0.0132	0.1632	75.836	6.128	5.084	31.156	18
19	14.232	0.0703	0.0113	0.1613	88.212	6.198	5.231	32.421	19
20	16.367	0.0611	0.0098	0.1598	102.444	6.259	5.365	33.582	20
21	18.822	0.0531	0.0084	0.1584	118.810	6.312	5.488	34.645	21
22	21.645	0.0462	0.0073	0.1573	137.632	6.359	5.601	35.615	22
23	24.891	0.0402	0.0063	0.1563	159.276	6.399	5.704	36.499	23
24	28.625	0.0349	0.0054	0.1554	184.168	6.434	5.798	37.302	24
25	32.919	0.0304	0.0047	0.1547	212.793	6.464	5.883	38.031	25
26	37.857	0.0264	0.0041	0.1541	245.712	6.491	5.961	38.692	26
27	43.535	0.0230	0.0035	0.1535	283.569	6.514	6.032	39.289	27
28	50.066	0.0200	0.0031	0.1531	327.104	6.534	6.096	39.828	28
29	57.575	0.0174	0.0027	0.1527	377.170	6.551	6.154	40.315	29
30	66.212	0.0151	0.0023	0.1523	434.745	6.566	6.207	40.753	30

FINAL EXAM

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20% **Compound Interest Factors** 20%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
	Find *F*	Find *P*	Find *A*	Find *A*	Find *F*	Find *P*	Find *A*	Find *P*	
	Given *P*	Given *F*	Given *F*	Given *P*	Given *A*	Given *A*	Given *G*	Given *G*	
n	***F/P***	***P/F***	***A/F***	***A/P***	***F/A***	***P/A***	***A/G***	***P/G***	n
1	1.2000	0.8333	1.0000	1.2000	1.0000	0.833	0.000	0.000	1
2	1.4400	0.6944	0.4545	0.6545	2.200	1.528	0.455	0.694	2
3	1.7280	0.5787	0.2747	0.4747	3.640	2.106	0.879	1.852	3
4	2.0736	0.4823	0.1863	0.3863	5.368	2.589	1.274	3.299	4
5	2.4883	0.4019	0.1344	0.3344	7.442	2.991	1.641	4.906	5
6	2.9860	0.3349	0.1007	0.3007	9.930	3.326	1.979	6.581	6
7	3.5832	0.2791	0.0774	0.2774	12.916	3.605	2.290	8.255	7
8	4.2998	0.2326	0.0606	0.2606	16.499	3.837	2.576	9.883	8
9	5.1598	0.1938	0.0481	0.2481	20.799	4.031	2.836	11.434	9
10	6.1917	0.1615	0.0385	0.2385	25.959	4.192	3.074	12.887	10
11	7.4301	0.1346	0.0311	0.2311	32.150	4.327	3.289	14.233	11
12	8.9161	0.1122	0.0253	0.2253	39.581	4.439	3.484	15.467	12
13	10.699	0.0935	0.0206	0.2206	48.497	4.533	3.660	16.588	13
14	12.839	0.0779	0.0169	0.2169	59.196	4.611	3.817	17.601	14
15	15.407	0.0649	0.0139	0.2139	72.035	4.675	3.959	18.509	15
16	18.488	0.0541	0.0114	0.2114	87.442	4.730	4.085	19.321	16
17	22.186	0.0451	0.0094	0.2094	105.931	4.775	4.198	20.042	17
18	26.623	0.0376	0.0078	0.2078	128.117	4.812	4.298	20.680	18
19	31.948	0.0313	0.0065	0.2065	154.740	4.843	4.386	21.244	19
20	38.338	0.0261	0.0054	0.2054	186.688	4.870	4.464	21.739	20
21	46.005	0.0217	0.0044	0.2044	225.026	4.891	4.533	22.174	21
22	55.206	0.0181	0.0037	0.2037	271.031	4.909	4.594	22.555	22
23	66.247	0.0151	0.0031	0.2031	326.237	4.925	4.647	22.887	23
24	79.497	0.0126	0.0025	0.2025	392.484	4.937	4.694	23.176	24
25	95.396	0.0105	0.0021	0.2021	471.981	4.948	4.735	23.428	25
26	114.475	0.0087	0.0018	0.2018	567.377	4.956	4.771	23.646	26
27	137.371	0.0073	0.0015	0.2015	681.853	4.964	4.802	23.835	27
28	164.845	0.0061	0.0012	0.2012	819.223	4.970	4.829	23.999	28
29	197.814	0.0051	0.0010	0.2010	984.068	4.975	4.853	24.141	29
30	237.376	0.0042	0.0008	0.2008	1,181.88	4.979	4.873	24.263	30