Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	ENGINEERING ECONOMY
COURSE CODE	:	BDA 40902
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JULY / AUGUST 2023
EXAMINATION PERIOD	:	2 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS IN **SECTION A** 2. SELECT **ONE(1)** FROM **TWO(2)** QUESTIONS IN **SECTION B** 3. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**. 4. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION VIA CLOSED BOOK

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

SECTION A: Answer ALL questions

Q1 (a) Using a suitable sketch, briefly describe the Classical Engineering approach and its problem.

(8 marks)

(b) An assistant engineer of Industrial Automation Laboratory plans to purchase a new electro-pneumatic trainer (EPT). In the selection process, there are three equal service life (7 years) EPT brands to be considered.

Table Q1

Items	FETO	BOSS	CMS
Initial cost, RM	40,500	53,500	45,000
Operation and maintenance cost, RM/year	1000	2500	1500
Salvage value, RM	9000	15000	12000

(i) Draw the cash-flow diagrams.

(6 marks)

(ii) Based on data in **Table Q1**, estimate the annuity worth (AW) values. Assume the MARR is 10% per year.

(9 marks)

(iii) Justify which EPT brand to be the most economics.

(2 marks)

Q2 (a) To be a Global Technopreneur University in 2030 (GTU 2030), UTHM plans to invest RM 1.5 million to accommodate research on new learning methods. Through the 15-year research duration, UTHM is expected to gain RM 500,000 per year by attracting new students. To ensure the success of the research, RM 50,000 per year is allocated to research officers as operating costs. Inversely, the allocation for student activities will be reduced by RM 200,000 per year. Based on present worth (PW) and annuity worth (AW) values, apply both conventional B/C ratio and modified B/C ratio to see whether the research plan could be initiated economically. Assume that the MARR is 6% per annum.

(20 marks)

(b) In civil project evaluation theory, briefly describe with example the terms of benefit, disbenefit and cost.

(5 marks)

Q3 ABC company is considering replacing an old machine with a new one. The old machine was purchased 6 years ago for USD 120,000 and has a remaining useful life of 2 years. The new machine costs USD 250,000 and has an expected useful life of 8 years. The annual operating cost of the old machine and new machine are USD 40,000 and USD 30,000 respectively. The salvage value of the old machine and new machine are estimated to be USD 20,000 and USD 100,000 respectively. The company's cost of capital is 8%.

(a) Analyze the economic service life (ESL) of the old machine.

(5 marks)

(b) Analyze the ESL of the new machine.

(5 marks)

(c) Analyze the annual worth (AW) of the old machine.

(5 marks)

(d) Analyze the AW of the new machine.

(5 marks)

(e) Should the company replace the old machine with the new one? Justify your answer based on the AW and ESL analysis.

(5 marks)

SECTION B: Answer ONE question only

Q4 (a) Using an appropriate example, describe the following cost terminologies:

(i) Implicit versus Explicit costs.

(4 marks)

(ii) Sunk cost.

(2 marks)

(iii) Direct versus Indirect costs.

(4 marks)

(b) YEY online shop sells a variety of fragrances. The costs of each fragrance (in average) are given in **Table Q4**.

Table Q4

Items	RM
Selling price	3.00 / unit
Variable cost	1.85 / unit
Fixed cost	1000 / month

(i) Based on the information in **Table Q4**, create a linear equation that relate the profit, return sales and costs.

(6 marks)

(i) Analyze how many units of fragrance must be sold per month to meet break-even point or capital recovery.

(4 marks)

(ii) Calculate how many fragrances need to be sold if YEY online shop targets to gain RM 25,000 profit per month.

(5 marks)

Q5 (a) AERO Company plans to establish a new Foundation to help people 5 years from now. The company's current worth is RM500 million. The company's chief executive officer decided the initial fund of the Foundation is based on 10 percent of the company's future worth. Based on (i) Simple Interest, and (ii) Compound Interest, estimate the amount of initial funds of the Foundation if the Company's worth is constantly growing at a rate of 15% per year.

(10 marks)

(b) Mr. Putra deposited RM 1800 each year for 20 years in his financial account. A year after that saving period ended, he withdrew RM 7500 each year for 5 years. In the 6th and 7th years, he only withdrew RM 5000 per year. Then, in the 8th year, he decided to withdraw his remaining money.

(i) Draw a cash flow diagram to represent the situation.

(7 marks)

(ii) If the return profit is 6% per year throughout the whole period, estimate the amount of money that he withdrew at the end of the 8th year.

(8 marks)

- END OF QUESTION –

FINAL EXAM

SEMESTER/SESSION: SEM II / 2022/2023 PROGRAMME CODE: BDD
COURSE NAME : ENGINEERING ECONOMY COURSE CODE: BDA40902

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	$AW_k = - CR_k - AOC$

FINAL EXAM

SEMESTER/SESSION: SEM II / 2022/2023 PROGRAMME CODE: BDD
COURSE NAME : ENGINEERING ECONOMY COURSE CODE: BDA40902

COMPOUND INTEREST FACTORS

6% Compound Interest Factors 6%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
n	Compound Amount Factor Find *F* Given *P* *F/P*	Present Worth Factor Find *P* Given *F* *P/F*	Sinking Fund Factor Find *A* Given *F* *A/F*	Capital Recovery Factor Find *A* Given *P* *A/P*	Compound Amount Factor Find *F* Given *A* *F/A*	Present Worth Factor Find *P* Given *A* *P/A*	Gradient Uniform Series Find *A* Given *G* *A/G*	Gradient Present Worth Find *P* Given *G* *P/G*	*n*
1	1.060	.9434	1.0000	1.0600	1.000	0.943	0	0	1
2	1.124	.8900	.4854	.5454	2.060	1.833	0.485	0.890	2
3	1.191	.8396	.3141	.3741	3.184	2.673	0.961	2.569	3
4	1.262	.7921	.2286	.2886	4.375	3.465	1.427	4.945	4
5	1.338	.7473	.1774	.2374	5.637	4.212	1.884	7.934	5
6	1.419	.7050	.1434	.2034	6.975	4.917	2.330	11.459	6
7	1.504	.6651	.1191	.1791	8.394	5.582	2.768	15.450	7
8	1.594	.6274	.1010	.1610	9.897	6.210	3.195	19.841	8
9	1.689	.5919	.0870	.1470	11.491	6.802	3.613	24.577	9
10	1.791	.5584	.0759	.1359	13.181	7.360	4.022	29.602	10
11	1.898	.5268	.0668	.1268	14.972	7.887	4.421	34.870	11
12	2.012	.4970	.0593	.1193	16.870	8.384	4.811	40.337	12
13	2.133	.4688	.0530	.1130	18.882	8.853	5.192	45.963	13
14	2.261	.4423	.0476	.1076	21.015	9.295	5.564	51.713	14
15	2.397	.4173	.0430	.1030	23.276	9.712	5.926	57.554	15
16	2.540	.3936	.0390	.0990	25.672	10.106	6.279	63.459	16
17	2.693	.3714	.0354	.0954	28.213	10.477	6.624	69.401	17
18	2.854	.3503	.0324	.0924	30.906	10.828	6.960	75.357	18
19	3.026	.3305	.0296	.0896	33.760	11.158	7.287	81.306	19
20	3.207	.3118	.0272	.0872	36.786	11.470	7.605	87.230	20
21	3.400	.2942	.0250	.0850	39.993	11.764	7.915	93.113	21
22	3.604	.2775	.0230	.0830	43.392	12.042	8.217	98.941	22
23	3.820	.2618	.0213	.0813	46.996	12.303	8.510	104.700	23
24	4.049	.2470	.0197	.0797	50.815	12.550	8.795	110.381	24
25	4.292	.2330	.0182	.0782	54.864	12.783	9.072	115.973	25
26	4.549	.2198	.0169	.0769	59.156	13.003	9.341	121.468	26
27	4.822	.2074	.0157	.0757	63.706	13.211	9.603	126.860	27
28	5.112	.1956	.0146	.0746	68.528	13.406	9.857	132.142	28
29	5.418	.1846	.0136	.0736	73.640	13.591	10.103	137.309	29
30	5.743	.1741	.0126	.0726	79.058	13.765	10.342	142.359	30

FINAL EXAM

SEMESTER/SESSION: SEM II / 2022/2023
COURSE NAME : ENGINEERING ECONOMY

PROGRAMME CODE: BDD
COURSE CODE: BDA40902

COMPOUND INTEREST FACTORS

8% Compound Interest Factors 8%

	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	1.080	.9259	1.0000	1.0800	1.000	0.926	0	0	1
2	1.166	.8573	.4808	.5608	2.080	1.783	0.481	0.857	2
3	1.260	.7938	.3080	.3880	3.246	2.577	0.949	2.445	3
4	1.360	.7350	.2219	.3019	4.506	3.312	1.404	4.650	4
5	1.469	.6806	.1705	.2505	5.867	3.993	1.846	7.372	5
6	1.587	.6302	.1363	.2163	7.336	4.623	2.276	10.523	6
7	1.714	.5835	.1121	.1921	8.923	5.206	2.694	14.024	7
8	1.851	.5403	.0940	.1740	10.637	5.747	3.099	17.806	8
9	1.999	.5002	.0801	.1601	12.488	6.247	3.491	21.808	9
10	2.159	.4632	.0690	.1490	14.487	6.710	3.871	25.977	10
11	2.332	.4289	.0601	.1401	16.645	7.139	4.240	30.266	11
12	2.518	.3971	.0527	.1327	18.977	7.536	4.596	34.634	12
13	2.720	.3677	.0465	.1265	21.495	7.904	4.940	39.046	13
14	2.937	.3405	.0413	.1213	24.215	8.244	5.273	43.472	14
15	3.172	.3152	.0368	.1168	27.152	8.559	5.594	47.886	15

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* 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	1.100	.9091	1.0000	1.1000	1.000	0.909	0	0	1
2	1.210	.8264	.4762	.5762	2.100	1.736	0.476	0.826	2
3	1.331	.7513	.3021	.4021	3.310	2.487	0.937	2.329	3
4	1.464	.6830	.2155	.3155	4.641	3.170	1.381	4.378	4
5	1.611	.6209	.1638	.2638	6.105	3.791	1.810	6.862	5
6	1.772	.5645	.1296	.2296	7.716	4.355	2.224	9.684	6
7	1.949	.5132	.1054	.2054	9.487	4.868	2.622	12.763	7
8	2.144	.4665	.0874	.1874	11.436	5.335	3.004	16.029	8
9	2.358	.4241	.0736	.1736	13.579	5.759	3.372	19.421	9
10	2.594	.3855	.0627	.1627	15.937	6.145	3.725	22.891	10
11	2.853	.3505	.0540	.1540	18.531	6.495	4.064	26.396	11
12	3.138	.3186	.0468	.1468	21.384	6.814	4.388	29.901	12
13	3.452	.2897	.0408	.1408	24.523	7.103	4.699	33.377	13
14	3.797	.2633	.0357	.1357	27.975	7.367	4.996	36.801	14
15	4.177	.2394	.0315	.1315	31.772	7.606	5.279	40.152	15

FINAL EXAM

SEMESTER/SESSION: SEM II / 2022/2023
COURSE NAME : ENGINEERING ECONOMY

PROGRAMME CODE: BDD
COURSE CODE: BDA40902

COMPOUND INTEREST FACTORS

15% Compound Interest Factors 15%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
n	Compound Amount Factor Find F Given P F/P	Present Worth Factor Find P Given F P/F	Sinking Fund Factor Find A Given F A/F	Capital Recovery Factor Find A Given P A/P	Compound Amount Factor Find F Given A F/A	Present Worth Factor Find P Given A P/A	Gradient Uniform Series Find A Given G A/G	Gradient Present Worth Find P Given G P/G	n
1	1.150	.8696	1.0000	1.1500	1.000	0.870	0	0	1
2	1.322	.7561	.4651	.6151	2.150	1.626	0.465	0.756	2
3	1.521	.6575	.2880	.4380	3.472	2.283	0.907	2.071	3
4	1.749	.5718	.2003	.3503	4.993	2.855	1.326	3.786	4
5	2.011	.4972	.1483	.2983	6.742	3.352	1.723	5.775	5
6	2.313	.4323	.1142	.2642	8.754	3.784	2.097	7.937	6
7	2.660	.3759	.0904	.2404	11.067	4.160	2.450	10.192	7
8	3.059	.3269	.0729	.2229	13.727	4.487	2.781	12.481	8
9	3.518	.2843	.0596	.2096	16.786	4.772	3.092	14.755	9
10	4.046	.2472	.0493	.1993	20.304	5.019	3.383	16.979	10
11	4.652	.2149	.0411	.1911	24.349	5.234	3.655	19.129	11
12	5.350	.1869	.0345	.1845	29.002	5.421	3.908	21.185	12
13	6.153	.1625	.0291	.1791	34.352	5.583	4.144	23.135	13
14	7.076	.1413	.0247	.1747	40.505	5.724	4.362	24.972	14
15	8.137	.1229	.0210	.1710	47.580	5.847	4.565	26.693	15