



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME	:	ENGINEERING ECONOMY
COURSE CODE	:	BDA 40902
PROGRAMME CODE	:	4 BDD
EXAMINATION DATE	:	JANUARY/FEBRUARY 2021
EXAMINATION PERIOD	:	2 HOURS
INSTRUCTION	:	1. ANSWER ALL QUESTIONS IN SECTION A 2. SELECT ONE (1) QUESTION FROM TWO (2) QUESTIONS PROVIDED IN SECTION B

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

SECTION A

Q1 (a) Define engineering economy. (2 marks)

(b) Describe why engineering economy is important to engineers? (4 marks)

(c) You are an owner of an aluminum supply company and plan to add a new aluminum smelting machine into existing production processes. There are two models of machines that have been suggested by your engineer

Model A: The first option is to upgrade to a fully automated system with an initial cost of RM 80,000, life cycle of 5 years with residual value of RM 15,000. System operating cost is RM 7,000 per annum

Model B: The second option is to upgrade to a semi-automated system with an initial cost of RM 40,000, life cycle of 5 years without any residual value. The system operating costs is RM 12,000 per annum.

(i) Based on the expected MARR of 20% per year, calculate the present value (PW) investment for the two systems considered (14 mark)

(ii) Determine the economic system for investment purposes with its justification. (5 mark)

Q2 The Melaka state government plans to build a new dam in Jasin to overcome the flood problem in the surrounding area. The construction of this dam involves an initial cost of 2.8 million and a maintenance cost of RM 20,000 per year. Apart from that, there are also minor renovations that need to be done every five years and the cost value is RM 190,000. With the construction of this dam, the average flood damage is estimated to be reduced by RM 120,000 per year. Using an interest rate of 7% and the useful life of the dam is 60 years, determine whether the construction of this dam is beneficial to the community. Apply these methods in the evaluation of project

(a) Conventional PW and AW B/C ratio (12 marks)

(b) Modified PW and AW B/C ratio (13 marks)

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- Q3 (a)** For equipment that has a first cost of RM 10,000 and the estimated operating costs and year-end salvage values shown in **Table Q3(a)** below, determine the economic service life at $i = 10\%$ per year.

Table Q3(a)

Year	Operating Cost, RM per Year	Salvage Value, RM
1	-1,000	7,000
2	-1,200	5,000
3	1,300	4,500
4	2,000	3,000
5	3,000	2,000

(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 determine 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, how much is the minimum value of the defender so that the challenger could replace the defender now? (5 marks)

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SECTION B

Q4 (a) After graduated, Nandeeta has open a bakery at Petaling Jaya. Since she is new in business, she is quite worried about her bakery. This is due to the revenue from the sales are below the total costs of running the bakery. At the same time, Amy has already committed to paying for one year of rent, electricity, and employee salaries. Consequently, even the business was to shut down, Nandeeta would still acquire these costs until the year-end. In January, the business reported revenues of RM3,000 but incurred total costs of RM4,000, for a net loss of RM1,000. Nandeeta estimates that February should experience revenues similar to that of January. In January, Nandeeta's has spent money for the cost of as **Table Q4(a)** below.

Table Q4(a)

Items	RM
Rent	1,000
Electricity	200
Employee salaries	500
Cost of flour, butter, sugar, and milk	1,800
Total cost of labor	500

Based on your opinion, explain whether she should close down the business or not. (4 marks)

(b) SEB Group is a company that produce electrical product such as Tefal rice cooker. Every year, if the company is operating with full capacity, it can produce 100,000 unit of rice cooker. The fixed cost of production is RM 1,000,000 and variable cost for each rice cooker is RM 100. The selling price for each rice cooker is RM 125.

(i) Calculate the breakeven point for the SEB group. Then, explain the breakeven point using the breakeven chart. (8 marks)

(ii) To achieve the maximum profit, the company has plan to consider the two cases. Decide which case that generate more profit to the company. (13 marks)



- Q5** DG Industry plans to buy a new CNC lathe machine from China. The cost estimation of three type CNC machines at similar performance are shown in **Table Q5**. Given the MARR is 20% per annum.

Table Q5: Manufacturers, lives and costs of three lined slurry pump

	CNC Chocu	CNC AlpaX	CNC BzeX
Capital Investment	RM 32,000	RM 42,500	RM 37,000
Annual Expenses: Electrical Energy Maintenance	RM 4,200 RM 1,900 in year 1, and increasing RM 750/yr thereafter	RM 1,500 RM 900 in year 1, and increasing RM 400/yr thereafter	RM 2,800 RM 1,500 in year 1, and increasing RM 350/yr thereafter
Useful life (years)	6	10	8
Market Value (Disposal Cost)	RM 1,000	RM 7,500	RM 3,500

- (a) Draw cash-flow diagrams for each machine. (9 marks)
- (b) Estimate the annual worth (AW) for each machine. (12 marks)
- (c) Justify which machine should be selected (4 marks)

- END OF QUESTION -

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LIST OF FORMULA

1	$TC = FC + VC(Q)$	9	Conventional B-C ratio with PW $B-C - PW(B) \cdot [(I - PW(MV)) + PW(O\&M)]$
2	$IR = P \times Q$	10	Conventional B-C ratio with AW $B-C - AW(B) \cdot [CR + AW(O\&M)]$
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	$F = P \left(\frac{P}{F}, i, n\right) - P(1+i)^n$	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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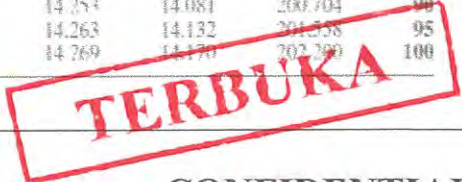
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INTEREST TABLE

7%									
Compound Interest Factors									
Single Payment		Uniform Payment Series				Arithmetic Gradient			
n	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	n
	Find F Given P F/P	Find P Given F P/F	Find A Given F A/F	Find A Given P A/P	Find F Given A F/A	Find P Given A P/A	Find A Given G A/G	Find P Given G P/G	
1	1.070	.9346	1.0000	1.0700	1.000	0.935	0	0	1
2	1.145	.8734	.4831	.5531	2.070	1.808	0.483	0.873	2
3	1.225	.8163	.3111	.4811	3.075	2.654	0.955	1.506	3
4	1.311	.7629	.2252	.3952	4.440	3.387	1.416	2.795	4
5	1.403	.7130	.1739	.2439	5.751	4.100	1.865	4.647	5
6	1.501	.6665	.1398	.2098	7.133	4.767	2.303	6.978	6
7	1.606	.6227	.1156	.1856	8.654	5.389	2.730	14.715	7
8	1.718	.5820	.0975	.1675	10.360	5.971	3.147	18.789	8
9	1.838	.5439	.0835	.1535	11.978	6.515	3.557	23.140	9
10	1.967	.5083	.0724	.1424	13.816	7.024	3.946	27.716	10
11	2.105	.4751	.0634	.1334	15.784	7.499	4.330	32.467	11
12	2.252	.4440	.0569	.1259	17.888	7.943	4.703	37.351	12
13	2.410	.4150	.0497	.1197	20.141	8.358	5.065	42.330	13
14	2.579	.3878	.0443	.1143	22.551	8.745	5.417	47.372	14
15	2.759	.3624	.0398	.1098	25.129	9.108	5.758	52.446	15
16	2.952	.3387	.0359	.1059	27.888	9.447	6.090	57.527	16
17	3.159	.3166	.0324	.1024	30.840	9.763	6.411	62.592	17
18	3.380	.2959	.0294	.0994	33.999	10.059	6.722	67.622	18
19	3.617	.2765	.0268	.0968	37.379	10.336	7.024	72.599	19
20	3.870	.2584	.0244	.0944	40.996	10.594	7.316	77.509	20
21	4.141	.2415	.0223	.0923	44.865	10.836	7.599	82.339	21
22	4.430	.2257	.0204	.0904	49.006	11.061	7.872	87.079	22
23	4.741	.2109	.0187	.0887	53.436	11.272	8.137	91.720	23
24	5.072	.1971	.0172	.0872	58.177	11.469	8.392	96.255	24
25	5.427	.1842	.0158	.0858	63.249	11.654	8.639	100.677	25
26	5.807	.1722	.0146	.0846	68.677	11.826	8.877	104.981	26
27	6.214	.1609	.0134	.0834	74.484	11.987	9.107	109.166	27
28	6.649	.1504	.0124	.0824	80.698	12.137	9.329	113.227	28
29	7.114	.1406	.0114	.0814	87.347	12.278	9.543	117.162	29
30	7.612	.1314	.0106	.0806	94.461	12.409	9.749	120.973	30
31	8.145	.1228	.00980	.0798	102.073	12.532	9.947	124.655	31
32	8.715	.1147	.00907	.0791	110.218	12.647	10.138	128.212	32
33	9.325	.1072	.00841	.0784	118.934	12.754	10.322	131.644	33
34	9.978	.1007	.00780	.0778	128.259	12.854	10.499	134.951	34
35	10.677	.0951	.00723	.0772	138.237	12.948	10.669	138.135	35
40	14.974	.0668	.00501	.0750	199.636	13.332	11.423	152.293	40
45	21.002	.0476	.00350	.0735	285.750	13.606	12.036	163.756	45
50	29.457	.0339	.00246	.0725	406.530	13.801	12.529	172.905	50
55	41.515	.0242	.00174	.0717	575.930	13.940	12.921	180.121	55
60	57.947	.0173	.00123	.0712	813.523	14.039	13.232	185.768	60
65	81.273	.0123	.00087	.0709	1146.8	14.110	13.476	190.145	65
70	113.990	.00877	.00062	.0706	1614.1	14.160	13.666	193.519	70
75	159.877	.00625	.00044	.0704	2269.7	14.196	13.814	196.104	75
80	224.235	.00446	.00031	.0703	3189.1	14.222	13.927	198.075	80
85	314.502	.00318	.00022	.0702	4478.6	14.240	14.015	199.572	85
90	441.105	.00227	.00016	.0702	6287.2	14.253	14.081	200.704	90
95	618.673	.00162	.00011	.0701	8823.9	14.263	14.132	201.558	95
100	867.720	.00115	.00008	.0701	12381.7	14.269	14.170	202.200	100



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Discrete compounding: $i = 10\%$						
Factor	Compound Amount	Present Worth	Capital Recovery	Present Worth	Compound Amount	Sinking Fund
n	F/P	P/F	A/P	P/A	F/A	A/F
1	1.1000	0.9091	1.1000	0.9091	1.0000	1.0000
2	1.2100	0.8264	0.5762	1.7355	2.1000	0.4762
3	1.3310	0.7513	0.4021	2.4869	3.3100	0.3021
4	1.4641	0.6830	0.3155	3.1699	4.6410	0.2155
5	1.6105	0.6209	0.2638	3.7908	6.1051	0.1638
6	1.7716	0.5645	0.2296	4.3553	7.7156	0.1296
7	1.9487	0.5132	0.2054	4.8684	9.4872	0.1054
8	2.1436	0.4665	0.1874	5.3349	11.4359	0.0874
9	2.3579	0.4241	0.1736	5.7590	13.5795	0.0736
10	2.5937	0.3855	0.1627	6.1446	15.9374	0.0627
11	2.8531	0.3505	0.1540	6.4951	18.5312	0.0540
12	3.1384	0.3186	0.1468	6.8137	21.3843	0.0468
13	3.4523	0.2897	0.1408	7.1034	24.5227	0.0408
14	3.7975	0.2633	0.1357	7.3667	27.9750	0.0357
15	4.1772	0.2394	0.1315	7.6061	31.7725	0.0315
16	4.5950	0.2176	0.1278	7.8237	35.9497	0.0278
17	5.0545	0.1978	0.1247	8.0216	40.5447	0.0247
18	5.5599	0.1799	0.1219	8.2014	45.5992	0.0219
19	6.1159	0.1635	0.1195	8.3649	51.1591	0.0195
20	6.7275	0.1486	0.1175	8.5136	57.2750	0.0175
21	7.4002	0.1351	0.1156	8.6487	64.0025	0.0156
22	8.1403	0.1228	0.1140	8.7715	71.4027	0.0140
23	8.9543	0.1117	0.1126	8.8832	79.5430	0.0126
24	9.8497	0.1015	0.1113	8.9847	88.4973	0.0113
25	10.8347	0.0923	0.1102	9.0770	98.3471	0.0102

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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 <i>F</i> Given <i>P</i>	Find <i>P</i> Given <i>F</i>	Find <i>A</i> Given <i>F</i>	Find <i>A</i> Given <i>P</i>	Find <i>F</i> Given <i>A</i>	Find <i>P</i> Given <i>A</i>	Find <i>A</i> Given <i>G</i>	Find <i>P</i> Given <i>G</i>																						
<i>n</i>	<i>F/P</i>	<i>P/F</i>	<i>A/F</i>	<i>A/P</i>	<i>F/A</i>	<i>P/A</i>	<i>A/G</i>	<i>P/G</i>												<i>n</i>									
1	1.200	.8333	1.0000	1.2000	1.000	0.833	0	0												1									
2	1.440	.6944	.4545	.6545	2.200	1.528	0.455	0.694												2									
3	1.728	.5787	.2717	.4717	3.640	1.106	0.879	1.852												3									
4	2.074	.4823	.1863	.3863	5.368	2.589	1.174	1.799												4									
5	2.488	.4019	.1344	.3344	7.442	2.991	1.641	4.906												5									
6	2.986	.3349	.1007	.3007	9.930	3.326	1.979	6.581												6									
7	3.583	.2791	.0774	.2774	12.916	3.605	2.290	8.255												7									
8	4.300	.2326	.0606	.2606	16.499	3.817	2.576	9.883												8									
9	5.160	.1938	.0481	.2481	20.799	4.031	2.836	11.434												9									
10	6.192	.1615	.0385	.2385	25.959	4.192	3.074	12.887												10									
11	7.430	.1346	.0311	.2311	32.150	4.327	3.289	14.233												11									
12	8.916	.1122	.0253	.2253	39.581	4.439	3.484	15.467												12									
13	10.699	.0935	.0206	.2206	48.497	4.533	3.660	16.588												13									
14	12.839	.0779	.0169	.2169	59.196	4.611	3.817	17.601												14									
15	15.407	.0649	.0139	.2139	72.035	4.675	3.959	18.509												15									
16	18.488	.0541	.0114	.2114	87.442	4.730	4.085	19.321												16									
17	22.186	.0451	.00944	.2094	105.931	4.775	4.198	20.042												17									
18	26.623	.0376	.00781	.2078	128.117	4.812	4.298	20.680												18									
19	31.948	.0313	.00646	.2065	154.740	4.843	4.386	21.244												19									
20	38.338	.0261	.00536	.2054	186.688	4.870	4.464	21.739												20									
21	46.005	.0217	.00444	.2044	225.026	4.891	4.533	22.174												21									
22	55.206	.0181	.00369	.2037	271.031	4.909	4.594	22.555												22									
23	66.247	.0151	.00307	.2031	326.237	4.925	4.647	22.887												23									
24	79.497	.0126	.00255	.2025	392.484	4.937	4.694	23.176												24									
25	95.396	.0105	.00212	.2021	471.981	4.948	4.735	23.428												25									
26	114.475	.00874	.00176	.2018	567.377	4.956	4.771	23.646												26									
27	137.371	.00728	.00147	.2015	681.853	4.964	4.802	23.835												27									
28	164.845	.00607	.00122	.2012	819.223	4.970	4.829	23.999												28									
29	197.814	.00506	.00102	.2010	984.068	4.975	4.853	24.141												29									
30	237.376	.00421	.00085	.2008	1181.9	4.979	4.873	24.263												30									
31	284.852	.00351	.00070	.2007	1419.3	4.982	4.891	24.368												31									
32	341.822	.00293	.00059	.2006	1704.1	4.985	4.906	24.459												32									
33	410.186	.00244	.00049	.2005	2105.9	4.988	4.919	24.537												33									
34	492.224	.00203	.00041	.2004	2456.1	4.990	4.931	24.604												34									
35	590.668	.00169	.00034	.2003	2948.3	4.992	4.941	24.661												35									
40	1469.8	.00068	.00014	.2001	7343.9	4.997	4.973	24.847												40									
45	3657.3	.00027	.00005	.2001	18281.3	4.999	4.988	24.932												45									
50	9100.4	.00011	.00002	.2000	45497.2	4.999	4.995	24.970												50									
55	22644.8	.00004	.00001	.2000	113219.0	5.000	4.998	24.987												55									
60	56347.3	.00002		.2000	281742.6	5.000	4.999	24.994												60									

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