Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	ENGINEERING ECONOMY
COURSE CODE	:	BDA 40902
PROGRAMME CODE	:	4 BDD
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
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**.

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

SECTION A

Q1 (a) Define engineering economy.

(2 marks)

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

(4 marks)

(c) ABC Company plans to use an equal-service machine that can reduce the consumption cost by selecting the appropriate of power source. **Table Q1** shows the cost of equal-service machine based on different alternatives. The MARR is 10% and revenues for all three alternatives are expected to be the same.

Table Q1

Items	Electric-power	Gas-power	Solar-power
1. First cost (RM)	-2,500	-3,500	-6,000
2. Annual operating cost (RM per year)	-900	-700	-50
3. Salvage value (RM)	200	350	100
4. Life (years)	5	5	5

(i) Draw a cash flow diagram for all alternatives to reflect your analysis.

(4 marks)

(ii) Perform a present worth (PW) analysis to determine the appropriate power source for the services machine.

(15 marks)

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

(i) Lost of income to local business because of a new freeway.

(ii) Less travel time because of a loop bypass.

(iii) RM 40,000 annual income to local businesses because of tourism created by a national park.

(iv) Cost of fish from a hatchery to stock a lake at the state park.

(v) Decrease in property values due to the closure of a government research lab.

(vi) Less tire wear because of smoother road surfaces

(vii) School overcrowded because of a military base expansion

(viii) Revenue to local motels because of an extended weekend holiday

(10 marks)

(b) The cost of grading and spreading gravel on a short rural road is expected to be RM 300,000. The road will have to be maintained at a cost of RM 25,000 per year. Even though the new road is not very smooth, it allows access to an area that previously could only be reached with off-road vehicles. The improved accessibility has led to a 150% increase in the property values along the road.

(i) If the previous market value of a property was RM 900,000, calculate the conventional B/C ratio with PW using an interest of 6% per year and a 20-year study period.

(10 marks)

(ii) State whether the project should be proceeded or not and justify the reason.

(5 marks)

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** below, determine the economic service life at i = 10% per year.

Table Q3

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) (i) State the difference between today's RM and constant-value RM?

(3 marks)

(ii) Determine the annual inflation rate is implied from an inflation-adjusted interest rate of 10% per year, when the real interest rate is 4% per year?

(4 marks)

(iii) Assume that you want to retire 30 years from now with an amount of money that will have the same value (same purchasing power) as RM 1.5 million today. If you estimate the inflation rate will be 4% per year, determine the future (then- current) RM will you need?

(4 marks)

(iv) If the inflation rate is 7% per year, calculate how many years will it take for the cost of something to double when prices increase at exactly the same rate as inflation?

(4 marks)

SECTION B

Q4 (a) Handheld fiber-optic meters with white light polarization interferometry are useful for measuring temperature, pressure, and strain in electrically noisy environments. The fixed cost associated with manufacturing are RM 800,000 per year. If a base unit sells for RM 2,950 and its variable cost is RM 2,075,

(i) Determine the units that must be sold each year for breakeven?

(5 marks)

(ii) Calculate the profit for sales of 3,000 units per year?

(5 marks)

(iii) The manager of the company has a goal of RM 2.5 million profit next year without the fixed cost increases. Determine the new sale price to meet this goal if the number of units sold is double and variable cost is increased by 10%.

(5 marks)

(b) University tuition and fees can be paid by using one of two plans as shown in **Table Q4.** The cost of tuition and fees is RM 10,000 per year.

Table Q4

Plan	Description
Early-bird	Pay total amount due 1 year in advance and get a 10% discount
On-time	Pay total amount due when classes start

(i) Calculate how much is paid in the early-bird plan?

(5 marks)

(ii) Determine the equivalent amount of the savings compared to the on-time payment at the time that the on-time payment is made?

(5 marks)

Q5 (a) Iselt Welding has extra funds to invest for future capital expansion. If the selected investment pays simple interest, determine the interest rate required for the amount to grow from RM 60,000 to RM 90,000 in 5 years?

(5 marks)

(b) Mazda's hydrogen-fuel hybrid vehicle will be available for leasing in Japan in 2019. Since the leasing fee will be RM 3,500 per month, it is aimed at government and ecological organizations. At an interest rate of 12% per year compounded monthly, determine the present worth of a 3 year lease.

(5 marks)

(c) Your company has a RM 100,000 loan for a new security system they just bought. The annual payment is RM 8,880 and the interest rate is 8% per year for 30 years. Your company decides that they can afford to pay RM 10,000 per year.

(i) Draw a cash flow diagram to reflect the case study above
(5 marks)

(ii) Determine the number of payments (in years) will the loan be paid off?
(10 marks)

- END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2018/2019
COURSE NAME : ENGINEERING ECONOMY

PROGRAMME : 4 BDD
COURSE CODE: BDA40902

LIST OF FORMULA

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

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2018/2019
COURSE NAME : ENGINEERING ECONOMY

PROGRAMME : 4 BDD
COURSE CODE: BDA40902

INTEREST TABLE

1.0% **Compound Interest Factors**

	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***
1	1.0100	0.9901	1.0000	1.0100	1.000	0.990	0.000	0.000
2	1.0201	0.9803	0.4975	0.5075	2.010	1.970	0.498	0.980
3	1.0303	0.9706	0.3300	0.3400	3.030	2.941	0.993	2.921
4	1.0406	0.9610	0.2463	0.2563	4.060	3.902	1.488	5.804
5	1.0510	0.9515	0.1960	0.2060	5.101	4.853	1.980	9.610
6	1.0615	0.9420	0.1625	0.1725	6.152	5.795	2.471	14.321
7	1.0721	0.9327	0.1386	0.1486	7.214	6.728	2.960	19.917
8	1.0829	0.9235	0.1207	0.1307	8.286	7.652	3.448	26.381
9	1.0937	0.9143	0.1067	0.1167	9.369	8.566	3.934	33.696
10	1.1046	0.9053	0.0956	0.1056	10.462	9.471	4.418	41.843
11	1.1157	0.8963	0.0865	0.0965	11.567	10.368	4.901	50.807
12	1.1268	0.8874	0.0788	0.0888	12.683	11.255	5.381	60.569
13	1.1381	0.8787	0.0724	0.0824	13.809	12.134	5.861	71.113
14	1.1495	0.8700	0.0669	0.0769	14.947	13.004	6.338	82.422
15	1.1610	0.8613	0.0621	0.0721	16.097	13.865	6.814	94.481
16	1.1726	0.8528	0.0579	0.0679	17.258	14.718	7.289	107.273
17	1.1843	0.8444	0.0543	0.0643	18.430	15.562	7.761	120.783
18	1.1961	0.8360	0.0510	0.0610	19.615	16.398	8.232	134.996
19	1.2081	0.8277	0.0481	0.0581	20.811	17.226	8.702	149.895
20	1.2202	0.8195	0.0454	0.0554	22.019	18.046	9.169	165.466
21	1.2324	0.8114	0.0430	0.0530	23.239	18.857	9.635	181.695
22	1.2447	0.8034	0.0409	0.0509	24.472	19.660	10.100	198.566
23	1.2572	0.7954	0.0389	0.0489	25.716	20.456	10.563	216.066
24	1.2697	0.7876	0.0371	0.0471	26.973	21.243	11.024	234.180
25	1.2824	0.7798	0.0354	0.0454	28.243	22.023	11.483	252.894
26	1.2953	0.7720	0.0339	0.0439	29.526	22.795	11.941	272.196
27	1.3082	0.7644	0.0324	0.0424	30.821	23.560	12.397	292.070
28	1.3213	0.7568	0.0311	0.0411	32.129	24.316	12.852	312.505
29	1.3345	0.7493	0.0299	0.0399	33.450	25.066	13.304	333.486
30	1.3478	0.7419	0.0287	0.0387	34.785	25.808	13.756	355.002
36	1.4308	0.6989	0.0232	0.0332	43.077	30.108	16.428	494.621
40	1.4889	0.6717	0.0205	0.0305	48.886	32.835	18.178	596.856

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2018/2019
COURSE NAME : ENGINEERING ECONOMY

PROGRAMME : 4 BDD
COURSE CODE: BDA40902

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

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2018/2019 PROGRAMME : 4 BDD
COURSE NAME : ENGINEERING ECONOMY COURSE CODE: BDA40902

8.0% **Compound Interest Factors**

	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***
1	1.0800	0.9259	1.0000	1.0800	1.0000	0.926	0.000	0.000
2	1.1664	0.8573	0.4808	0.5608	2.080	1.783	0.481	0.857
3	1.2597	0.7938	0.3080	0.3880	3.246	2.577	0.949	2.445
4	1.3605	0.7350	0.2219	0.3019	4.506	3.312	1.404	4.650
5	1.4693	0.6806	0.1705	0.2505	5.867	3.993	1.846	7.372
6	1.5869	0.6302	0.1363	0.2163	7.336	4.623	2.276	10.523
7	1.7138	0.5835	0.1121	0.1921	8.923	5.206	2.694	14.024
8	1.8509	0.5403	0.0940	0.1740	10.637	5.747	3.099	17.806
9	1.9990	0.5002	0.0801	0.1601	12.488	6.247	3.491	21.808
10	2.1589	0.4632	0.0690	0.1490	14.487	6.710	3.871	25.977
11	2.3316	0.4289	0.0601	0.1401	16.645	7.139	4.240	30.266
12	2.5182	0.3971	0.0527	0.1327	18.977	7.536	4.596	34.634
13	2.7196	0.3677	0.0465	0.1265	21.495	7.904	4.940	39.046
14	2.9372	0.3405	0.0413	0.1213	24.215	8.244	5.273	43.472
15	3.1722	0.3152	0.0368	0.1168	27.152	8.559	5.594	47.886
16	3.4259	0.2919	0.0330	0.1130	30.324	8.851	5.905	52.264
17	3.7000	0.2703	0.0296	0.1096	33.750	9.122	6.204	56.588
18	3.9960	0.2502	0.0267	0.1067	37.450	9.372	6.492	60.843
19	4.3157	0.2317	0.0241	0.1041	41.446	9.604	6.770	65.013
20	4.6610	0.2145	0.0219	0.1019	45.762	9.818	7.037	69.090
21	5.0338	0.1987	0.0198	0.0998	50.423	10.017	7.294	73.063
22	5.4365	0.1839	0.0180	0.0980	55.457	10.201	7.541	76.926
23	5.8715	0.1703	0.0164	0.0964	60.893	10.371	7.779	80.673
24	6.3412	0.1577	0.0150	0.0950	66.765	10.529	8.007	84.300
25	6.8485	0.1460	0.0137	0.0937	73.106	10.675	8.225	87.804
26	7.3964	0.1352	0.0125	0.0925	79.954	10.810	8.435	91.184
27	7.9881	0.1252	0.0114	0.0914	87.351	10.935	8.636	94.439
28	8.6271	0.1159	0.0105	0.0905	95.339	11.051	8.829	97.569
29	9.3173	0.1073	0.0096	0.0896	103.966	11.158	9.013	100.574
30	10.063	0.0994	0.0088	0.0888	113.283	11.258	9.190	103.456

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2018/2019 PROGRAMME : 4 BDD
COURSE NAME : ENGINEERING ECONOMY COURSE CODE: BDA40902

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

FINAL EXAMINATION

SEMESTER/SESSION : SEM I / 2018/2019 PROGRAMME : 4 BDD
COURSE NAME : ENGINEERING ECONOMY COURSE CODE: BDA40902

Discrete compounding; i = 12%						
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	1.1200	0.8929	1.1200	0.893	1.000	1.0000
2	1.2544	0.7972	0.5917	1.690	2.120	0.4717
3	1.4049	0.7118	0.4163	2.402	3.374	0.2963
4	1.5735	0.6355	0.3292	3.037	4.779	0.2092
5	1.7623	0.5674	0.2774	3.605	6.353	0.1574
6	1.9738	0.5066	0.2432	4.111	8.115	0.1232
7	2.2107	0.4523	0.2191	4.564	10.089	0.0991
8	2.4760	0.4039	0.2013	4.968	12.300	0.0813
9	2.7731	0.3606	0.1877	5.328	14.776	0.0677
10	3.1058	0.3220	0.1770	5.650	17.549	0.0570
11	3.4785	0.2875	0.1684	5.938	20.655	0.0484
12	3.8960	0.2567	0.1614	6.194	24.133	0.0414
13	4.3635	0.2292	0.1557	6.424	28.029	0.0357
14	4.8871	0.2046	0.1509	6.628	32.393	0.0309
15	5.4736	0.1827	0.1468	6.811	37.280	0.0268
16	6.1304	0.1631	0.1434	6.974	42.753	0.0234
17	6.8660	0.1456	0.1405	7.120	48.884	0.0205
18	7.6900	0.1300	0.1379	7.250	55.750	0.0179
19	8.6128	0.1161	0.1358	7.366	63.440	0.0158
20	9.6463	0.1037	0.1339	7.469	72.052	0.0139
21	10.804	0.0926	0.1322	7.562	81.699	0.0122
22	12.100	0.0826	0.1308	7.645	92.503	0.0108
23	13.552	0.0738	0.1296	7.718	104.603	0.0096
24	15.179	0.0659	0.1285	7.784	118.155	0.0085
25	17.000	0.0588	0.1275	7.843	133.334	0.0075