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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019**

COURSE NAME : ENGINEERING ECONOMY
COURSE CODE : BNJ 30902 / BNP 30402
PROGRAMME CODE : BNA / BNG / BNH / BNM
EXAMINATION DATE : JUNE / JULY 2019
DURATION : 2 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

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- Q1**
- (a) Give **FOUR (4)** purpose of Engineering Economy to engineering technologist.
(4 marks)
- (b) Explain the differences between sunk cost and opportunity cost.
(2 marks)
- (c) Give **ONE (1)** example with calculation for each sunk cost and opportunity cost.
(5 marks)
- (d) Two currently owned machines by EON Auto Mart Sdn Bhd are being considered for the production of a new part for car bumper. The capital investment associated with both machines are about the same. The important differences between the machines are their production capacities (production rate multiple available production hours) and their rejection rate (percentage of parts produced that cannot be sold). The material cost is RM 8.00 per part, and all defect-free parts produced can be sold for RM 15.00 each. The operator cost is RM 20.00 per hour and the variable overhead rate for traceable cost is RM 7.00 per hour for both machines. Consider the following **Table Q1 (d)** when answering the questions below.
- (i) Calculate the profit for Machine A.
(4 marks)
- (ii) Calculate the profit for Machine B.
(4 marks)
- (iii) Determine the maximum percentage of rejected part produced by Machine B to be as profitable as Machine A.
(6 marks)
- Q2**
- (a) **Table Q2 (a)** below shows the past price of Crude Palm Oil (CPO) from 2014 until 2016. The price for 2015 is the reference year having an index value of 215. The weight placed on CPO MQ is three times that of either CPO 10 or CPO 25.
- (i) Calculate the weighted index for the price (RM/kg) of CPO in 2016.
(4 marks)
- (ii) Calculate the corresponding 2017 prices of CPO from 2016 if 232 is the index value in 2017.
(6 marks)

- (b) Sumur Wang Engineering company had received a purchase order of fabrication for 30 units of helix vertical wind turbine. The time required for the company to fabricate the first helix vertical wind turbine is 48 hours. Their improvement (learning curve) is 80%, which means that as output is doubled, their time to fabricate the helix vertical wind turbine is reduced by 20%.
- (i) Calculate the time it will take the company to fabricate the 10th and 20th of helix vertical wind turbine units.
(5 marks)
- (ii) Calculate the total time required to fabricate the first 5 and 10 of helix vertical wind turbine units.
(5 marks)
- (iii) Determine the estimated cumulative average fabrication time for the first 5 and 10 of helix vertical wind turbine units.
(5 marks)

Q3 (a) Define the following terms.

- (i) Simple interest
(ii) Compound interest
(iii) Cash flow diagram

(3 marks)

(b) Give example of situation for each terms as in Q3 (a) (i) until (iii).

(3 marks)

(c) You were offered to purchase a land that will be worth RM 100,000 in six years. If the value of the land increases at 15% each year, estimate the amount you will be willing to pay now for this property.

(3 marks)

(d) Starting of January 2019, Ali has a loan of RM 40,000 with CIMB bank at 5% simple interest per year (assume a 365 day year). Calculate the total amount he has borrowed after 181 days?

(4 marks)

(e) Malik is planning to further his PhD study in UTHM in 10 years time. Based on his current planning, he has 10 years to save a lump-sum amount for his study. He also had done some research on the current year fees and found that the course will cost him RM 35,000 and the fee is expected to increase by 15% each year. Consider the **Table Q3 (e) (i)** and **Table Q3 (e) (ii)** when answering the questions below.

- (i) Calculate the total cost of Malik's education if he finish his study in 10 years with 15% increment per year.
(3 marks)
- (ii) Calculate the amount Malik must save each year for 10 years if he invests in a tax-free trust fund with 6% investment return per year.
(3 marks)
- (iii) Draw the cash flow time lines for Malik saving plan in Q3(e)(i) and Q3(e)(ii).
(6 marks)

Q4 Rentaka Corporation is considering a new project to construct a new ferry terminal near Tg.Emas, Muar. This ferry terminal will be used to be a gateway tourism's ferry to and from Indonesia. This project is including the construction of custom and immigration facilities. The land acquisition is expected to be RM 2.5 million. Construction cost for the ferry terminal and other facilities is expected to be RM 4.5 million with an additional annual maintenance cost of RM 200,000. This project also have an additional ferry terminal traffic controller with an annual cost of RM 100,000. Market value of some assets at the end of useful life is estimated RM 50,000. Annual benefits of the ferry terminal has been estimated as in **Table Q4**. The study period of this proposed project is for 10 years with the MARR of 15% per year. Consider the **Table Q3 (e) (ii)** when answering the questions below.

- (a) Calculate the conventional Benefit-Cost (B-C) ratio with the Present Worth (PW) method.
(5 marks)
- (b) Calculate the modified Benefit-Cost (B-C) ratio with the Present Worth (PW) method.
(5 marks)
- (c) Calculate the conventional Benefit-Cost (B-C) ratio with the Annual Worth (AW) method.
(5 marks)
- (d) Calculate the modified Benefit-Cost (B-C) ratio with the Annual Worth (AW) method.
(5 marks)
- (e) From Q4 (a) until (d), please justify accordingly to the each Benefit-Cost (B-C) ratio evaluation method whether the project should be proceeded or not.
(5 marks)

-END OF QUESTIONS -

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Table Q1 (d) : Production Capacity

	Machine A	Machine B
Production rate	200 parts / hour	250 parts / hour
Hours available for production	7 hours / day	6 hours / day
Percent parts rejected	5%	15%

Table Q2 (a) : The Past Price of Crude Palm Oil (CPO)

CPO	Price (RM/kg) in Year		
	2014	2015	2016
CPO 10	1010	1200	1310
CPO 25	1030	1080	1230
CPO MQ	970	1020	1100

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Table Q3 (e) (i) : Compound Interest Factors 6%

6% Compound Interest Factors 6%									
Compound Interest Factors									
n	Single Payment		Uniform Payment Series				Arithmetic Gradient		n
	Compound Amount Find F Given P F/P	Present Worth 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	
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
31	6.088	.1643	.0118	.0718	84.801	13.929	10.574	147.286	31
32	6.453	.1550	.0110	.0710	90.890	14.084	10.799	152.090	32
33	6.841	.1462	.0103	.0703	97.343	14.230	11.017	156.768	33
34	7.251	.1379	.00960	.0696	104.184	14.368	11.228	161.319	34
35	7.686	.1301	.00897	.0690	111.435	14.498	11.432	165.743	35
40	10.286	.0972	.00646	.0665	154.762	15.046	12.359	185.957	40
45	13.765	.0727	.00470	.0647	212.743	15.456	13.141	203.109	45
50	18.420	.0543	.00344	.0634	290.335	15.762	13.796	217.457	50
55	24.650	.0406	.00254	.0625	394.171	15.991	14.341	229.322	55
60	32.988	.0303	.00188	.0619	533.126	16.161	14.791	239.043	60
65	44.145	.0227	.00139	.0614	719.080	16.289	15.160	246.945	65
70	59.076	.0169	.00103	.0610	967.928	16.385	15.461	253.327	70
75	79.057	.0126	.00077	.0608	1300.9	16.456	15.706	258.453	75
80	105.796	.00945	.00057	.0606	1746.6	16.509	15.903	262.549	80
85	141.578	.00706	.00043	.0604	2343.0	16.549	16.062	265.810	85
90	189.464	.00528	.00032	.0603	3141.1	16.579	16.189	268.395	90
95	253.545	.00394	.00024	.0602	4209.1	16.601	16.290	270.437	95
100	339.300	.00295	.00018	.0602	5638.3	16.618	16.371	272.047	100

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Table Q3 (e) (ii) : Compound Interest Factors 15%

15% Compound Interest Factors 15%									
n	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	
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
16	9.358	.1069	.0179	.1679	55.717	5.954	4.752	28.296	16
17	10.761	.0929	.0154	.1654	65.075	6.047	4.925	29.783	17
18	12.375	.0808	.0132	.1632	75.836	6.128	5.084	31.156	18
19	14.232	.0703	.0113	.1613	88.212	6.198	5.231	32.421	19
20	16.367	.0611	.00976	.1598	102.444	6.259	5.365	33.582	20
21	18.822	.0531	.00842	.1584	118.810	6.312	5.488	34.645	21
22	21.645	.0462	.00727	.1573	137.632	6.359	5.601	35.615	22
23	24.891	.0402	.00628	.1563	159.276	6.399	5.704	36.499	23
24	28.625	.0349	.00543	.1554	184.168	6.434	5.798	37.302	24
25	32.919	.0304	.00470	.1547	212.793	6.464	5.883	38.031	25
26	37.857	.0264	.00407	.1541	245.712	6.491	5.961	38.692	26
27	43.535	.0230	.00353	.1535	283.569	6.514	6.032	39.289	27
28	50.066	.0200	.00306	.1531	327.104	6.534	6.096	39.828	28
29	57.575	.0174	.00265	.1527	377.170	6.551	6.154	40.315	29
30	66.212	.0151	.00230	.1523	434.745	6.566	6.207	40.753	30
31	76.144	.0131	.00200	.1520	500.957	6.579	6.254	41.147	31
32	87.565	.0114	.00173	.1517	577.100	6.591	6.297	41.501	32
33	100.700	.00993	.00150	.1515	664.666	6.600	6.336	41.818	33
34	115.805	.00864	.00131	.1513	765.365	6.609	6.371	42.103	34
35	133.176	.00751	.00113	.1511	881.170	6.617	6.402	42.359	35
40	267.864	.00373	.00056	.1506	1779.1	6.642	6.517	43.283	40
45	538.769	.00186	.00028	.1503	3585.1	6.654	6.583	43.805	45
50	1083.7	.00092	.00014	.1501	7217.7	6.661	6.620	44.096	50
55	2179.6	.00046	.00007	.1501	14524.1	6.664	6.641	44.256	55
60	4384.0	.00023	.00003	.1500	29220.0	6.665	6.653	44.343	60
65	8817.8	.00011	.00002	.1500	58778.6	6.666	6.659	44.390	65
70	17735.7	.00006	.00001	.1500	118231.5	6.666	6.663	44.416	70
75	35672.9	.00003		.1500	237812.5	6.666	6.665	44.429	75
80	71750.9	.00001		.1500	478332.6	6.667	6.666	44.436	80
85	144316.7	.00001		.1500	962104.4	6.667	6.666	44.440	85

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Table Q4 : Annual Benefits of the Rentaka Corporation Ferry Terminal Project

Annual Benefits	RM
Rental receipts from ferry	400,000
Ferry terminal charges to passengers	300,000
Convenience benefit to the local community	100,000
Additional tourism income to state of Johor	150,000

LIST OF FORMULA

1.	$C_n = C_k \left(\frac{\bar{I}_n}{\bar{I}_k} \right)$
2.	$\frac{C_A}{C_B} = \left(\frac{S_A}{S_B} \right)^x$
3.	$Z_u = K(u^n)$
4.	$T_x = K \sum_{u=1}^x u^n$
5.	$\bar{I}_n = \frac{W_1(C_{n1}/C_{k1}) + W_2(C_{n2}/C_{k2}) + \dots + W_M(C_{nM}/C_{kM})}{W_1 + W_2 + \dots + W_M} \times \bar{I}_k$
6.	$B - C = \frac{PW(B)}{I - PW(MV) + PW(O\&M)}$
7.	$B - C = \frac{PW(B) - PW(O\&M)}{I - PW(MV)}$
8.	$B - C = \frac{AW(B)}{CR + AW(O\&M)}$
9.	$B - C = \frac{AW(B) - AW(O\&M)}{CR}$