UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BCE 3183
COURSE	: ENGINEERING ECONOMY
SEMESTER/SESSION	: 2-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 10 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1 (25 marks)

a) Raiqal wants to deposit an amount of money now such that he can withdraw an equal annual amount of RM 2500 per year for the first 5 years, starting 1 year after the deposit, and a different annual withdrawal of RM 4000 per year for the following 3 years.

i. Indicate engineering economy symbol and value from the situation. (5 marks)

ii. Construct complete cash flow diagram appear if i = 9.0% per year. (4 marks)

b) Bank ANDA lent an engineering company RM 100,000 to retrofit an environmentally unfriendly building. The loan is for 3 years at 10% per year interest. Calculate:

i. The amount of money will the firm repay at the end of 3 years if the calculation is based on simple interest? (6 marks)

ii. The amount of money will the firm repay at the end of 3 years if the calculation is based on compound interest? (6 marks)

iii. The difference of interest in (i) and (ii) (2 marks)

(Hint: show detail calculation)

c) Give two types of company in Malaysia. (2 marks)

QUESTION 2 (25 marks)

a) ElectroVehicles Berhad specializes in manufacturing high-performance electric vehicles. An engineer from Electro Vehicles is part of a committee tasked with evaluating bids for state-of-the-art coordinate-measuring machinery. This machinery will be directly integrated into the automated manufacturing process for producing precise vehicle components. The engineer has received three bids, each with different interest rates applicable to unpaid balances. In order to accurately assess the financial costs involved, ElectroVehicles' management has requested the engineer to calculate the effective semiannual and annual interest rates for each bid. The details of the bids are as follows:

Bid 1: 9% per year, compounded quarterly
Bid 2: 3% per quarter, compounded quarterly
Bid 3: 8.8% per year, compounded monthly

i. Find the effective rate for each bid on the basis of semiannual periods. (9 marks)

ii. Calculate effective annual rates for each bid. (9 marks)

iii. Identify which bid has the lowest effective annual rate. (2 marks)

b) Classify the following interest rate statements as either nominal or effective:

i. 1.5% per month, compounded daily,
ii. 17% per year, compounded quarterly,
iii. Effective 15% per year, compounded monthly,
iv. Nominal 0.6% per month, compounded weekly,
v. 8% per year.

(5 marks)

QUESTION 3 (25 marks)

a) A pipeline engineer working in Kuwait for the oil giant company wants to perform a present worth analysis on alternative pipeline routings; the first predominately by land and the second primarily undersea. The undersea route is more expensive initially due to extra corrosion protection and installation costs, but cheaper security and maintenance reduces annual costs.

Details	Land	Undersea
Installation cost, $ million	-215	-350
Pumping, operating, security, $ million per year	-22	-2
Replacement of valves and appurtenances in year 25, $ million	-30	-70
Expected Life, years	50	50

i. Construct complete cash flow diagram for both routes. (8 marks)

ii. Analyze the preferable route for selection if the interest rate is 15% per year. (12 marks)

b) In Malaysia, for the year 2022, individuals may be eligible for various tax exemptions. Give five common tax exemptions available for individuals. (5 marks)

QUESTION 4 (25 marks)

a) Company XYZ operates in Malaysia and has reported the following financial results for the year:

Total Revenue: RM 10 million
Operating Expenses: RM 5 million
Interest Expenses: RM 1 million
Depreciation: RM 2 million
Non-taxable Income: RM 300,000

Assuming a corporate tax rate of 24%, calculate:

i. Net operating income (NOI) (2 marks)
ii. Taxable income (TI) (2 marks)
iii. Tax rate (2 marks)
iv. Net operating profit after taxes (NOPAT) (2 marks)

b) Classify the primary term described by each event below:

gross income, depreciation, operating expense, taxable income, income tax, or net operating profit after taxes.

i. A freelance graphic designer earned RM50,000 from client projects in a year.
ii. A manufacturing company deducted RM10,000 from the value of its machinery as it depreciated over time.
iii. A restaurant incurred RM5,000 in monthly expenses for rent, utilities, and supplies.

iv. A retail store generated RM500,000 in sales revenue, incurred operating expenses of RM300,000, and paid RM50,000 in income tax, resulting in a net operating profit after taxes of RM150,000.

v. A salaried employee with an annual income of RM60,000 incurred RM7,500 in tax expenses based on the applicable tax rates.

vi. A retail store achieved RM500,000 in sales revenue and had operating expenses of RM300,000. After deducting income tax expenses of RM50,000, the store had a remaining profit of RM150,000.

vii. A real estate agent earned RM10,000 in commissions from property sales in a month.

viii. An IT company wrote off RM20,000 from the value of its computer equipment over a five-year period.

ix. A transportation company spent RM2,000 on fuel, maintenance, and insurance for its fleet of vehicles in a week.

x. After accounting for deductions and exemptions, a business owner has a taxable income of RM200,000, subject to the applicable corporate tax rate.

(10 marks)

c) Handheld fiber optic meters with white light polarization interferometry are useful for measuring temperature, pressure, and strain in electrically noisy environments. The fixed costs associated with manufacturing are RM 80,000 per year. If a base unit sells for RM 2950 and its variable cost is RM2075:

i. Find how many units must be sold each year for breakeven. (3 marks)

ii. Determine the profit for sales of 3000 units per year? (4 marks)

----------End of question----------

ATTACHMENTS

$$\text{Effective } i \text{ per time period} = \left(1 + \frac{r}{m}\right)^m - 1$$

$$\begin{aligned}\text{Profit} &= \text{revenue} - \text{total cost} \\ &= R - \text{TC} \\ &= R - (\text{FC} + \text{VC})\end{aligned}$$

$$Q_{\text{BE}} = \frac{\text{FC}}{r - v}$$

Net operating income = revenue − operating expenses

Taxable income = revenue − operating expenses − depreciation

$$\text{NOI} = \text{EBIT} = \text{GI} - \text{OE}$$

$$\begin{aligned}\text{TI} &= \text{gross income} - \text{operating expenses} - \text{depreciation} \\ &= \text{GI} - \text{OE} - \text{D}\end{aligned}$$

$$\begin{aligned}\text{Income taxes} &= \text{applicable tax rate} \times \text{taxable income} \\ &= (T)(\text{TI})\end{aligned}$$

$$\begin{aligned}\text{NOPAT} &= \text{TI} - \text{taxes} = \text{TI} - (T)(\text{TI}) \\ &= \text{TI}(1 - T)\end{aligned}$$

9% Compound Interest Factors 9%

	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	1.090	.9174	1.0000	1.0900	1.000	0.917	0	0	1
2	1.188	.8417	.4785	.5685	2.090	1.759	0.478	0.842	2
3	1.295	.7722	.3051	.3951	3.278	2.531	0.943	2.386	3
4	1.412	.7084	.2187	.3087	4.573	3.240	1.393	4.511	4
5	1.539	.6499	.1671	.2571	5.985	3.890	1.828	7.111	5
6	1.677	.5963	.1329	.2229	7.523	4.486	2.250	10.092	6
7	1.828	.5470	.1087	.1987	9.200	5.033	2.657	13.375	7
8	1.993	.5019	.0907	.1807	11.028	5.535	3.051	16.888	8
9	2.172	.4604	.0768	.1668	13.021	5.995	3.431	20.571	9
10	2.367	.4224	.0658	.1558	15.193	6.418	3.798	24.373	10
11	2.580	.3875	.0569	.1469	17.560	6.805	4.151	28.248	11
12	2.813	.3555	.0497	.1397	20.141	7.161	4.491	32.159	12
13	3.066	.3262	.0436	.1336	22.953	7.487	4.818	36.073	13
14	3.342	.2992	.0384	.1284	26.019	7.786	5.133	39.963	14
15	3.642	.2745	.0341	.1241	29.361	8.061	5.435	43.807	15
16	3.970	.2519	.0303	.1203	33.003	8.313	5.724	47.585	16
17	4.328	.2311	.0270	.1170	36.974	8.544	6.002	51.282	17
18	4.717	.2120	.0242	.1142	41.301	8.756	6.269	54.886	18
19	5.142	.1945	.0217	.1117	46.019	8.950	6.524	58.387	19
20	5.604	.1784	.0195	.1095	51.160	9.129	6.767	61.777	20
21	6.109	.1637	.0176	.1076	56.765	9.292	7.001	65.051	21
22	6.659	.1502	.0159	.1059	62.873	9.442	7.223	68.205	22
23	7.258	.1378	.0144	.1044	69.532	9.580	7.436	71.236	23
24	7.911	.1264	.0130	.1030	76.790	9.707	7.638	74.143	24
25	8.623	.1160	.0118	.1018	84.701	9.823	7.832	76.927	25
26	9.399	.1064	.0107	.1007	93.324	9.929	8.016	79.586	26
27	10.245	.0976	.00973	.0997	102.723	10.027	8.191	82.124	27
28	11.167	.0895	.00885	.0989	112.968	10.116	8.357	84.542	28
29	12.172	.0822	.00806	.0981	124.136	10.198	8.515	86.842	29
30	13.268	.0754	.00734	.0973	136.308	10.274	8.666	89.028	30
31	14.462	.0691	.00669	.0967	149.575	10.343	8.808	91.102	31
32	15.763	.0634	.00610	.0961	164.037	10.406	8.944	93.069	32
33	17.182	.0582	.00556	.0956	179.801	10.464	9.072	94.931	33
34	18.728	.0534	.00508	.0951	196.983	10.518	9.193	96.693	34
35	20.414	.0490	.00464	.0946	215.711	10.567	9.308	98.359	35
40	31.409	.0318	.00296	.0930	337.883	10.757	9.796	105.376	40
45	48.327	.0207	.00190	.0919	525.860	10.881	10.160	110.556	45
50	74.358	.0134	.00123	.0912	815.085	10.962	10.430	114.325	50
55	114.409	.00874	.00079	.0908	1 260.1	11.014	10.626	117.036	55
60	176.032	.00568	.00051	.0905	1 944.8	11.048	10.768	118.968	60
65	270.847	.00369	.00033	.0903	2 998.3	11.070	10.870	120.334	65
70	416.731	.00240	.00022	.0902	4 619.2	11.084	10.943	121.294	70
75	641.193	.00156	.00014	.0901	7 113.3	11.094	10.994	121.965	75
80	986.555	.00101	.00009	.0901	10 950.6	11.100	11.030	122.431	80
85	1 517.9	.00066	.00006	.0901	16 854.9	11.104	11.055	122.753	85
90	2 335.5	.00043	.00004	.0900	25 939.3	11.106	11.073	122.976	90
95	3 593.5	.00028	.00003	.0900	39 916.8	11.108	11.085	123.129	95
100	5 529.1	.00018	.00002	.0900	61 422.9	11.109	11.093	123.233	100

10% Compound Interest Factors 10%

n	Single Payment: Compound Amount Factor Find F Given P F/P	Single Payment: Present Worth Factor Find P Given F P/F	Uniform Payment Series: Sinking Fund Factor Find A Given F A/F	Uniform Payment Series: Capital Recovery Factor Find A Given P A/P	Uniform Payment Series: Compound Amount Factor Find F Given A F/A	Uniform Payment Series: Present Worth Factor Find P Given A P/A	Arithmetic Gradient: Gradient Uniform Series Find A Given G A/G	Arithmetic Gradient: Gradient Present Worth Find P Given 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
16	4.595	.2176	.0278	.1278	35.950	7.824	5.549	43.416	16
17	5.054	.1978	.0247	.1247	40.545	8.022	5.807	46.582	17
18	5.560	.1799	.0219	.1219	45.599	8.201	6.053	49.640	18
19	6.116	.1635	.0195	.1195	51.159	8.365	6.286	52.583	19
20	6.728	.1486	.0175	.1175	57.275	8.514	6.508	55.407	20
21	7.400	.1351	.0156	.1156	64.003	8.649	6.719	58.110	21
22	8.140	.1228	.0140	.1140	71.403	8.772	6.919	60.689	22
23	8.954	.1117	.0126	.1126	79.543	8.883	7.108	63.146	23
24	9.850	.1015	.0113	.1113	88.497	8.985	7.288	65.481	24
25	10.835	.0923	.0102	.1102	98.347	9.077	7.458	67.696	25
26	11.918	.0839	.00916	.1092	109.182	9.161	7.619	69.794	26
27	13.110	.0763	.00826	.1083	121.100	9.237	7.770	71.777	27
28	14.421	.0693	.00745	.1075	134.210	9.307	7.914	73.650	28
29	15.863	.0630	.00673	.1067	148.631	9.370	8.049	75.415	29
30	17.449	.0573	.00608	.1061	164.494	9.427	8.176	77.077	30
31	19.194	.0521	.00550	.1055	181.944	9.479	8.296	78.640	31
32	21.114	.0474	.00497	.1050	201.138	9.526	8.409	80.108	32
33	23.225	.0431	.00450	.1045	222.252	9.569	8.515	81.486	33
34	25.548	.0391	.00407	.1041	245.477	9.609	8.615	82.777	34
35	28.102	.0356	.00369	.1037	271.025	9.644	8.709	83.987	35
40	45.259	.0221	.00226	.1023	442.593	9.779	9.096	88.953	40
45	72.891	.0137	.00139	.1014	718.905	9.863	9.374	92.454	45
50	117.391	.00852	.00086	.1009	1 163.9	9.915	9.570	94.889	50
55	189.059	.00529	.00053	.1005	1 880.6	9.947	9.708	96.562	55
60	304.482	.00328	.00033	.1003	3 034.8	9.967	9.802	97.701	60
65	490.371	.00204	.00020	.1002	4 893.7	9.980	9.867	98.471	65
70	789.748	.00127	.00013	.1001	7 887.5	9.987	9.911	98.987	70
75	1 271.9	.00079	.00008	.1001	12 709.0	9.992	9.941	99.332	75
80	2 048.4	.00049	.00005	.1000	20 474.0	9.995	9.961	99.561	80
85	3 299.0	.00030	.00003	.1000	32 979.7	9.997	9.974	99.712	85
90	5 313.0	.00019	.00002	.1000	53 120.3	9.998	9.983	99.812	90
95	8 556.7	.00012	.00001	.1000	85 556.9	9.999	9.989	99.877	95
100	13 780.6	.00007	.00001	.1000	137 796.3	9.999	9.993	99.920	100

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
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