BSc. Eng. (ME) Date: 23 February 2023
Semester: 6th Semester Time: 10:00 am – 11:30 am

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid-Semester Examination Summer Semester, A. Y. 2021-2022
Course No IPE 4639 Time: 1½ Hours
Course Title: Engineering Economy and Finance Full Marks: 75

There are 3 (Three) questions. Answer all of them. The symbols and abbreviations carry their usual meanings. Marks of each question and corresponding CO and PO are written in the right column. Assume reasonable values if required. A factor table is provided with this question.

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1. a. Explain MARR in the context of economic comparison with a relevant example. [7] CO1, PO1

   b. Illustrate Bai Muazzal Islamic Financing method with an example including a brief description of its distinctive features. Also mention the principle of loss distribution in Musharaka and Mudaraba Islamic financing modes. [8] CO3, PO8

   c. A company is evaluating whether it should retain the current system or replace it with a new advanced one that is built on Industry 4.0 principles. The relevant costs for each system are known or estimated as provided in the table below. Use an interest rate of 12% per year to perform the replacement analysis to determine whether the company should retain the old system or replace with the new one. [10] CO2, P02

	Current System	New System
First cost 7 years ago, $	450,000	N/A
First Cost,$	N/A	700,000
Remaining life, years	3	10
Current Market Value, $	50,000	N/A
AOC, $/per year	160,000	150,000
Salvage value, $	20,000	50,000

2. Compare the alternatives shown below on the basis of their Present Worth (PW), using an interest rate of 12% per year and provide a decision about which one of them should be selected. [25] CO2, PO2

Item	Project X	Project Y
Initial Cost, $	350,000	400,000
Annual operating cost, $/year	130,000	Not Applicable
Maintenance Cost,$	25,000 at year 2, then increases by $500 every year	31,000 at year 3, then increases by 4% every year
Annual Revenue, $/year	500,000	410,000
Inspection cost in 3rd year, $	Not applicable	1,700
Salvage value, $	80,000	150,000
Life, years	4	8

3. a A process for manufacturing laser levels will have a first cost of \$36,000 . It has annual operating cost of \$17,000. Income associated with the process is expected to be \$23,000 at year 3, which increases by 3% every year thereafter. There is a registration cost of \$700 at year 2. Determine the payback period when $i = 12\%$ per year. [15] CO2, PO2

b A renowned university is thinking of installing an in-house lab. Installing the in-house lab requires first cost of \$300,000. Technician salary for operating the in-house lab is \$4,000 per month. In the university, 400 tests are required every month. This in-house lab costs \$3 per test whereas a private one charges \$25 per test. If the useful life of the in-house lab is 5 years and interest rate is 12% per month, decide whether the university should go forward to install its own lab. Use the Benefit-Cost ratio analysis method. [10] CO2, PO11

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Formula: Geometric gradient:

$$(P/A,g,i,n) = \frac{1-\left(\frac{1+g}{1+i}\right)^n}{i-g} \quad \text{when } g \neq i \quad \text{and} \quad \frac{n}{1+i} \quad \text{when } g = i$$

	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	1.120	.8929	1.0000	1.1200	1.000	0.893	0	0	1
2	1.254	.7972	.4717	.5917	2.120	1.690	0.472	0.797	2
3	1.405	.7118	.2963	.4163	3.374	2.402	0.925	2.221	3
4	1.574	.6355	.2092	.3292	4.779	3.037	1.359	4.127	4
5	1.762	.5674	.1574	.2774	6.353	3.605	1.775	6.397	5
6	1.974	.5066	.1232	.2432	8.115	4.111	2.172	8.930	6
7	2.211	.4523	.0991	.2191	10.089	4.564	2.551	11.644	7
8	2.476	.4039	.0813	.2013	12.300	4.968	2.913	14.471	8
9	2.773	.3606	.0677	.1877	14.776	5.328	3.257	17.356	9
10	3.106	.3220	.0570	.1770	17.549	5.650	3.585	20.254	10
11	3.479	.2875	.0484	.1684	20.655	5.938	3.895	23.129	11
12	3.896	.2567	.0414	.1614	24.133	6.194	4.190	25.952	12
13	4.363	.2292	.0357	.1557	28.029	6.424	4.468	28.702	13
14	4.887	.2046	.0309	.1509	32.393	6.628	4.732	31.362	14
15	5.474	.1827	.0268	.1468	37.280	6.811	4.980	33.920	15
16	6.130	.1631	.0234	.1434	42.753	6.974	5.215	36.367	16
17	6.866	.1456	.0205	.1405	48.884	7.120	5.435	38.697	17
18	7.690	.1300	.0179	.1379	55.750	7.250	5.643	40.908	18
19	8.613	.1161	.0158	.1358	63.440	7.366	5.838	42.998	19
20	9.646	.1037	.0139	.1339	72.052	7.469	6.020	44.968	20
21	10.804	.0926	.0122	.1322	81.699	7.562	6.191	46.819	21
22	12.100	.0826	.0108	.1308	92.503	7.645	6.351	48.554	22
23	13.552	.0738	.00956	.1296	104.603	7.718	6.501	50.178	23
24	15.179	.0659	.00846	.1285	118.155	7.784	6.641	51.693	24
25	17.000	.0588	.00750	.1275	133.334	7.843	6.771	53.105	25
26	19.040	.0525	.00665	.1267	150.334	7.896	6.892	54.418	26
27	21.325	.0469	.00590	.1259	169.374	7.943	7.005	55.637	27
28	23.884	.0419	.00524	.1252	190.699	7.984	7.110	56.767	28
29	26.750	.0374	.00466	.1247	214.583	8.022	7.207	57.814	29
30	29.960	.0334	.00414	.1241	241.333	8.055	7.297	58.782	30
31	33.555	.0298	.00369	.1237	271.293	8.085	7.381	59.676	31
32	37.582	.0266	.00328	.1233	304.848	8.112	7.459	60.501	32
33	42.092	.0238	.00292	.1229	342.429	8.135	7.530	61.261	33
34	47.143	.0212	.00260	.1226	384.521	8.157	7.596	61.961	34
35	52.800	.0189	.00232	.1223	431.663	8.176	7.658	62.605	35
40	93.051	.0107	.00130	.1213	767.091	8.244	7.899	65.116	40
45	163.988	.00610	.00074	.1207	1 358.2	8.283	8.057	66.734	45
50	289.002	.00346	.00042	.1204	2 400.0	8.304	8.160	67.762	50
55	509.321	.00196	.00024	.1202	4 236.0	8.317	8.225	68.408	55
60	897.597	.00111	.00013	.1201	7 471.6	8.324	8.266	68.810	60
65	1 581.9	.00063	.00008	.1201	13 173.9	8.328	8.292	69.058	65
70	2 787.8	.00036	.00004	.1200	23 223.3	8.330	8.308	69.210	70
75	4 913.1	.00020	.00002	.1200	40 933.8	8.332	8.318	69.303	75
80	8 658.5	.00012	.00001	.1200	72 145.7	8.332	8.324	69.359	80
85	15 259.2	.00007	.00001	.1200	127 151.7	8.333	8.328	69.393	85
90	26 891.9	.00004		.1200	224 091.1	8.333	8.330	69.414	90
95	47 392.8	.00002		.1200	394 931.4	8.333	8.331	69.426	95
100	83 522.3	.00001		.1200	696 010.5	8.333	8.332	69.434	100