Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

VII SEMESTER B.TECH. (COMMON TO ALL)

END SEMESTER EXAMINATIONS- DEC 2020

SUBJECT: ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT [HUM 4002]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Interest factor table is provided in the last page (**else use formulae**).

1A. State the Law of Demand. With examples, discuss the determinants of Demand. **(05)**

1B. One of the four ovens at a bakery is being considered for replacement. Its salvage value and maintenance costs are given in the table below for several years. A new oven costs $80,000 and this price includes a complete guarantee of the maintenance costs for the first two years, and it covers a good proportion of the maintenance costs for years 3 and 4. The salvage value and maintenance costs are also summarized in the table. **(05)**

	Old oven		New oven	
Year	Salvage value end of the year ($)	Maintenance costs ($)	Salvage value end of the year ($)	Maintenance costs ($)
0	20,000	-	80,000	-
1	17,000	9,500	75,000	0
2	14,000	9,600	70,000	0
3	11,000	9,700	66,000	$1,000
4	7,000	9,800	62,000	$3,000

Both the old and new ovens have similar productivities and energy costs. Should the oven be replaced this year, if the MARR equals 10%?

2A. A railroad branch line to a missile site is to be constructed. It is expected that the railroad line will be used for 15 years, after which the missile site will be removed and the land turned back to agricultural use The railroad track and ties will be removed at that time. **(05)**

In building the railroad line, either treated or untreated wood ties may be used. Treated ties have an installed cost of $6 and a 10-year life; untreated ties are $4.50 with a 6-year life. If at the end of 15 years the ties then in place have a remaining useful life of 4 years or more, they will be used by the railroad elsewhere and have an estimated salvage value of $3 each. Any ties that are removed at the end of their service life, or too close to the end of their service life to be used elsewhere, can be sold for $0.50 each.

Determine the most economical plan for the initial railroad ties and their replacement for the 15-year period. Make a present worth analysis assuming 10% interest.

2B.	A construction contractor has three options to purchase a dump truck for transportation and dumping of earth at a construction site. All the alternatives have the same useful life of 10 years. The cash flow details of all the alternatives are presented as follows; Option-1: Initial purchase price = Rs.2500000, Annual operating cost Rs.45000 at the end of 1st year and increasing by Rs.3000 in the subsequent years till the end of useful life, Annual income = Rs.120000, Salvage value = Rs.550000. Option-2: Initial purchase price = Rs.3000000, Annual operating cost = Rs.30000, Annual income Rs.150000 for first three years and increasing by Rs.5000 in the subsequent years till the end of useful life, Salvage value = Rs.800000. Option-3: Initial purchase price = Rs.2700000, Annual operating cost Rs.35000 for first 5 years and increasing by Rs.2000 in the successive years till the end of useful life, Annual income = Rs.140000, Expected salvage value = Rs.650000. Using future worth method, find out which alternative should be selected, if the rate of interest is 10% per year.	**(05)**
3A.	A company is planning to introduce a new product in near future. In order to have sufficient money for investment, it plans to save some equal amounts every six months for the next five years. In the fifth year the company acquires patent rights to the new product by investing $1000000. However, the manufacturing of the new product is expected to initiate in the second quarter of the seventh year with an investment of $10000 and an increase of $1000 per quarter for the next six quarters. If the interest rate is 10% compounded semi-annually during the first two years, 12% compounded semi-annually for the next three years, 13% compounded quarterly for the following two years and 16% compounded quarterly thereafter, calculate the money to be invested.	**(05)**
3B.	Consider the cash flows for the project alternatives given below. n (Year) | A($) \| B($) | C($) 0 | -1000 | -1000 | -2000 1 | 900 | 600 | 900 2 | 500 | 500 | 900 3 | 100 | 500 | 900 4 | 50 | 100 | 900 Assume that the MARR is 10%. Suppose A, B and C are mutually exclusive projects, select the best alternative using incremental ROR evaluation.	**(05)**
4A.	Upjohn Company purchased new packaging equipment with an estimated useful life of five years. The cost of the equipment was $55,000, and the salvage value was estimated to be $7,500 at the end of year five. Compute the annual depreciation expenses over the five-year life of the equipment under each of the following methods of book depreciation: (a) Straight-line method. (b) Double Declining-balance method.	**(05)**
4B.	Sam, a sales engineer owns two vehicles, and one of them is entirely dedicated to business use. His business car is a used small pickup truck, which he purchased with $11,000 of personal savings. On the basis of his own records and with data compiled by the U.S. Department of Transportation, Sam has estimated the costs of owning and operating his business vehicle for the first three years as follows:	**(05)**

	YEAR 1	YEAR 2	YEAR 3
Depreciation	$2,879	$1,776	$1,545
Scheduled Maintenance	100	153	220
Insurance	635	635	635
Registration & taxes	78	57	50
Total ownership costs	$3,692	$2,621	$2,450
Nonscheduled repairs	35	85	200
Replacement tires	35	30	27
Accessories	15	13	12
Gasoline & Taxes	688	650	522
Oil	80	100	100
Parking & Tolls	135	125	110
Total operating costs	$988	$1,003	$971
Total of all costs	$4,680	$3,624	$3,421
Expected miles driven	14,500	13,000	11,500

If interest rate is 10%, what should be the reimbursement rate per mile so that he can break even?

5A. Determine the Sales of the company from the following data. **(05)**

- Current Ratio – 1.5
- Acid Test Ratio – 1.2
- Current Liabilities – Rs. 8,00,000
- Inventory Turnover Ratio – 8

5B.	The following equation describes the conversion of a cash flow into an equivalent equal payment series with N=25: A = {[50+25(A/G, 11%,8)] (F/A, 11%, 8) (F/P, 11%,17) + [500-10(A/G, 11%, 10)] (F/A, 11%, 10) (F/P, 11%, 7) - [200+100(A/G,11%,6)] (P/A,11%,6) (F/P,11%, 25) – [1300+100(A/G, 11%,4)] (F/A, 11%, 4) (F/P,11%,15) – [1200-200(A/G, 11%, 6)] (F/A, 11%, 6)} x (A/F, 11%, 25). Reconstruct the original cash flow diagram.	**(05)**

Interest rate for 10%

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*	*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