Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

VII SEMESTER B.TECH. (COMMON TO ALL)

ONLINE PROCTURED END SEMESTER EXAMINATIONS- MARCH 2021

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. Two possible routes for a power line are under study. Data on the routes are as follows: **(05)**

	Around the Lake	Under the Lake
Length	15Kms	5Kms
First cost	$ 5000/km	$ 25000/km
Maintenance	$ 200/km/year	$ 400/km/year
Useful life	15 years	15 years
Salvage value	$ 3000/km	$ 5000/km
Yearly power loss	$ 500/km	$ 500/km
Annual property taxes	2% of the first cost	2% of the first cost

If 12% interest is used, should the power line be routed around the lake or under the lake? Use Annual worth method.

1B. A cooling-water pumping station at the LCRA plant costs $600,000 to construct, and it is projected to have a 25-year life with an estimated salvage value of 12% of the construction cost. However, the station will be book-depreciated to zero over a recovery period of 30 years. Calculate the annual depreciation charge for years 4, 10, and 25, using (a) Straight line depreciation and (b) DDB depreciation. **(05)**

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 **(05)**

	removed at that time. 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 12% interest.	
2B.	A 50 HP motor is required to drive a pump to remove water from a tunnel. The unit will be needed for a period of 4 years. Two alternatives are under consideration. Alternative A calls for the construction of a power line and purchase of the electric motor at a total cost of \$4900. The salvage value of this equipment after 4 years is estimated to be \$700. The cost of the power per hour of the operation is estimated to be \$2.94 and the maintenance is estimated as \$420 per year. Alternative B calls for purchase of diesel engine pump set at a cost of \$1925 and it will have no salvage value at the end of 4 years period. The cost of diesel per hour of operation is estimated at \$1.47 maintenance is estimated at \$0.53 per hour operation and the cost of wages chargeable when the engine runs is \$2.8 per hour. How many hours per year the two machines have to run so that the two alternatives incur equal costs. If the no. of hours of operation is estimated at 100 hours which alternative is more economical? Take interest rate at 12% per year.	**(05)**
3A.	For equipment that has a first cost of \$10,000 and the estimated operating costs and year-end salvage values are shown below, determine the economic service life at 12% per year.	**(05)**

Year	Operating Cost \$(Year)	Salvage Value \$
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

3B.	State the Law of Demand. With examples, discuss the exceptions for the law of Demand.	**(05)**

4A. An engineer compared the following four machines to choose the best. All of them have 10 years of service life. At MARR of 12%, which machine should be selected based on Incremental ROR analysis? **(05)**

	Machines			
	1	2	3	4
Initial cost	-44,000	-72000	-98000	-60000
Annual cost per year	-70000	-61000	-68000	-64000
Annual savings	80000	80000	82000	80000
ROR %	18.6	23.1	20.8	23.4

4B. Anita Tahani, who owns a travel agency, bought an old house to use as her business office. She found that the ceiling was poorly insulated and that the heat loss could be cut significantly if 6 inches of foam insulation were installed. She estimated that with the insulation, she could cut the heating bill by $40 per month and the air-conditioning cost by $25 per month. Assuming that the summer season is three months (June, July, and August) of the year and that the winter season is another three months (December, January, and February) of the year, how much can Anita spend on insulation if she expects to keep the property for five years? Assume that neither heating nor air-conditioning would be required during the fall and spring seasons. If she decides to install the insulation, it will be done at the beginning of May. Anita's interest rate is 12% compounded monthly. **(05)**

5A. A FMCG company is experiencing a surge in the demand and decides to expand its facility after five years. It forecasts that $500,000 would be needed in the fifth year to purchase land and construct factory building and $250,000 in the following year to purchase necessary machines. In order to meet these expenses, the company is planning to set aside an equal amount every quarter from its profits. However after three years, the company doubles the savings but invests once in six months. Determine the amount the company has to save if the interest rate is 11% per annum compounded quarterly during the first three years, 11% p.a compounded monthly during the next two years and 11% p.a. compounded semiannually during the last one year. **(05)**

5B.	Determine the Sales of the company from the following data. • Current Ratio – 1.4 • Current Liabilities – Rs. 1,600 • Acid Test Ratio – 1.2 • Inventory Turnover Ratio – 8	**(05)**

Interest rate for 12%

12% Compound Interest Factors 12%

	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