Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

VII SEMESTER B.TECH. (COMMON TO ALL)

END SEMESTER EXAMINATIONS- JAN 2021 (ONLINE)

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. Given the cash flow of an equipment which has a first cost of Rs. 150,000 and a salvage value (S) in Rupees, described by S= 120,000 – 20,000k, where k is the number of years since it was purchased. The salvage value does not go below zero. Determine its economic service life at an interest rate of 12% per year. Note that the equipment will have a maximum service life of 8 years. **(05)**

Years of Service	O&M Costs (Rs.)
1	72000
2	74000
3	76000
4	78000
5	80000
6	84000
7	88000
8	92000

1B. The following equation describes the conversion of a cash flow into a Present Worth series, **(05)**

P = 50(P/A,15%,20) + (10+10(A/G,15%,15))*(P/A,15%,15)*(P/F,15%,5) – 50
- 75(P/A,15%,5) - (80+10(A/G,15%,6))*(P/A,15%,6)*(P/F,15%,5)
– (55 + 5(A/G,15%,6))*(P/A,15%,6)*(P/F,15%,11)
– (90-10(A/G, 15%,3)) *(P/A,15%,3) * (P/F,15%,17).

Reconstruct the original cash flow diagram.

2A. Determine the sales of a firm given the following information: **(05)**

Current ratio: 1.6
Acid test ratio : 1.4
Current liabilities : 18000
Inventory turn-over ratio : 6

2B. Using the declining balance method (depreciation rate (α) = 0.3) for automated process control equipment with initial cost of $175,000, useful life =5 years, and Salvage value = $32,000. Calculate the annual depreciation amount and book values as a five-year schedule. **(05)**

3A. Explain briefly and clearly how the topics we have covered under 'Time value of Money' and 'Evaluation of alternatives' might help you, for example, while making a decision evaluating education loans in various banks to pay for your post graduate studies. **(05)**

3B. A road building contractor has received a major highway construction contract for some asphalt paving, based on a specification. Three paving subcontractors quoted the following prices and terms of payment: **(05)**

Paving Co.	Price	Payment schedule
Quick	$85000	50% payable immediately 25% payable in six months 25% payable at the end of one year
Tartan	$82000	Payable immediately
Faultless	$84000	25% payable immediately 75% payable in six months

If the contractor uses a 12% nominal interest rate, compounded monthly, on the basis of present worth analysis, which paving subcontractor should be awarded the paving work?

4A. A metal plating company is considering five different methods for recovering byproduct heavy metals from a manufacturing site 's liquid waste. An engineer is considering the projects, all of which can be considered to last perpetually. If the metal plating company's MARR is 12% per year, determine which should be selected (a) if they are independent and (b) if they are mutually exclusive? Use Rate of return method. **(05)**

	First Cost, ($)	Annual Income, $/year	Alternative's Rate of Return, %
A	- 20,000	+3,000	15
B	- 10,000	+2,000	20
C	- 15,000	+2,800	18.7
D	- 70,000	+10,000	14.3
E	- 50,000	+6,000	12

4B.	A person would like to receive Rs.30000 monthly as pension after his retirement (60 years). To receive this amount, he plans to invest some equal amount every quarter when he attains the age of 42. He continued this investment for 5 years. However, after 5 years he doubles the investment amount but invests with a frequency of semi-annual period for the next 10 years. During the last three years of his service, he invests an amount five times his initial investment, on a monthly basis. Assuming that he lives for 20 years after retirement, calculate the amount to be invested if the interest rate is 7 percent per annum compounded monthly during the first fifteen years and increases to 12 percent per annum compounded monthly thereafter.	**(05)**
5A.	Production of Air filters requires the machine (that produces air filters) to be turned off by the operator, after each piece is completed. The machine coasts for 15 seconds after it is turned off thus preventing the operator from removing the piece quickly before producing the next piece. Installing a brake could prevent the time lost. That would reduce the coasting time to 03 (three) seconds. The machine produces 55,000 filters a year. The time taken to produce one piece is 1 minute and 35 seconds, excluding coasting time. The operator earns $8.00 per hour. In addition, $4 an hour is incurred for operating the machine as direct cost. For every 600 hours of operation, the brake will require servicing. The maintenance of the brake takes 40 minutes for the operator and will cost $45 in parts and material. The brake is expected to last 7500 hours of operation with proper maintenance and will have no salvage value. How much could be spent for the brake if the minimum attractive rate of return is 12% compounded annually.	**(05)**
5B.	Let, **X** = Last 4 digits of your registration number **Y** = Last 3 digits of your registration number Certain kind of machine has a first-year maintenance cost of **X** which increases by **Y** per year over the 10-year useful life of the machine. Answer the following if the firm's interest rate is 12%: i. What equal annual payments could the firm make to a service organization to carry out the maintenance for 5 machines? ii. How much additionally could be paid for a new type of machine with the same useful life that requires no maintenance during its life?	**(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
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