Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

VII SEMESTER B.TECH. (COMMON TO ALL)

END SEMESTER EXAMINATIONS- NOV 2019

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. Compare the following alternatives on the basis of their capitalized cost at an interest rate of 10% per year. **(04)**

	Petroleum-Based Feedstock	Inorganic-Based Feedstock
First cost, $	-250,000	-110,000
Annual operating cost, $/year	-130,000	-65,000
Annual revenues, $/year	400,000	270,000
Salvage value, $	50,000	20,000
One cycle	6 years	4 years

1B. A certain Automatic testing operation can be performed by either Unit X or Unit Y. Unit X has a first cost of $16,000 and a $2000 salvage value. Annual disbursements are expected to be $9000 in year 1, $9030 in year 2 and to increase by $30 each year thereafter. Unit Y has first cost of $24,000 and a salvage value of $3000. Annual disbursements are expected to be uniform $7000 each year. If unit Y is chosen, additional annual income taxes will be $520 in year1, $532 in year2 and will increase by $12 each year thereafter. Each unit has an estimated life of 10 years. Find the comparative equivalent uniform annual costs for each unit using interest rate of 10% after income taxes. **(03)**

1C. Compare the equivalent uniform annual costs of two materials-handling systems, E and F. Use 10% interest rate. **(03)**

Description	Unit E	Unit F
First cost	$ 44,000	$ 72, 000
Life in years	6	10
Salvage value	$2000	$6000
Annual O&M costs	$16, 800	$9,800
Extra Annual Income tax		$2960

2A.	Three types of drill bits can be used in a certain manufacturing operation. A bright high-speed steel (HSS) bit is the least expensive to buy, but it has a shorter life than either gold oxide or titanium nitride bits. The HSS bits will cost $3500 to buy and will last for 3 months under the conditions in which they will be used. The operating cost for these bits will be $2000 per month and salvage value is $2000. The gold oxide bits will cost $6500 to buy and will last for 6 months with an operating cost of $1500 per month and salvage value is $4000. The titanium nitride bits will cost $7000 to buy and will last 12 months with an operating cost of $1200 per month with salvage value $3000. At an interest rate of 12% per year, compounded monthly, which type of drill bit should be used on the basis of Present Worth analysis?	**(03)**
2B.	Air Links, a commuter airline company, is considering replacing one of its baggage handling machines with a newer and more efficient one. The current book value of the old machine is $50,000, and it has a remaining useful life of five years. The salvage value expected from scrapping the old machine at the end of five years is zero, but the company can sell the machine now to another firm in the industry for $10,000. The new baggage-handling machine has a purchase price of $120,000 and an estimated useful life of seven years. It has an estimated salvage value of $30,000 and is expected to realize economic savings on electric power usage, labor and repair costs and also to reduce the amount of damaged luggage. In total, an annual savings of $50,000 will be realized if the new machine is installed. The firm uses a 10% MARR. (a) What is the initial cash outlay required for the new machine? (b) What are the cash flows for the defender in years 0 to 5? (c) Should the airline purchase the new machine?	**(04)**
2C.	A new machine costs $100000. The annual operating costs are $200 for the first year and increases by $100 for the next seven years. If the required rate of return is 10% compounded quarterly, what is the minimum annual revenue the machine must generate for the investment to become feasible?	**(03)**
3A.	A company is considering the purchase of an automatic feed machine for a certain phase of finishing process. The machine has an initial cost of $23,000, a salvage value of $4,000 and life of 10 years. The machine requires one person to operate it, whose labor cost is $12 an hour. The output of this machine is 8 tons/ hour. Annual maintenance and operation cost of the machine is $3,500. Alternatively, the company can purchase a less sophisticated manual feed machine for $8,000, which has no salvage value and a life of 5 years. However, with this alternative 3 workers are required at a cost of $8/ hour for each person and will have an annual maintenance and operating cost of $4,500. Output is 6 tons per hour for this machine. How much sheet metal must be finished per year in order to justify the purchase of the automatic feed machine if interest rate is 10%?	**(04)**
3B.	Calculate the future value of the following cash flows series. (i) A uniform quarterly payment of Rs. 10000 for the next three years at an interest rate of 12% compounded quarterly. (ii) A uniform quarterly payment of Rs. 10000 for the next three years at an interest rate of 12% compounded semi-annually. (iii) A uniform quarterly payment of Rs. 10000 for the next three years at an interest rate of 12% compounded monthly.	**(06)**

4A. What is the amount of 10 equal annual deposits that can provide five annual withdrawals, where a first withdrawal of $2000 is made at the end of year 11 and subsequent withdrawals increase at the rate of $500 year over the previous year's, if the interest rate is 10% compounded annually? **(02)**

4B. The total sales call credit of a firm is Rs, 3,50,000. It has a gross profit margin of 25% and current ratio is 2. The firm's current liability is Rs. 60,000. Inventories are Rs. 34,000 and cash at Rs. 13,000. Determine the average inventory to be carried by the firm, if an inventory turnover of 5 times is expected.
Determine the average collection period if the opening balance of debtors is intended to be Rs. 50,000. **(04)**

4C. ANS Quarry purchased a computer-controlled face cutter saw for $80,000. The unit has an anticipated life of 5 years and a salvage value of $10000. Compute the schedules for annual depreciation and book value using straight line method, declining balance and double decline balance method for 4 years. **(04)**

5A. 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 10% per year. **(04)**

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

5B. To reduce the operating cost, a company plans to purchase **only one** of the four automatic machines available in the market. All the four machines have ten years of life. A summary of economic analysis performed by the company is given in the table below (with missing numbers marked as A, B, C, D, E, F and G). The company's MARR is 10%. **(06)**

Particulars	**Machines**			
	M1	**M2**	**M3**	**M4**
Investment (Rs)	**A**	-13000	-30000	-60000
Annual Cost (Rs)	-48200	-47400	-44250	-39800
Annual Savings (Rs)	+50000	+50000	+50000	+50000
IRR (%)	12%	**B**	14%	**E**
Machines Compared	-	2 to 1	3 to 2	4 to 3
Incremental Investment (Rs)	-	-3000	-17000	-30000
Incremental cash flow (Rs)	-	+800	**C**	**F**
Incremental ROR (%)	-	23.5%	**D**	**G**

(i) Fill the **missing data** and recommend which machine should be purchased.

(ii) Suppose that the above alternatives are independent, and MARR is 13%, which machine(s) should the company select?

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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