Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of MAHE, Manipal)

VII SEMESTER B.TECH. (COMMON TO ALL)

MAKE UP EXAMINATION, DECEMBER 2019

SUBJECT: ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT [HUM 4002]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL FIVE FULL** questions.
- **INTEREST TABLE** is provided in the last page (else use formula).
- Missing data may be suitably assumed.

1A)	The Cadillac Motor Car Company is advertising a 36-month lease of a Cadillac Deville for $550, payable at the beginning of each month. The lease requires a $3,500 down payment, plus a $600 refundable security deposit. As an alternative, the company offers a 24-month lease with a single up-front payment of $13,000, plus a $600 refundable security deposit. The security deposit will be refunded at the end of the 24-month lease. Assuming an interest rate of 6%, compounded monthly, which lease is the preferred one?	**(3)**
1B)	A low-cost non-contact temperature measuring tool may be able to identify rail road car wheels that are in need of repair long before a costly structural failure occurs. If the tool is bought the railways would save $25,000 per quarter in the years 1 through 5 and this savings is expected to increase by $2500 every quarter in the years 6 through 20. What is the annual worth of savings over the 20 years? Interest rate is 6% per annum compounded quarterly.	**(4)**
1C)	A large food-processing corporation is considering using laser technology to speed up and eliminate waste in the potato-peeling process. To implement the system, the company anticipates needing $3.5 million to purchase the industrial strength lasers. The system will save $1,550,000 per year in labour and materials. However, it will require an additional operating and maintenance cost of $350,000. Annual income taxes will also increase by $150,000. The system is expected to have a 10-year service life and will have a salvage value of about $200,000. If the company's MARR is 6%, use the FW method to justify the economics of the project.	**(3)**

2A) A suburban taxi company is considering buying taxis with diesel engines instead of gasoline engines. The cars average 50,000 km per year, with a useful life of 3 years for the taxi with the gasoline engine and 4 years for the diesel taxi. Other comparative information is as follows. **(4)**

(Costs in $)	**Diesel**	**Gasoline**
Vehicle cost	13,000	12,000
Fuel cost per liter	0.48	0.51
Mileage, in km/ liter	35	28
Annual repairs	300	200
Annual insurance premium	500	500
End-of-useful-life resale value	2,000	3,000

Use an annual cash flow analysis to determine the more economical choice if interest is 6%.

2B) 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. **(4)**

2C) A couple is planning to finance its two-year-old son's college education. Money can be deposited at 6% compounded quarterly. What quarterly deposit must be made from the son's 2nd birthday to his 18th birthday to provide $50,000 on each birthday from the 18th to the 21st ? (Note that the last deposit is made on the date of the first withdrawal.) **(2)**

3A) Midwest Power and Light operates 14 coal-fired power plants in several states around the United States. The company recently settled a lawsuit by agreeing to pay $60 million in mitigation costs related to acid rain. The settlement included $21 million to reduce emissions from barges and trucks in the Ohio River Valley, $24 million for projects to conserve energy and produce alternative energy, $3 million for Chesapeake Bay, $2 million for Shenandoah National Park, and $10 million to acquire ecologically sensitive lands in Appalachia. The question of how to distribute the money over time has been posed. Plan A involves spending $5 million now and the remaining $55 million equally over a 10-year period (that is, $5.5 million in each of years 1 through 10). Plan B requires expenditures of $5 million now, $25 million 2 years from now, and $30 million 7 years from now. Determine which plan is more economical on the basis of a present worth analysis over a 10-year period at an interest rate of 6% per year. **(5)**

3B)	A piece of machinery costs $7500 and has no salvage value after it is installed. The manufacturer's warranty will pay the first year's maintenance and repair costs. In the second year, maintenance costs will be $900, and this item will increase on a $900 arithmetic gradient in subsequent years. Also, operating expenses for the machinery will be $500 in the first year and will increase on a $400 arithmetic gradient in the following years. If interest is 8%, what is the economic service life for this machine?	**(5)**
4A)	The U.S. Bureau of Reclamation is considering five national park projects shown below, all of which can be considered to last indefinitely. At a MARR of 6% per year, determine which should be selected, if they are (a) Independent and (b) Mutually exclusive.	**(4)**
4B)	A newly constructed bridge costs INR 5,00,00,000. The same bridge is estimated to need renovation every 15 years at a cost of INR 50,00,000. Annual repairs and maintenance are estimated to be INR 10,00,000 per year for the first seven years and then increases to an amount of INR 12,50,000 from the eighth year onwards till fifteenth year and afterwards to an amount of INR 15,00,000 per year forever. If the interest rate is 6%, determine the capitalized cost of the bridge. Also, what is its equivalent annual cost?	**(3)**
4C)	Komatsu Cutting Technologies is considering replacing one of its CNC machines with one that is newer and more efficient. The firm purchased the CNC machine 10 years ago at a cost of $135,000. The machine had an expected economic life of 12 years at the time of purchase and an expected salvage value of $12,000 at the end of the 12 years. The original salvage estimate is still good, and the machine has a remaining useful life of 2 years. The firm can sell this old machine now to another firm in the industry for $30,000. The new machine can be purchased for $165,000, including installation costs. It has an estimated useful (economic) life of 8 years. The new machine is expected to reduce cash operating expenses by $30,000 per year over its 8-year life, at the end of which the machine is estimated to be worth only $5,000. The company has a MARR of 12%. If the firm needs the service of these machines for an indefinite period and no technology improvement is expected in future machines, what will be your decision?	**(3)**
5A)	Determine the Sales of the company from the following data. • Current Ratio – 1.5 • Acid Test Ratio – 1.2 • Current Liabilities – Rs. 8,00,000 • Inventory Turnover Ratio – 8	**(5)**

Project ID	**First Cost, $1000**	**Rate of Return %**	**Annual Income, $1000**
A	-20000	10	2000
B	-10000	13	1300
C	-15000	6.6	1000
D	-70000	5.7	4000
E	-50000	5.2	2600

5B)	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 6% per year.	**(5)**

6% Compound Interest Factors 6%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
n	Compound Amount Factor Find *F* Given *P* *F/P*	Present Worth Factor Find *P* Given *F* *P/F*	Sinking Fund Factor Find *A* Given *F* *A/F*	Capital Recovery Factor Find *A* Given *P* *A/P*	Compound Amount Factor Find *F* Given *A* *F/A*	Present Worth Factor Find *P* Given *A* *P/A*	Gradient Uniform Series Find *A* Given *G* *A/G*	Gradient Present Worth Find *P* Given *G* *P/G*	*n*
1	1.060	.9434	1.0000	1.0600	1.000	0.943	0	0	1
2	1.124	.8900	.4854	.5454	2.060	1.833	0.485	0.890	2
3	1.191	.8396	.3141	.3741	3.184	2.673	0.961	2.569	3
4	1.262	.7921	.2286	.2886	4.375	3.465	1.427	4.945	4
5	1.338	.7473	.1774	.2374	5.637	4.212	1.884	7.934	5
6	1.419	.7050	.1434	.2034	6.975	4.917	2.330	11.459	6
7	1.504	.6651	.1191	.1791	8.394	5.582	2.768	15.450	7
8	1.594	.6274	.1010	.1610	9.897	6.210	3.195	19.841	8
9	1.689	.5919	.0870	.1470	11.491	6.802	3.613	24.577	9
10	1.791	.5584	.0759	.1359	13.181	7.360	4.022	29.602	10
11	1.898	.5268	.0668	.1268	14.972	7.887	4.421	34.870	11
12	2.012	.4970	.0593	.1193	16.870	8.384	4.811	40.337	12
13	2.133	.4688	.0530	.1130	18.882	8.853	5.192	45.963	13
14	2.261	.4423	.0476	.1076	21.015	9.295	5.564	51.713	14
15	2.397	.4173	.0430	.1030	23.276	9.712	5.926	57.554	15
16	2.540	.3936	.0390	.0990	25.672	10.106	6.279	63.459	16
17	2.693	.3714	.0354	.0954	28.213	10.477	6.624	69.401	17
18	2.854	.3503	.0324	.0924	30.906	10.828	6.960	75.357	18
19	3.026	.3305	.0296	.0896	33.760	11.158	7.287	81.306	19
20	3.207	.3118	.0272	.0872	36.786	11.470	7.605	87.230	20
21	3.400	.2942	.0250	.0850	39.993	11.764	7.915	93.113	21
22	3.604	.2775	.0230	.0830	43.392	12.042	8.217	98.941	22
23	3.820	.2618	.0213	.0813	46.996	12.303	8.510	104.700	23
24	4.049	.2470	.0197	.0797	50.815	12.550	8.795	110.381	24
25	4.292	.2330	.0182	.0782	54.864	12.783	9.072	115.973	25
26	4.549	.2198	.0169	.0769	59.156	13.003	9.341	121.468	26
27	4.822	.2074	.0157	.0757	63.706	13.211	9.603	126.860	27
28	5.112	.1956	.0146	.0746	68.528	13.406	9.857	132.142	28
29	5.418	.1846	.0136	.0736	73.640	13.591	10.103	137.309	29
30	5.743	.1741	.0126	.0726	79.058	13.765	10.342	142.359	30
31	6.088	.1643	.0118	.0718	84.801	13.929	10.574	147.286	31
32	6.453	.1550	.0110	.0710	90.890	14.084	10.799	152.090	32
33	6.841	.1462	.0103	.0703	97.343	14.230	11.017	156.768	33
34	7.251	.1379	.00960	.0696	104.184	14.368	11.228	161.319	34
35	7.686	.1301	.00897	.0690	111.435	14.498	11.432	165.743	35