Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (CHEMICAL ENGINEERING)

MAKE-UP EXAMINATIONS, DEC 2015/JAN 2016

SUBJECT: PROCESS ENGINEERING ECONOMICS [CHE 401]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 100

Instructions to candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data, if any, may be suitably assumed.

1A.	A bond is purchased for ₹ 900 and kept for 10 years at which time it matures at a face value of ₹ 1000. During the 10 year period, ₹ 60 is received every 6 months. What is the rate of return for the investment?	**08**
1B.	A person wishes to deposit a single sum of money in a savings account so that five equal annual withdrawals of ₹ 2000 can be made before depleting the fund. If the first withdrawal is to occur one year after the deposit and the fund pays interest at the rate of 7% compounded annually, how much amount should be deposited.	**04**
1C.	Develop the expression for the future worth of a series of cash flow forming geometric series.	**08**
2A.	A coal mine having 6 million units of coal, has a first cost of ₹ 10,000,000. The gross income for this coal is ₹ 18/ unit and operating cost are ₹ 14.8/ unit. If during the first two years of operation, the mine yields 150,000 and 200,000 units respectively. Use the better method of depletion and calculate after tax cash flow. Use tax rate of 50% and depletion % = 10%.	**12**
2B.	What are the present worth and future worth equivalents of a uniform series of continuous cash flows, totaling ₹ 1000/year for 10 years when interest is compounded continuously at a rate of 10% per year?	**08**
3A.	Fin the best alternative by incremental approach (future worth and annual worth) method. Given i=10% Cash flows in ₹ .	**10**
3B.	An evaporator has an initial cost of ₹ 100,000 and a salvage value of ₹ 5000 at the end of ten years. Calculate the recovered and unrecovered capital for all the years using sinking fund depreciation. Use interest rate of 10%.	**10**

	Alternative 1	Alternative 2	Alternative 3
0	0	-10000	-15000
1	4000	7000	7000
2	4000	7000	8000
3	4000	7000	9000
4	4000	7000	10000
5	4000	7000	11000

4A. Four investment proposals W, X, Y and Z are being considered by a process industry. Proposals X and Z are mutually exclusive. Proposal Y is contingent on either X or Z. Proposal W and Y are mutually exclusive. A budget limitation of ₹ 200,000 exists. Either proposal X or proposal Z must be included in the alternative selected. Using MARR of 20%, determine the best alternative by annual worth method.
Cash flow is in ₹ .

EOY	CF(W)	CF(X)	CF(Y)	CF(Z)
0	-100,000	-125,000	-90,000	-100,000
1-8	30,000	50,000	25,000	20,000
8	40,000	10,000	120,000	100,000

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4B. A company has an evaporator that has an estimated remaining life of 10 years. The evaporator can be sold for ₹ 6000. If the crane is kept in service, it must be repaired immediately at a cost of ₹ 3000. Operating and maintenance cost will be ₹ 2000/year, if the crane is repaired. After repairing it, the evaporator will have a zero salvage value at the end of 10 year period. A new evaporator will cost ₹ 16000 and will last for 10 years and will have ₹ 3000 salvage value at that time. Operating and maintenance cost are ₹ 1000 for the new evaporator every year. The company uses an interest rate of 10%. Evaluate the best alternative by annual worth method. **06**

5A. Derive the expression for optimum production rate in terms of minimum cost per unit of production and maximum profit per unit of time. **10**

5B. A certain batch operation requires a total batch time of 7 hours permitting the operation to be completed in one shift. The annual fixed cost varies with the size of the batch as follows
$C_F = 12\ Q_B^{1.2}$, where Q_B is batch size in kg.
The charging, discharging cost are ₹ 466 per batch with an operating cost of ₹ 18/hr and other cost varies as $Q_A^2/10^6$ ₹ /year, where Q_A is annual production. What is the optimum batch size to produce 0.1 million kg per year of the product. **10**

6A. The installation cost for insulating a steam pipe is given by
$C_F = 40S+30$ ₹ /yr
Where S is the thickness of insulation in mm.
The annual cost of steam lost is $C_D = 130/S$, (₹ /yr)
Determine analytically and graphically the optimum insulation thickness and the optimum cost. **10**

6B. If the ratio of variable cost to total sales is 0.5 and the fixed cost are ₹ 120,000 for a product selling at ₹ 40/tonne. What is the total cost per unit of product?
(a) At maximum capacity of 15,000 tonnes.
(b) At ₹ 220,000 net sales. **10**