BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH **SEMESTER : V**
BRANCH: CHEMICAL ENGINEERING **SESSION : MO/2024**

SUBJECT: CL327 PROJECT ENGINEERING AND ECONOMICS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	The total capital investment for a chemical plant is \$1 million, and the working capital is \$100,000. If the plant can produce an average of 8000 kg of final product per day during a 365-day year, what selling price in dollars per kilogram of product would be necessary to give a turnover ratio of 1.0?	[5]	1	3
Q.1(b)	A process plant making 2000 tons per year of a product selling for \$0.80 per lb has annual direct production costs of \$2 million at 100 percent capacity and other fixed costs of \$700,000. What is the fixed cost per pound at the break-even point? If the selling price of the product is increased by 10 percent, what is the dollar increase in net profit at full capacity if the income tax rate is 34 percent of gross earnings?	[5]	1	3
Q.2(a)	A heat exchanger has been designed for use in a chemical process. A standard type of heat exchanger with a negligible scrap value costs \$4000 and will have a useful life of 6 years. Another proposed heat exchanger of equivalent design capacity costs \$6800 but will have a useful life of 10 years and a scrap value of \$800. Assuming an effective compound interest rate of 8 percent per year, determine which heat exchanger is cheaper by comparing the capitalized costs.	[5]	2	3
Q.2(b)	An annuity due is being used to accumulate money. Interest is compounded at an effective annual rate of 8 percent, and \$1000 is deposited at the beginning of each year. What will the total amount of the annuity due be after 5 years?	[5]	2	3
Q.3(a)	The original investment for an asset was \$10,000, and the asset was assumed to have a service life of 12 years with \$2000 salvage value at the end of the service life. After the asset has been in use for 5 years, the remaining service life and final salvage value are re-estimated at 10 years and \$1000, respectively. Under these conditions, what is the depreciation cost during the sixth year of the total life if straight-line depreciation is used?	[5]	3	3
Q.3(b)	The total value of a new plant is \$2 million. A certificate of necessity has been obtained permitting a write-off of 60 percent of the initial value in 5 years. The balance of the plant requires a write-off period of 15 years. Using the straight-line method and assuming negligible salvage and scrap value, determine the total depreciation cost during the first year.	[5]	3	3
Q.4(a)	A batch reactor produces 1,00,000 kg of product per year. The operating time per batch (In hours) is equal to $(P_B)^{0.5}$, where P_B is kgs of product produced per batch. The operating cost of the reactor is Rs. 200/h. The total annual fixed cost is equal to Rs. $340P_B$ and the annual raw material cost is Rs. 2,000,000. Determine the size in kg of each batch for minimum total cost per annum.	[5]	4	3
Q.4(b)	Solve the following linear programming problem using graphical method. Minimize, $Z = 6x + 3y$ Subject to the constraints: $4x + y \geq 80$; $x + 5y \geq 115$; $3x + 2y \leq 150$; $x \geq 0$; $y \geq 0$	[5]	4	3

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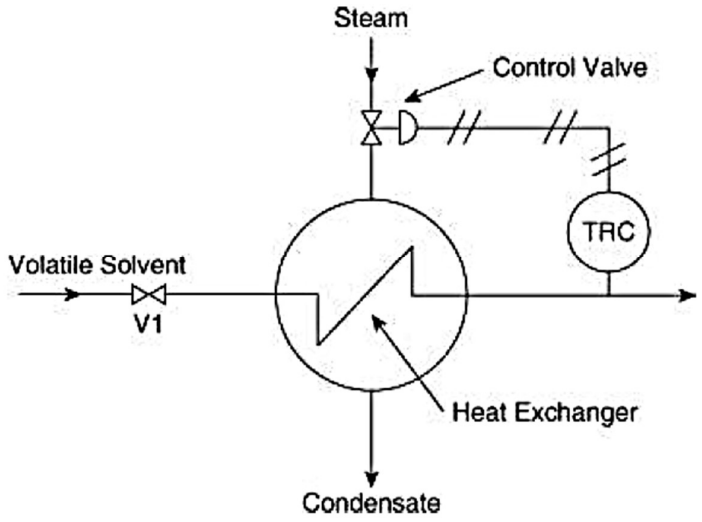
Q.5(a)	Explain Hazards identification and risk assessment procedure with the help of a flowchart.	[3]	5	2
Q.5(b)	A heat exchanger is used to heat flammable, volatile solvent as shown in the below figure. The temperature of the outlet stream is measured by a thermocouple, and a controller valve manipulates the amount of steam to the heat exchanger to achieve the desired set point temperature. Perform a HAZOP study on the hot solvent stream from heat exchanger. Use flow as process parameter and use the following guide words: No, More and Less.	[7]	5	4



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