U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Chemical Engineering **Duration: 3 hrs.**

Course Code: 19CH5DELB2 **Max Marks: 100**

Course: Optimization of Chemical Processes

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Describe the six steps to solve optimization problem.	*CO1*	*PO2*	**10**
	b)	A cylindrical can with volume at least Vo is to be designed in such a way as to minimize the total cost of the material in a box of 12 cans, arranged in a 3×4 pattern. The cost is proportional to surface area of cans and box. It is given as , $$\text{Cost} = C_1S_1 + C_2S_2$$ where S_1 is the surface area of the 12 cans and S_2 is the surface area of the box. The constant coefficients $C_1$and C_2 are positive. Another constraint is that no dimension of the box can exceed a given value D_0. Formulate the optimization problem, considering the objective function as cost function.	*CO1*	*PO2*	**10**
		OR			
2	a)	Elaborate on i)Net present value ii)Initial rate of return iii) Payback period iv) Time value of money	*CO1*	*PO2*	**10**
	b)	For the following data, how much premium petrol and regular petrol should be produced to maximize the profit? Show the stepwise procedure of problem formulation.	*CO1*	*PO2*	**10**

Crude oil	Octane number	Cost ($/b)	Availability (b)
1	86	17	20000
2	88	18	15000
3	92	20	15000
4	96	23	10000

			<table><tr><td>Petrol</td><td>Octane number</td><td>Selling price($/b)</td><td>Maximum daily demand (b)</td></tr><tr><td>Regular</td><td>89</td><td>19.5</td><td>35,000</td></tr><tr><td>Premium</td><td>93</td><td>22</td><td>23,000</td></tr></table>			
		UNIT - II				
3	a)	Determine the stationary points of function: $12x^5 - 45x^4 + 40x^3 + 5$ and classify them as minima, maxima or saddle point.	*CO2*	*PO3*	**10**
	b)	Show that the function f(x) = exp (x1) + exp (x2) is strictly convex.	*CO2*	*PO3*	**10**
		OR			
4	a)	Explain the algorithm of interval halving method of region elimination	*CO2*	*PO3*	**10**
	b)	Consider the minimization of the function $f(x) = 2 - 4x + ex$ in the interval [0.5, 2.5] using Dichotomous search method. Use ε = 0.01**.** What is the midpoint of the interval of uncertainty after 3 iterations	*CO2*	*PO3*	**10**
		UNIT - III			
5	a)	A cylindrical refrigeration tank of volume 50 m3 has to be built. Two circular ends cost Rs.500 per m2, the cylindrical wall costs Rs. 300 per m^2 and the cost of refrigeration is Rs. 5000 per m^2 over the life of the tank. Find the diameter of the tank that will minimize the total cost using bisection method. Consider that the minimum is bracketed in the range [1, 6] and perform 3 iterations.	*CO3*	*PO3*	**10**
	b)	Elaborate on Simplex method of solving linear programming.	*CO3*	*PO3*	**10**
		OR			
6	a)	Explain the knapsack and traveling salesman problem of mixed integer programming.	*CO3*	*PO3*	**10**
	b)	Maximize: $f = 86y_1 + 4y_2 + 40y_3$ Subject to: $774y1 + 76y2 + 42y_3 \leq 875$ by branch and bound analysis	*CO3*	*PO3*	**10**
		UNIT - IV			
7	a)	Enumerate the optimum design of multiple effect evaporators .	*CO4*	*PO3*	**10**

		b)	Describe the optimal design and operation of staged distillation columns.	*CO4*	*PO3*	**10**
			OR			
	8	a)	Explain the optimization of liquid-liquid extraction processes.	*CO4*	*PO3*	**10**
		b)	Explain the optimization of staged distillation columns.	*CO4*	*PO3*	**10**
			UNIT - V			
	9	a)	Illustrate the procedure to determine the optimum diameter of pipe in a fluid flow system.	*CO5*	*PO3*	**10**
		b)	Summarize the optimization procedure of thermal cracker via linear programming.	*CO5*	*PO3*	**10**
			OR			
	10	a)	Illustrate the optimization of ammonia reactor.	*CO5*	*PO3*	**10**

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