U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

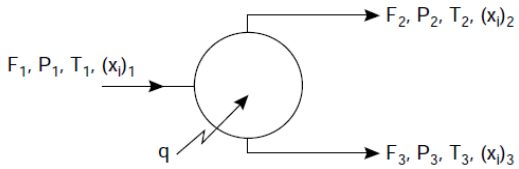
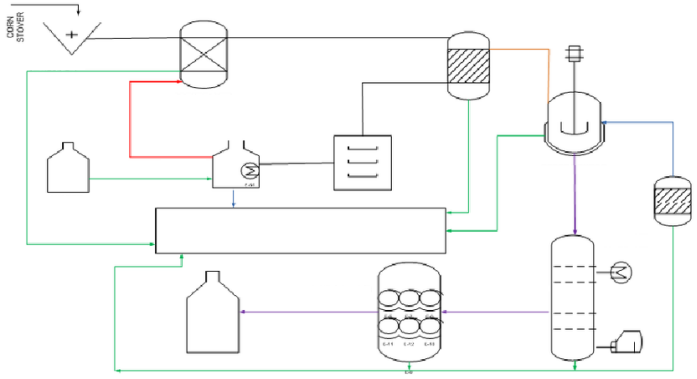
Programme: B.E. **Semester: VII**

Branch: Biotechnology **Duration: 3 hrs.**

Course Code: 22BT7PCEQD **Max Marks: 100**

Course: Bioprocess Equipment Design and CAED

Instructions: 1. Answer any THREE full questions, choosing one full question from each it.
2. Missing data, if any, may be suitably assumed.
3. Use of Perrys hand book, IS 2825 and IS 4503 is allowed.

		UNIT - I	CO	PO	Marks
1	a)	Discuss the key aspects involved in the nature of bioprocess design and the anatomy of a biochemical manufacturing process.	CO1	PO 1	**10**
	b)	Explain the concepts of optimization, factors of safety, and codes and standards in the context of biochemical engineering projects.	CO1	PO1	**10**
		OR			
2	a)	Analyze the following process. Estimate the number of degrees of freedom and find out number of design variables.  Figure 1.7. Flash distillation	CO1	PO1	**05**
	b)	Deliberate on how the P and I diagram aids in deriving the engineering flow-sheet.	CO1	PO1	**10**
	c)	Analyze the process flow diagram, identify the equipments and demonstrate the production of bio-ethanol from corn. 	CO1	PO1	**05**

			UNIT - II			
	3	a)	Draw the assembled sectional view of the flanged pipe joint. Provide the parts list.	*CO2*	*PO2*	**12**
		b)	Discuss the different types of valves and pumps, commonly used in bioprocessing.	*CO2*	*PO2*	**08**
			OR			
	4	a)	Draw a neat sketch of Lap joint and Edge joint.	*CO2*	*PO2*	**06**
		b)	Draw the assembled sectional view of the Non-return Valve. Provide the parts list.	*CO2*	*PO2*	**14**
			UNIT - III			
	5		Design a one shell side pass and one tube side pass shell and tube heat exchanger (STHE) to cool 60000 kg/h of methyl alcohol from 90ºC to 40ºC, using water which flows through the tubes with the temperature rise from 35º to 55ºC. 20 mm od, 16 mm id, 4.88 m long (effective length) cupronickel tubes are to be arranged in triangular pitch. 20% cut baffles are to be spaced. Fouling coefficient for methanol and brackish water are 5000 and 3000W/m2 ºC respectively. An overall coefficient of 650 W/m^2 ºC can be used for the initial trial. Design the exchanger and check for the pressure drop. (Conductivity of metal; Kw is 50 W/ m^2 ºC). Operating pressure in shell side is 900 kPa and tube side is 300 kPa respectively. Allowable stress for the material is 11.7 kgf/cm^2. Properties of Methanol: Density = 750 kg/m^3, Heat capacity = 2.84 kJ/ kg ºC, Viscosity = 0.34 mNs/m^2, Thermal conductivity = 0.19 W/m ºC Properties of water: Density = 995 kg/m^3, Heat capacity = 4.2 kJ/ kg ºC, Viscosity = 0.8 mNs/m^2, Thermal conductivity = 0.59 W/m ºC Draw a neat front sectional view of STHE. Name at least 10 parts.	*CO3*	*PO3*	**60**
			OR			
	6		Design a continuous stirred tank fermenter for citric acid production. Diameter of the vessel is 1.6 m. Volume of vessel is 7.56 m^3. Diameter of agitator is 0.70 m. Height of placement of agitators from bottom is 0.601 m and 1.83 m. Speed of agitation is 100 rpm. Superficial velocity is 0.0107 m/s. Viscocity is 1.4 cP. Jacket spacing is 100 mm. Internal pressure = 2.5 Kgf/cm^2. Steam pressure = 1.5 Kgf/cm^2. Allowable stress = 55 x 10^6 N/m^2. Yield stress 1950 kgf/cm^2. Specific gravity = 1.038. Top and bottom head is tori-spherical type and material of construction is stainless steel. Draw neat diagram of fermenter to suitable scale naming the parts.	*CO3*	*PO3*	**60**

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