Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.Tech. END EXAMINATIONS (AOPE)- March 2021

SUBJECT: Membrane Science and Technology [CHE 4019]

REVISED CREDIT SYSTEM, (22/03/2021)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates: Answer ALL the questions. Missing data may be suitable assumed.

	Explain the aromatic polyamides used in membranes	2
1A	What type of membranes are used in gas separation, pervaporation, dialysis and electro	$\frac{2}{2}$
	dialysis	
1B	Explain Track-Elect method of memorane preparation with help of diagram	3
1C	Explain three optical methods used to measure the pore size of membranes	3
2A	Explain the tubular membranes and its characteristics	2
2B	List the advantages of reverse osmosis in industries? Methods of reducing the concentration polarization in reverse osmosis	2 2
2C	$30 \text{ m}^3/\text{hr}$ seawater is to be used as a feedstock to produce boiler water with reverse osmosis. Assuming that all of the 4.2 % salt is NaCl and that there will be a 25% brine bleed-off, calculate the power required in the membrane separation process. Assume that an additional net operating pressure drop across the membrane of 20 atm will be required. The density of the seawater is 1023 kg/m ³ at 25 °C. Assume pump efficiency is 75%.	4
3A	30 m^3 /hr seawater is to be used as a feedstock to produce boiler water with Nanofiltration unit with membrane area 12 m^2 . Assuming that all of the 4.2 % salt is NaCl and that there will be a 25% brine bleed-off, calculate the total resistance offered by membrane.	3
3B	An asymmetric ultrafiltration membrane is used with the aim of separating dyes from a liquid stream and to achieve a more concentrated dye-water mixture. The feed waste stream arrives at a flow rate of 3.2 m ³ /hour with concentration of 0.45 kg/m ³ and assume permeate is pure. Two tubular UF membranes are available with 30 m ² area and used in series. The membrane's operating characteristic was calculated from various experiments: $J_v = 0.04 \ln \left(\frac{25}{C}\right)$ where the bulk concentration C in kg/m ³ and flux is measured in m ³ /hour/m ² . 1) What is the flow rate of the cleaned water from the system 2) What is the final concentration of dye after second stage?	7
4 A	Why internal fouling is difficult to overcome than external fouling in microfiltration	2
4 B	Explain the factors effecting the pervaporation process	3
4C	Derive the flux equation using solution –diffusion model for dialysis process	5

5A	Briefly explain the microscopic models in gas separation	2
	Describe various applications of gas separation	2
	Explain three permporometry used to measure the pore size of membranes	2
5B	Explain the electro dialysis and its applications	2
	Explain the applications of membranes in our daily life	2