MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH (INDUSTRIAL BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS - REGULAR, NOV/DEC 2018

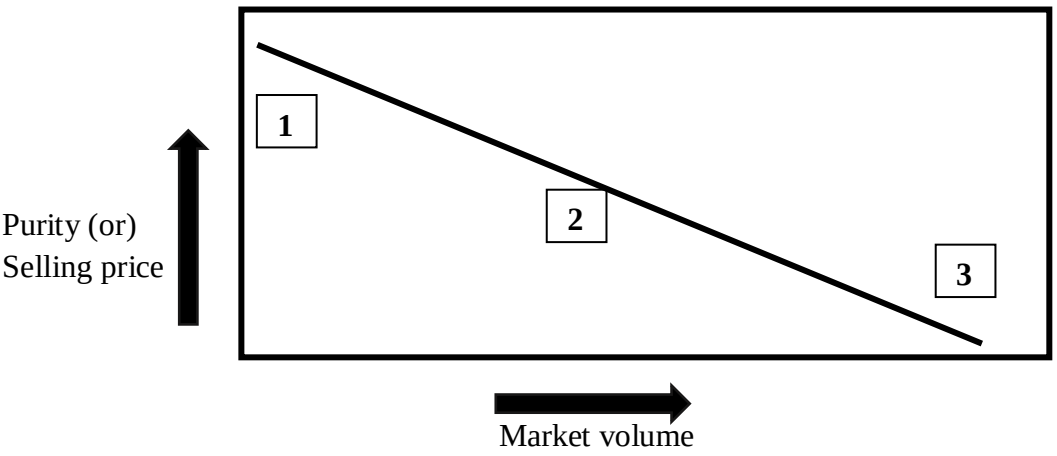
SUBJECT: **ADVANCED BIOSEPARATION PROCESSES** [**BIO 507**]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions Missing data may be assumed.

1A.	Below is the correlation between market volume of the desired product and purity or selling price. Categorize and place different bio-products in the below given regions (1, 2 & 3):  	**3**
1B.	For successful separation of product of interest from range of impurities, careful discrimination of physicochemical properties of these components from the fermentation mixture is a quintessential step. Detail the role and importance of any four physicochemical properties in bioseparations?	**4**
1C.	Ms. Shruti research focuses on isolation of peroxidase, an intracellular enzyme. Assist her (through a flow chart) with various downstream processing steps for successful isolation.	**3**
2A.	A fermentation broth encompasses 80 litres with a desired protein at 12.8 g/L and a contaminant protein at 1.9 g/L. Determine the salt (ammonium sulphate) concentration required to recover 98% of the desired protein if the precipitation constants β and K of the desired protein are 9.33 and 1.1 respectively and that of the contaminant protein are 8.8 and 0.95 respectively. Estimate the purity of the desired protein at 98% recovery?	**4**
2B.	A pharma company intends to isolate a protein by using two entities that don't mix due to stearic exclusion. What is the name of the method (with their significances) the company is employing for protein separation and what are those two entities made up of?	**3**
2C.	Describe ways to improve the filtration efficiency?	**3**
3A.	Rakshit used a tubular bowl centrifuge with an internal diameter and length of 15 cm	**3**

<table>
<tr><td></td><td>and 80 cm respectively, for concentration of engineered bacterial species. Estimate the settling velocity of the cells at a speed of 18,000 rpm in centrifuge with the volumetric capacity of 250 litres per hour.</td><td></td></tr>
<tr><td>3B.</td><td>Ramesh uses Craig extraction for separating trichloroacetic acid. The initial mass of the solute is 500 g and the system uses 800 transfers with acetone as the light phase and water as the heavy phase. During separation, 50% goes to the mobile phase and the extraction factor is 3. Calculate the distribution of the organic acid after 3 transfers.</td><td>5</td></tr>
<tr><td>3C.</td><td>A famous brewer observed aggregates formed due to turbulence, ionic concentration and bacteria. This has huge impact on the yield. Assist the company to overcome this hindrance?</td><td>2</td></tr>
<tr><td>4A.</td><td>Ultrafiltration of pepsin was performed using a spiral wound membrane at a rate of 1.5×10^{-3} cm/sec. Estimate the concentration of the solute on the membrane surface, if the bulk solution concentration is 0.39 wt%. Protein diffusion co-efficient is 9.6×10^{-7} cm^2/sec and the boundary layer is 178×10^{-4} cm.</td><td>3</td></tr>
<tr><td>4B.</td><td>In an ultrafiltration process, the intrinsic and rejection co-efficient for a solute in an ultrafiltration process were found to be 0.95 and 0.63 with a permeate flux of 6×10^{-3} cm/sec. Find the solute mass transfer co-efficient?</td><td>3</td></tr>
<tr><td>4C.</td><td>Discuss two critical factors that affect membrane-based separations?</td><td>4</td></tr>
<tr><td>5A.</td><td>Arshit used activated carbon to recover a steroid from 10 litres of feed solution by adsorption. The concentration of the steroid in the feed is 1.1 x 10-6 gram per gram of water. Assuming that this adsorption process follows Freundlich isotherm and adsorption data obtained is given below. Determine the adsorbent required for 95% recovery of steroid?
<table>
<tr><th>$C_U \times 10^6$ (g solute/ g water)</th><th>$C_B \times 10^3$ (g solute/ g carbon)</th></tr>
<tr><td>0.1</td><td>1.3</td></tr>
<tr><td>0.3</td><td>1.7</td></tr>
<tr><td>0.6</td><td>2.3</td></tr>
<tr><td>0.9</td><td>2.4</td></tr>
<tr><td>1.2</td><td>2.6</td></tr>
</table></td><td>4</td></tr>
<tr><td>5B.</td><td>Briefly explain the working principle of packed bed adsorption.</td><td>2</td></tr>
<tr><td>5C.</td><td>Elaborate the separation techniques using gel filtration and reverse phase chromatography with examples.</td><td>4</td></tr>
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