Registration No: | | | | | | | | | | |

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B.TECH
PCBT4306

6th Semester Regular / Back Examination 2015-16
DOWNSTREAM PROCESS ENGINEERING
BRANCH: BIOTECH
Time: 3 Hours
Max Marks: 70
Q.CODE: W325

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) What is triple point of water? What is its significance in freeze drying?
b) Enlist different chromatographic methods.
c) Differentiate between drying & crystallization?
d) What are the different physical methods of cell disruption?
e) Write the different mode of transfer of heat during drying process.
f) What in reverse phase chromatography?
g) What is hydrophobic chromatography?
h) What is CMC? Write it importance in drying curve?
i) Give examples of different membrane separation process.
j) Write the principle of affinity chromatography.

Q2 Write notes on. **(5)**
a) Homogenizer in cell disruption. **(5)**
b) Explain the method of protein precipitation by salting out method.

Q3 **a)** Write the principle, instrumentation of Freeze dryer. **(5)**
b) Discuss the principle of crystallization. Write different types of crystallizer used for industrial purpose. **(5)**

Q4 Discuss the different types of chromatography techniques on the basis of their working principles. What is HPLC? Write it advantages over other chromatography techniques? Explain the different components of the HPLC with a suitable schematic diagram along with its working. **(10)**

Q5 **a)** Discuss in detail the working of size exclusion chromatography.. **(5)**
b) The fermentation broth contains 20 g of cells per litre of the slurry and the cells have a density of 900 kg/m^3. The volume of filtrate collected with time was recorded and given as below. Calculate the specific cake resistance (α) and equivalent cake thickness (L_m) when the recovery is done at a constant pressure mode. Given that the pressure difference as $1x10^5$ Pa s; cross section area of filter press as 0.18 m^2 and viscosity (μ) of slurry as $1x\ 10^{-3}$ Pa s. **(5)**

Time , min	8	27	54	90	140
Vol, lit	20	40	60	80	100

Q6 **a)** Discuss in detail the principle and working of electrodialysis. **(5)**

b) Aqueous two-phase extraction is used to recover α-amylase from solution. A PEG- dextran mixture is added and the solution separates into two phases. The partition coefficient is 0.8. Calculate the maximum possible enzyme recovery when the volume ratio of the upper to lower phase is 4.0. What would be the recovery if the partition coefficient is 3.5? **(5)**

Q7 **a)** Write the construction, working of plate and frame filter press. **(5)**

b) Write the principle and working of ion exchange chromatography. **(5)**

Q8 Write Short Notes (Any Two) **(5 x 2)**

a) Ultrafiltration

b) 2-D gel electrophoresis

c) Liquid-liquid extraction

d) IMAC