BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: …… Roll No.: ……..

Branch: …… Signature of Invigilator: ……

Semester: VIth Date: 26/04/2022 (MORNING)

Subject with Code: **BE308 BIOSEPARATION ENGINEERING**

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI

Department of Bioengineering and Biotechnology

BE 308 Bioseparation Engineering (End Sem, SP 22)

B. Tech **6th Sem Biotech.** **Full marks: 50** **Time: 2 hrs**

Section A

(Multiple Choice Type Questions)

Choose the correct alternative for the following: **(15 × 2 = 30)**

i. In reverse phase chromatography, mobile phase used is
   a. Hydrophilic
   b. Hydrophobic
   c. Can be both
   d. Hexane

ii. A protein carries net negative charge when
   a. pH < PI
   b. pH > PI
   c. pH = PI
   d. None of these

iii. In Ion exchange chromatography, the ions that exchanged are of
   a. Same charge
   b. Opposite charge
   c. Equal charge
   d. Equal and opposite charge

iv. DEAE is used as
   a. Strong anion exchanger
   b. Weak anion exchanger
   c. Strong cation exchanger
   d. Weak cation exchanger

v. Molecular weight of a protein can be determined by which chromatography
   a. Gel filtration
   b. Ion exchange
   c. Affinity
   d. Hydrophobic interaction

vi. Mechanical cell disruption method is
   a. Heat shock
   b. Homogenizer
   c. Lysozyme
   d. Chemical agent

vii. Liquid-liquid extraction depends on
   a. Volatility
   b. Solubility
   c. Miscibility
   d. Distribution coefficient

viii. Cell disruption is needed to separate
   a. Extra-cellular product
   b. Intra-cellular product
   c. Both a and b
   d. None-of the above

ix. Dialysis can separate organic ions in the MW range

a. Greater than 10 b. Less than 10

c. Greater than 100 d. 10 to 100

x. The chemical most commonly used in salting out method is

a. Na_2HPO_4 b. NaCl

c. $(NH_4)_2SO_4$ d. $KMnO_4$

xi. Salt can be removed by

a. Gel filtration chromatography b. Affinity chromatography

c. Adsorption d. Electrophoresis

xii. The next step of Salting out is usually

a. UF b. RO

c. Dialysis d. None of the above

xiii. For a UF system, Pressure at the entrance of the system P_i = 6 atm and at the exit P_0 = 2 atm. Transmembrane pressure drop will be

a. 4 atm b. 3 atm

c. 1 atm d. 2 atm

xiv. The best cell lysis technique for plant cell is

a. Mortar-pestle b. Sonication

c. None d. Both a and b

xv. The driving force for dialysis is

a. Pressure b. Temperature

c. Concentration gradient d. pH

Section B

Answer any **FOUR (4)** questions **(4 × 5 = 20)**

1. Two proteins of MW 2.5×10^5 and 1×10^4 were eluted out of a gel in gel filtration column at 220 mL and 300 mL respectively. Determine the molecular weight of a protein that elutes out at 270 mL under the same condition? **(5)**
2. Two analytes A and B are separated on a 25 cm column. The observed retention times were 7 min 20 sec and 8 min 20 sec respectively. A reference compound completely exhausted by stationary phase is eluted out at 1 min 20 sec. considering number of theoretical plates are 1764,

    a. What is the resolution of these two peaks?

b. Is it good resolution? **(4+1)**

3. A protein solution (4.4 g/L) is UF using a membrane module that totally retains the protein. At a certain trans-membrane pressure, J = 1.3×10^{-5} m/s; D = 9.5×10^{-11} m^2/s; Cm =10 g/L.
   a. Calculate membrane thickness.
   b. If J is increased to 2.6×10^{-5} m/s. what will be the new Cm? **(2.5+2.5)**
4. Write a short note on electrodialysis. **(5)**
5. Describe with a diagram about rotary vacuum drum driers used in industry. **(5)**
6. A broth of 80 L contains lipase of 12.8 g/L and some contaminant of 1.8 g/L. Calculate the salt required to recover 98% of lipase if the value of β and k for lipase are 9.33 and 1.1 respectively and that of contaminant are 8.8 and 0.95 respectively. What will be the purity of the lipase at 98% recovery? **(5)**