M.TECH. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING

FIRST YEAR SECOND SEMESTER – 2018

ADVANCED FERMENTATION TECHNOLOGY

Time: Three Hours   Full Marks: 100

Use Separate Answer scripts for each part

Different parts of the same question should be answered together
Part-I
Full Marks-50

1. Answer any one question from (a) and (b):
 a) What is fermentation? Give example. Differentiate between SSF and SmF. Mention the important factors on which performance of SSF depends.   2+1.5+5+1.5

 b) Discuss about intra particle mass transfer and heat transfer in SSF system   5+5

2. Answer any one question from (a) and (b):
 a) Why medium sterilization is important for fermentation? What is del factor? State the relationship between del factor and activation energy.   3.5+3.5+3

 b) Discuss about continuous sterilization process of medium.   ·   10

3. Answer any two questions from (a) , (b) and (c):
 a) Mention the differences between absolute filter and fibrous filter. What is meant by X_{90} for air sterilization by fibrous filter   3+2

 b) For air sterilization by fibrous filter explain the following:
    log penetration relationship, efficiency of filter   2.5x2

 c) State the advantages of batch and continuous sterilization of medium.   5

4. Answer any two questions from (a) , (b) and (c):
    Explain the following:
 a) Tray bioreactor for SSF

 b) Rotating bioreactor for SSF

 c) Fluidized bed bioreactor for SSF   5x2

5. Answer any two questions from (a) , (b) and (c):
 a) Define with example primary metabolite and secondary metabolite.
 b) Extraction of Tetracycline from fermentation broth using aqueous two phase systems.
 c) Bacterial resistance mechanism of tetracycline.   5x2

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Use Separate Answer Scripts for Part I and Part II

Part II (Marks-50)

1. Answer any **one** from (a) and (b)   10
a) Explain any two methods for determination of Volumetric Oxygen Transfer Coefficient (k_La)
of a fermenter.   5+5=10
b) Why protein precipitation occurs due to addition of salt and organic solvents.   5+5=10

Answer any **two** from the rest

2. a) A stirred tank reactor is to be scaled up from 10 L to 10,000 L. The small fermenter has a
height to diameter ratio of 1:3. The impeller diameter is 305 of the tank diameter. Agitator speed
is 500 rpm.
i. Determine the dimensions of the small tank (Dt, Di, H) using geometric similarity.
ii. What would be the required rotational speed of the impeller in the small tank if the following
criteria were used?
• Constant P/V
• Constant tip speed
• Constant impeller Reynolds Number
b) Deduce the expression of doubling time and yield coefficient.

                                                   15+(2.5+2.5)=20

3. a) Derive the Ruth equation for constant pressure filtration.
The following data were obtained in a constant pressure filtration unit for Yeast suspension.

T (min)	4	20	48	76	120
V filtrate (L)	115	365	680	850	1130

Characteristics of the filter are as follows

A= 0.28 m^2, C= 1920 kg /m3, μ = 2.9 x 10^{-3} kg/m-s, α= 4 m/kg.

i) Determine the pressure drop across the filter (ΔP).

ii) Determine the filter medium resistance (r_m)   8+12=20

4. a) Prove that in a continuous stirred tank reactor μ_g =D. Explain with diagram the principle of
a Chemostat.   5+10
 b) Explain the principle of any **one** method of separation of insoluble products from fermented
broth.   5