Birla Institute of Technology & Science – Pilani, Hyderabad Campus
First Semester 2022-2023
Comprehensive Examination (Closed book)
Bioprocess Technology, BIO F451

Date: 27.12.2022 **Duration: 180 minutes** **Total Marks: 70 M**

Answer ALL the questions in the given sequence ONLY.

1. Identify True or False statement(s) (Note: In the answer sheet write only the question number and corresponding answer (True/False) (0.5×8 = 4M)
    a) Patent can be made on new application with innovative step but may not have any industrial application.
    b) Non-tax alcohol is fit for human consumption.
    c) The theoretical ethanol yield is 51.1% g/g.
    d) Itaconic acid is produced commercially by solid state fermentation of *Aspergillus terreus* or *A. itaconicus*
    e) TransCyte™ is temporary skin substitute consisting of a polymer membrane and mouse fibroblast cells cultured on a porcine collagen coated nylon mesh.
    f) Enzymes produced in the stomach of ruminant mammals (e.g., cows) are used in the production of cheese.
    g) Malt beverage is produced from wheat grains.
    h) Top fermenting yeast is used for the production of lager beer.

2. Describe the main steps of successful chondrocyte culture for cartilage replacement (6M)

3. You have discovered a pharmaceutically important product in the R&D section of a pharma company. You wish to launch the product in the market. What are the various steps involved before release of the product in the market? How will you ensure the product quality and safety? (6+4 = 10M)

4. How do you define octane number for a liquid fuel? What are the tests involved to determine the octane number? (2+2 = 4M)

5. What are microbial polysaccharides and how are they important to the microorganism? With a block flow diagram, describe the steps involved in production of the most commercially successful microbial exopolysaccharide. (4+6 = 10M)

P.T.O.

6. What are analytical enzymes? Give examples of analytical enzymes (two each) utilized for diagnostic and biochemical assays. What are the special requirements which needs to be considered in a product containing analytical enzymes? (2+4+4 = 10M)

7. What do you mean by capital cost? How does it differ from operational costs? What are the major factors which lead to cost sensitivity? (2+1+2 = 5M)

8. Describe only two differences for the following combinations (2+2+2 = 6M)
   a) White vs Red Wine production
   b) Cultured butter vs yoghurt production
   c) Beer vs vinegar production

9. A chemostat (100 m^3 bioreactor) is used for the cultivation of *Rhizobium* sp. The sucrose concentration in the feed is 12 g/L. K_s and μ_{max} for the organism are 0.2 g/L and 0.3 h^{-1} respectively. (2.5+2.5 = 5M)
   a) Find out the flow rate required to obtain steady state concentration of sucrose as 1.5 g/L in the bioreactor
   b) The steady state cell concentration and yield coefficient of the above culture in the bioreactor are 4.0 g/L and 0.4 g/g, respectively. Find out the steady state substrate concentration.

10. A 1 m^3 mixed flow reactor, at the initial substrate concentration (S_0) = 500 g/m^3 in the feed produces 100 g/h yeast cells in the exit stream at two different flow rates mentioned below (2.5×4 = 10M)
    i) At 0.5 m^3/h of feed for which the steady state S = 100 g/m^3
    ii) At 1.0 m^3/h of feed for which the steady state S = 300 g/m^3

    The yeast growth follows Monod kinetics. Compute the following:

    a) The fractional yield of yeast
    b) The kinetic equation for yeast formation
    c) The flow rate for maximum yeast production
    d) The maximum production rate of yeast

**********BEST OF LUCK**********