

National Exams May 2017

16-Chem-B4, Biochemical Engineering

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a CLOSED BOOK EXAM. One of two calculators permitted Casio or Sharp approved.
3. FIVE (5) questions constitute a complete exam paper. ANSWER ALL FIVE QUESTIONS.
4. Each question is of equal value.
5. Most questions require an answer in short essay format. Clarity and organization of the answer are important.

Question 1 (20 marks)

What is fed batch culture? What are the advantages of fed batch culture? Show using first principles, that the specific growth rate equals the dilution rate under quasi steady state (QSS) conditions for fed-batch cultivation in a continuous, well mixed, stirred tank bioreactor?

Question 2 (20 marks)

(a) Explain briefly (i) Vaccine (ii) Hybridoma (iii) Cell culture (iv) Anchorage dependence (v) Monoclonal antibodies.

(b) What are typical nutrient media needed for cell cultures? What are the optimum pH and temperature requirements for cell cultures?

Question 3 (20 marks)

Discuss in detail batch and continuous approaches for the sterilization of nutrients in bioprocess engineering.

Question 4 (20 marks)

Define and explain k_L and k_{La} . Discuss in detail the Air On and Air Off method and how it can be applied to determine parameters such as specific respiration rate of cells and the volumetric oxygen mass transfer coefficient?

Question 5 (20 marks)

Define and explain briefly the following terms used in bioreactor systems: (i) Reynolds number, (ii) Sherwood number; (iii) Schmidt number, (iv) Thiele modulus, (v) Damkohler number.