

BEL702: Bioprocess Plant Design

Major Examination

5th May 2015

10.30 – 12.30 Hours

V-315

Answer all questions. Maximum marks 100

- ✓ 1. Product P is extracted from the fermentation broth using an organic solvent B. The relative volatility of the mixture of P and B are such that they can be effectively separated using distillation. You need to develop the detailed engineering for a distillation column to separate P and B, with inputs from the process flow sheet. Explain how you will go about carrying out this task. How will you check the plate hydraulics for stable operation?
(20 marks)
- ✓ 2. What are the important material properties to be considered while carrying out the mechanical design of process equipment? Explain how these properties are important from a mechanical design point of view
(20 marks)
- ✓ 3. (i) How will you estimate the total equipment cost (delivered and installed at site) (a) while carrying out an economic feasibility study for a proposed project (b) during detailed engineering/project implementation stage?
(ii) What is depreciation? Why is it shown as an expenditure?
(iii) Explain how depreciation is calculated by the straight line method and declining balance method. Which of this will be more attractive to you if you are the owner of a medium scale industry and want to depreciate your plant and equipment? Why?
(8+4+8=20 marks)
- ✓ 4. (i) What are the major safety concerns in a typical biochemical/biological manufacturing facility? How will you address them as the design engineer in charge of developing the detailed engineering for the plant?
(ii) What is the concept of "Bioprocess Validation" as stipulated by the Centre for Biologics Evaluation and Review (CBER) of the U.S. Food and Drug Administration (FDA)? Explain.
(12+8=20 marks)
- ✓ 5. (i) During the design of a shell and tube heat exchanger, the theoretical value of shell side film coefficient needs to be corrected. What are the major factors which need to be considered while applying such a correction?
(ii) What is the relevance of checking the pressure drop across a heat exchanger unit during the design stage? What will you do if it was seen that the calculated value of pressure drop is too high for the shell-side fluid?
(iii) Why are plate type heat exchangers extensively employed in biochemical industries? Explain.
(8+4+8=20 marks)

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