BEL702: Bioprocess Plant Design

Major Examination

7th May 2016
15.30 – 17.30 Hours
LH - 111

Answer all questions. Maximum marks 100

1. You are provided with the flow-sheet for a process for the manufacture of product P. The down-stream operation involves extracting the product P from the fermentation broth using an organic solvent S. The relative volatility of the mixture of P and S are such that they can be effectively separated using distillation. The vapour-liquid equilibrium data for the binary mixture of P and S is also provided to you. Explain how you will design a distillation column to continuously separate P and S.

(20 marks)

2. What are the important material properties to be considered while carrying out the mechanical design of process equipment? Explain.

(12 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? 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? What is the concept behind 'sinking-fund' method of depreciating an equipment?

(4+8=12 marks)

4. 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?

(12 marks)

5. 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.

(8 marks)

6. Explain the operation of a plate-type heat exchanger. Why does it find favour with bioprocess industries?

(8 marks)

7. Why is it necessary to provide compensation for openings made on the shell/closure of an unfired pressure vessel? What is the concept behind the "area for area" method of providing compensation?

(8 marks)

8. (i).What is the importance of the initial gasket seating stress on the design of a flanged joint? How does this affect the selection of the gasket material?

(ii) What is a cumulative cash flow diagram? How is it useful in the process of project evaluation?

(12+8 = 20 marks)