**TUTORIAL ONE**

1. Describe three types of carbon sources that are used in industrial fermentation applications. Make note of the advantages and disadvantages of each. Describe which applications they are suited to. (12)
2. Discuss malt extract and corn steep liquor as nutrient sources for industrial fermentation. (6)
3. For the growth of a microorganism on an industrial scale, the use of low cost crude materials as sources of nutrients for the formulation of growth media and the need to optimize and control physical growth parameters are pivotal to the success of the fermentation process. Substantiate this statement. (12)
4. The initial step in media formulation for a fermentation process is the examination of the overall process based on the stoichiometry for growth and product formation. Discuss this statement. (10)
5. List the main factors that affect the final choice of individual raw materials when formulating media for industrial fermentations. (5)
6. Define foaming and discuss the use of antifoams to control foam production during fermentation. (5)
7. For the growth of a microorganism on an industrial scale, discuss the following:

7.1 The use of low-cost materials as sources of nutrients for the formulation of growth media. (5)

7.2 The need to optimize and control physical growth parameters to ensure the success of the fermentation process. (5)

1. Discuss three important environmental parameters that need to be controlled to maximise the productivity of a fermentation. Provide details of factors that are likely to influence these parameters. (9)
2. Define yield coefficient. Explain why it is an important parameter in a fermentation industry. Describe factors that affect yield coefficient in a fermentation process. (5)
3. Describe three nitrogen sources used in fermentation industries. Write short notes on the advantages and disadvantages of each. (6)
4. Provide definitions for the following approaches to isolating organisms for industrial applications:

11.1. Shotgun approach (2)

11.2. Objective approach (2)

1. Write brief short notes on the three ways that can be employed to genetically modify microorganisms to improve production of a commercially important product or induce production of new compounds.Describe one application where these have been used.(9)

**NOTE**: ALL QUESTIONS NEED TO BE ANSWERED AND SOLUTIONS TO BE SUBMITTED AT THE **BEGINNING** OF THE TUTORIAL SESSION. MAKE A SECOND COPY FOR YOURSELF IF YOU NEED TO VERIFY YOUR RESPONSES.

**ALSO NOTE** : ALL QUESTIONS WIL BE **DISCUSSED** BY YOUR TUTOR (THIS IS A TWO WAY COMMUNICATION – THE TUTOR WILL NOT JUST BE PROVIDING ANSWERS. IF YOU ARE QUIET AND DO NOT PARTICIPATE IT WILL BE UNDERSTOOD THAT YOU KNOW ALL THE RESPONSES). NOT ALL QUESTIONS WILL BE MARKED. ONLY A SELECTED FEW ILL BE ASSESSED AND THOSE WILL CONTRIBUTE TOWARDS YOUR TUTORIAL MARK