BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M. PHARM **SEMESTER: II**
BRANCH: PHARMACY **SESSION: SP2025**

SUBJECT: MPC204T PHARMACEUTICAL PROCESS CHEMISTRY

TIME: 3.00 Hours **FULL MARK: 75**

INSTRUCTIONS:

1. The missing data, if any, may be assumed suitably.
2. Before attempting the question paper, be sure that you have got the correct question paper.
3. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
5. Answer any five questions.

Q.1(a) Give a note on the impurities in API with its types? [7]

Q.1(b) Consider the scale-up of a fermenter producing E-coli from nominal volume of 10L to 10m^3 with aspect ratio of 3. Impeller diameter is 30% of tank diameter. Assume geometric similarity. If agitator speed is 500 rpm with 3 rushton-turbine impellers, determine dimensions of the large fermenter and agitator speed for constant; a. Power per unit volume b. Tip speed c.N_{Re} [8]

Q.2(a) Ethanol water azeotrope forms at 101.325 kPa, 78.5^oC, and with 96.6% concentration of ethanol in water. [2+3]

i) Is the separation of ethanol above 96.6% purity achievable by a simple distillation technique? Clarify it.

ii) Explain the distillation operation to purify ethanol from the abovementioned mixture with a diagram.

Q.2(b) Explain the crystallization of an API in an aqueous solution. Mention all the required operating conditions. [5]

Q.2(c) i) Define driving force and resistances in a simple filtration operation using Darcy's law. [2+3]

ii) Demonstrate the method of finding the filter medium resistance and specific cake resistance in constant pressure filtration.

Q.3(a) Demonstrate the flow sheet for the production of nitrobenzene from nitration of benzene. [5]

Q.3(b) Depict different types of aromatic halogenation: mention reactions and operating conditions. [5]

Q.3(c) Briefly explain the process for the production of terephthalic acid (TPA) from liquid phase oxidation of p-xylene. Mention reactions and operating conditions. [5]

Q.4(a) Write a case study about industrial reduction process? [7]

Q.4(b) What is fermentation? What is aerobic fermentation? Explain how fermentation can be used for industrial production of vitamin B_{12} or vitamin C? [8]

Q.5(a) Name different types of personal protection equipment (PPE) used in a process industry. [5]

Q.5(b) Hydrogen gas has the lower flammability limit (LFL) and upper flammability limit (UFL) 4.0% and 75% in air, respectively. [3+1]

i) Clarify the statement.

ii) Another gas ethylene oxide has the LFL and UFL 3.6% and 100% in air, respectively. Mention the most hazardous one of these two gases.

Q.5(c) Briefly explain different types of treatment methods for wastewater effluent. [6]

Q.6(a) Depict the operation of a multi-effect evaporator with a diagram. [5]

Q.6(b) Exemplify different types of liquid-liquid equilibria (Type-I and Type-II) with their ternary diagram. [4]

Q.6(c) Define polymorphs, hydrates, solvates, and amorphous compounds in crystallization operation with examples. [6]

Q.7(a) Discuss fermentation process in the production of penicillin and statins? [7]

Q.7(b) A fermentation broth with viscosity 10^{-2}Pa.s and density 1000 kg/m^3 is agitated in a 2.7m^3 working volume using Rushton turbine impellers with diameter 0.5m and stirrer speed of 1S^{-1}. a. Estimate mixing time? b. If speed is increased by 30%, what is the new mixing time? [8]

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