Register No.:   ................................   Name:   .................................................................

# SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**THIRD SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2023**

**(2020 SCHEME)**

**Course Code:**    **20CHT281**

**Course Name:**    **Introduction to Chemical Engineering**

**Max. Marks:**    **100**                                        **Duration: 3 Hours**

## PART A
### *(Answer all questions. Each question carries 3 marks)*

1.  Chemical Engineers work in various roles in an industry. List any three roles.
2.  List any three chemical industries in India.
3.  The weight of an object is 300 N at a location where the acceleration due to gravity is 9.81 m/s². Express the mass in the FPS system.
4.  Specify three terms for expressing the composition of an ore mixture.
5.  List the any three size reduction equipment and its corresponding size reduction mechanism.
6.  Define (a) Mesh Number (b) Saponification Number.
7.  Define Reynolds number. Explain how to identify the flow regime using Reynolds number.
8.  Define set point and manipulated variable.
9.  Differentiate between COD and BOD.
10. There are various solid waste disposal and management methods. List any three methods.

## PART B
### *(Answer one full question from each module, each question carries 14 marks)*

### MODULE I

11. a)  Write the history and evolution of Chemical Engineering as a profession. (7)

    b)  Discuss the role of Chemical Engineers in process development and design. (7)

### OR

12. a)  Describe the role of Chemical Engineers in an Industry. (7)

    b)  List any seven major Chemical Industries. Specify the processes for each of these industries. (7)

### MODULE II

13. a)  The molarity of an aqueous solution of $MgCl_2$ at 300 K is 4. The (8)

      specific gravity of the solution is 1.3 at 300 K. Determine the following

         i.    The concentration of $MgCl_2$ in weight fraction

        ii.    The concentration of $MgCl_2$ in mole fraction

       iii.    The molality of the solution

       iv.    The normality of the solution at 300 K

  b)  Calculate the pressure developed by 1 kmol gaseous ammonia contained in a vessel of 0.6 m³ capacity at a constant temperature of 473 K by the following methods       (6)

         i.    Using the ideal gas equation

        ii.    Using the Vander Waals equation

            ($a = 0.4233$ N m⁴/mol² ; $b= 3.73 \times 10^{-5}$ m³/mol)

<div align="center">**OR**</div>

14.  a)  Pure water and ethanol ($C_2H_5OH$) are mixed to get a 60% (weight) alcohol solution. The densities of water, alcohol and the solution may be taken to be 998, 798 and 895, respectively, at 293 K. Calculate the following       (9)

         i.    The volume percentage of ethanol in the solution at 293 K

        ii.    The molarity

       iii.    The molality

  b)  Thermal conductivity of pure iron is 39 Btu/(ft h °F) and that of steel containing 1% Carbon is 39 kcal/(m h °C). Which one is the best conductor?       (5)

<div align="center">**MODULE III**</div>

15.  a)  A wet paper pulp containing 70% water is dried to remove 60% of the water present. Determine the following.

      (all moisture contents are given in wet basis)       (10)

         i.    The mass of water removed per 100 kg of wet pulp.

        ii.    The composition of dried pulp.

  b)  Explain the different stages involved in bio-diesel production.       (4)

<div align="center">**OR**</div>

16.  a)  A mixture of benzene and toluene containing 10% (mole %) benzene is continuously distilled at a rate of 1000 kmol/h in a distillation column. 95% of the benzene in the feed is recovered as a distillate product which contains 98% benzene and 2% toluene. Calculate the moles of the bottom product.       (8)

  b)  Explain the types of polymerization reactions.       (6)

<div align="center">**MODULE IV**</div>

17.  a)  Explain the Fourier's law, Newton's law of cooling and Stefan Boltzmann law.       (9)

  b)  Distinguish between continuous stirred tank reactor and plug flow       (5)

reactor.

**OR**

18. a) With a neat sketch, explain the working of Venturimeter and Thermocouple. (12)

    b) Define order of a reaction. (2)

**MODULE V**

19. a) Describe the effects of aerial spraying of Endosulfan on residents of Kasargod, Kerala. (10)

    b) Explain the major air pollutants and their effects on human beings, plants and animals. (4)

**OR**

20. a) Describe a typical wastewater treatment system. (10)

    b) List any four important measures to be taken by an industry to prevent accidents. (4)

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