# BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
## B.Tech.Sem - VI CHEMICAL :SUMMER- 2022
## SUBJECT : CHEMICAL PROCESS EQUIPMENT DESIGN-I

Day : Wednesday
Date : 15-06-2022

**S-13509-2022**

Time : 02:30 PM-05:30 PM
Max. Marks : 60

**N.B.**

1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Assume suitable data, if necessary.
4) Use of non programmable calculator is allowed.

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**Q.1** **a)** Illustrate different codes and symbols used in chemical process equipment design. **(05)**

**b)** During the selection of MOC, why 'theories of failure' are considered? What are different theories of failure? **(05)**

**OR**

**Q.1** **a)** Elaborate the significance of process equipment design in chemical industry. **(05)**

**b)** Enumerate the design parameter – 'Maximum working pressure.' **(05)**

**Q.2** Derive an expression for the stress induced in cylindrical shell under combined loading. **(10)**

**OR**

**Q.2** **a)** Elaborate the design considerations of a pressure vessel. **(06)**

**b)** Write the equations for the stresses induced in long vertical cylindrical vessel. **(04)**

**Q.3** Elaborate different types of supports used in process plant. **(10)**

**OR**

**Q.3** The tall vertical column of 3.0 m in diameter and 30 m in height has an operating weight of 91000 Kg of the base. Estimate the compressor load of the base ring of this lower width of column base ring and the thickness of base plate. Allowable bearing load is 34 $Kg/cm^2$ compressive load at the base ring. **(10)**

**Q.4** In a counter flow double pipe heat exchanger, oil is cooled from $85^0C$ to $55^0C$ by water entering at $25^0C$. the mass flow rate of oil is 9,800 Kg/h and specific heat of oil is 2000 J/kgK. The mass flow rate of water is 8,000 kg/h and specific heat of water is 4180 J/kgK. Determine the heat exchanger area and heat transfer rate for an overall heat transfer coefficient of 280 $W/m^2$ K. **(10)**

**OR**

**Q.4** Elaborate bell's method and Kern's method for the heat exchanger design. **(10)**

**Q.5** **a)** Elaborate the criteria of selection of agitator. **(04)**

**b)** Derive the equation for power consumption in agitator. **(06)**

**OR**

**Q.5** Illustrate different types of agitator with neat sketch. **(10)**

**Q.6** A horizontal cylindrical continuous decanter is to separate 9.93 $m^3/h$ (day) of a liquid petroleum fraction from an equal volume of wash acid. The oil is the continuous phase at the operating temperature, has a viscosity of 1.1 cP and a density of 865 $Kg/m^3$. The density of the acid is 1153 $Kg/m^3$. Compute: a) the size of the vessel and b) the height of the acid overflow above the vessel floor. **(10)**

**OR**

**Q.6** **a)** Enumerate the design parameters for mechanically agitated contactors. **(05)**

**b)** Elaborate the design considerations for liquid-liquid separator design. **(05)**

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