

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (OLD) EXAMINATION – WINTER 2018****Subject Code: 170502****Date: 19/11/2018****Subject Name: Process Equipment Design - II****Time: 10:30 AM TO 01:30 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Discuss Various types of heads used in pressure vessel. Also, explain with equations about Weight and Volume contained within (i) Elliptical head & (ii) Conical head. **07**
- (b)** Turbine agitators operating in a vessel of 1600 mm diameters is to be designed **07**
with the following data :
Internal design pressure = 5 kgf/cm²
Agitator diameter = 500 mm
Max. agitator RPM = 200
Liquid in vessel μ = 600 cP
Specific gravity = 1.2
Over hang length of shaft = 1200 mm
No. of agitator blade = 6
Elastic limit = 250 N/mm²
Permissible shear stress in shaft = 55 N/mm²
Modulus of Elasticity 'E' = 19.5×10^4 N/mm²
Power number = 6 for $N_{Re} < 4500$
= 4.5 for $N_{Re} > 4500$
Calculate powers required & suggest suitable motor HP.
- Q.2 (a)** Briefly explain the uses of various types of jackets with a neat figure for reaction vessel. **07**
- (b)** Discuss about different types of agitators and their selection criteria. **07**
- OR**
- (b)** State and discuss the various types of flanges used in industries. **07**
- Q.3 (a)** What is gasket? Define gasket seating stress and discuss the various types of gaskets used in industries. **07**
- (b)** Discuss the design steps for the calculation of tube side heat transfer coefficient and pressure drop. **07**
- OR**
- Q.3** With neat sketch explain the design steps for the conical roof with structural support. **14**
- Q.4 (a)** Define (i) Elasticity (ii) Toughness (iii) Fatigue (iv) Creep (v) Poisson's ratio (vi) Moment of inertia (vii) Welding joint efficiency factor. **07**
- (b)** Discuss about different methods for fabrication of equipment in brief. **07**
- OR**
- Q.4** A reactor having an inside diameter of 1 meter with a seamless torispherical head having a crown radius 1000 mm & a knuckle radius of 100 mm. Inside maximum **14**

working pressure is $13 \text{ kgf/cm}^2(\text{g})$, working temperature is 70°C . Cylindrical vessel is covered with plain jacket such that 75% length of cylindrical shell & bottom torispherical head are not covered with jacket. Inside the jacket cooling water is circulated. Cooling water is supplied to reactor jacket by centrifugal pump, having shut off discharge pressure $6 \text{ kgf/cm}^2(\text{g})$. Calculate weight of bottom torispherical head of reactor. Torispherical head is fabricated from SA-516 Gr 70 carbon steel plate having maximum allowable stress 612.40 kgf/cm^2 at design temperature.

Data given: Modulus of Elasticity of plate material $E = 19500 \text{ kgf/mm}^2$

Poisson's ratio $\mu = 0.3$

Sp. Gravity of carbon steel = 7.83

Joint Efficiency for seamless torispherical = 1

- Q.5 (a)** Explain the function of the following parts for the shell and tube heat exchanger. (i) Baffles (ii) Tie rods (iii) Spacers (iv) Expansion joint (v) Tube side pass partition (vi) Tube sheet (vii) Support. **07**
- (b)** Explain Normal and Emergency venting for storage vessel. **07**

OR

- Q.5 (a)** Enlist different types of supports. Outline the stepwise procedure for the design of bracket support. **07**
- (b)** Discuss various pressure relieving devices. Explain rupture disc and safety valve with a neat sketch. **07**

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