B.TECH
(SEM VI) CARRY OVER THEORY EXAMINATION 2017-18
PROCESS EQUIPMENT DESIGN

Time: 3 Hours   *Total Marks: 100*

Note: **1.** Attempt all Sections. If require any missing data; then choose suitably.
　　　　2. Any special paper specific instruction.

SECTION A

1.　　　**Attempt *all* questions in brief.**　　　　　　　　　　　**2 x 10 = 20**

　　a) Define thickness.
　　b) What is Poisson's ratio?
　　c) What do you mean by elasticity?
　　d) What is flange thickness?
　　e) Define design stress.
　　f) What are the polymeric materials? Give some examples.
　　g) What do you mean by 'nozzle reinforcement'?
　　h) Explain the term 'Carbon Steel'.
　　i) Define Aluminium and also write name of its alloys.
　　j) Define factor of safety.

SECTION B

2.　　　**Attempt any *three* of the following:**　　　　　　　　　**10 x 3 = 30**

　　a) Explain various codes & standards in design.
　　b) Explain the various types of vessel supports.
　　c) A pressure vessel is to be design for the maximum a parting pressure of
　　　　500KN/m^2.The vessel have nominal diameter of 1.2m and tangent length of 2.4 m.
　　　　The vessel is made of IS-2002-1962 grade 2B quality steel having allowable design
　　　　stress value of 118 MN/m^2 ate working temperature. The corrosion allowable is
　　　　suggested tube 2 mm for the live spend specked for the vessel. The vessel is to
　　　　fabricate according to class two of IS specification which stipulate the welded
　　　　efficiency of 0.85.
　　i.　　What will be the standard plate thickness to fabricate this vessel?
　　ii.　　If a spherical vessel having the same diameter and thickness in fabricated with the
　　　　quality steel .what maximum pressure will stand safety.
　　d) Discuss the criteria of failure.

　　e) What are principal types of flanges used in the process industries? What types of
　　　　materials are used for gasket?

SECTION C

3.　　　**Attempt any *one* part of the following:**　　　　　　　**10 x 1 = 10**

　　a) Explain the various steps in design of spray drier.

b) A vessel having 1.8 m in diameter and 5 m in height is to operate at a pressure of 8 kg/cm^2.The permissible stress of the material used for fabrication is 1400 kg/ cm^2. Calculate the thickness required for cylindrical and spherical vessels. J=100% and C$_A$=2 mm.

4.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

a) A vessel & its head are to be connected with corrugated faced slip on tube flange. For the specification, as given below, design suitable gasket & bolts for such connection. It is desirable to use minimum no of bolts.
Design pressure - 20 bar (gauze)

Gasket material – 1.6mm thick compressed asbestos

Allowable pressure for flanged material -100MPa

Poisson`s ratio for flanged material- 0.3

Allowable stress for bolt material - 120M Pa

Shell OD: 800mm, shell thickness: 10mm

Flange thickness: 20mm

For the given operating conditions, is the flange thickness adequate? If it not, what alternative pressure would you recommend for safe operation till appropriate flange are procured?

b) Discuss the mechanical aspects for shell and tube heat exchanger tube sheet?

5.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

a) Determine the optimum proportion of a storage tank to store 700 m^3 liquid having density 1200 kg/m^3.The tank will be filled to 90% its capacity. C$_1$=2C$_2$, C$_3$=1.4C$_2$, C$_4$+C$_5$=C$_2$.Also calculate the max. Plate thickness required for fabrication of tank. Given f=1020 kg/m^3 and j=0.85.

b) How reinforcement of a nozzle is designed by area for area method.

6.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

a) Explain designing of sieve tray distillation column in details

b) Heat exchanger is required to condense 7.5 kg/s of n- hexane at a pressure of 15kN/m^2 involving a heat load of 4.5 MW. The hexane is to reach the condenser from the top of a fractionating column at its condensing temp of 350 K. Over all heat transfer coefficient is 450 W/m^{2}K. Cooling water is available at 289K with outlet temp being 310K. Select tube of 25.4mm, 14 BWG with tube diameter of 21.2mm. This type is selected in standard length of 4.87m. Take water velocity of 1.25m/s.

7.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

a) Explain the steam traps with suitable examples.

b) What is Corrosion? Explain the various types of corrosions in chemical industry.