Printed Pages: 6 **ECH-603**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 151603	**Roll No.**

B.TECH.

Theory Examination (Semester-VI) 2015-16

PROCESS EQUIPMENT DESIGN

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

Note: Attempt all three sections.

Section-A

1. Attempt all the parts. Write answer of each part in short. (2×10=20)

(a) What is fatigue?

(b) Name various types of heads commonly used in cylindrical vessels.

(c) What is meant by the maximum yield stress of a metal?

(d) Write the different kinds of corrosion .

(e) Define weep point.

(f) What is entrainment ?

(g) Why triangular pitch is preferred over square pitch in heat exchanger?

(h) What is the use of code in design?

(i) Define erosion.

(j) What are various mechanical properties of materials to be considered in the construction of chemical process equipment?

Section-B

2. Attempt any five parts of the following. (10×5=50)

(a) A process vessel has the following specifications:-

Outside diameter of the shell = 2m

Working pressure = 3.5×10^6 N/m²

Shell wall thickness = 0.05m (C.A. = 3mm)

Welded joint efficiency = 1, Allowable stress = 96 MN/m²

If a nozzle of the following specifications is to be made in the shell, evaluate the requirements of compensation for nozzle opening.

Outside diameter of nozzle = 0.25m

Nozzle wall thickness = 0.016m

Length of nozzle above surface = 0.10m

Inside proportion of nozzle not desired.

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

(c) Calculate the cylindrical shell thickness, the conical roof thickness & the thickness of the bottom plates for carbon steel (structural) conical roof stage tank to store 2, 50,000 liters of liquid of density 940kg/m^3. Slope of the roof-cone is five.

Superimposed load on the roof = 125kg/m^2,

Permissible stress in steel = 1450kg/cm^2, sp.gr of steel = 7.7

Modulus of elasticity = 2×10^6 kg/cm^2. Assume diameter of tank equal to its height.

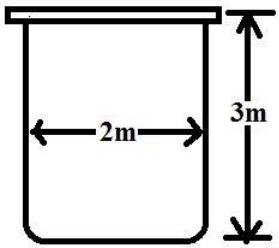
(d) A vessel of 1.5m diameter is to operate at a pressure of 14bar (abs) & temperature of 300° C. The material of construction is plain carbon steel & corrosion allowances of 2mm should be used. The design stress value is 85N/mm^2. Find out the thickness of standard torispherical head & standard elliptical head for this vessel. Suggest among these the most appropriate thickness to be selected. Welded will be fully radio graphed.

(e) What are different types of vessel support? Discuss any one of them in detail.

(f) Discuss in detail the general design consideration in designing a pressure vessel operated under Internal Pressure.

(g) Write a short note on Bolts and Flange.

(h) A closed reaction vessel made of plain carbon steel is to be designed for operation at a pressure of 15bar(abs) & a temperature of 290° C. The ellipsoidal bottom will have a ratio of major axis: minor axis of 2:1. As a safeguard it is proposed to provide a corrosion allowance of 10% of calculated thickness. Design pressure may be taken as 110% of the operating pressure. At the operating conditions the design stress permissible will have a value of 85N/mm². Calculate the thickness of the cylindrical portion of thereactor & the ellipsoidal bottom. Figure may be referred for dimensions.



Section-C

Note: Attempt any two parts of the following. (15×2=30)

3. (i) Discuss various steps in Heat Exchanger Design by Kern's.

   (ii) Explain the Design of Domed ends.

4. Make a preliminary estimate of the plate thickness requires for the distillation column specified below:

Height between tangent lines	=	50m
Diameter	=	2m
Skirt support height	=	3m
100 sieve plates, equally spaced		
Insulation mineral wool	=	75mm thick
Material of construction	=	Stainless steel
Design stress	=	135N/mm^2
Design temperature	=	200^o C
Operating pressure	=	10 bar (abs)
Vessel to be fully radiograph (j)	=	1
Cv	=	1.15 vessel with plate
Mineral wool density	=	130kg/m^3

5. Write short notes on:-

(i) Design of crystallizer

(ii) Design of spray drier

(iii) Design and costing for reactor vessel