Total No. of printed pages = 4

19/5th Sem/UFET503

2021

FOOD PROCESS EQUIPMENT DESIGN

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Define Process. What is Process Design ? Explain. 1+4=5

   (b) Distinguish between Chemical Operation and Physical Operation. 3

   (c) Describe six steps for design of a chemical process. 12

2. (a) What is Onion diagram ? Explain with a neat diagram. 10

   (b) Define stress. Explain different types of stress and strain with diagram. 10

[Turn over

3. (a) Define Hook's law. Establish a relationship between stress and strain for a two-dimensional stress system. 2+8=10

(b) A rod 150 cm long and 2 cm is subjected to an axial pull of 25 kN. If the modulus of elasticity of the material is 2×10^5 N/mm^2. Determine the stress, the strain and the elongation of the rod. 2×3=6

(c) The safe stress, for a hollow steel column which carries an axial load of 2×10^3 kN is 125 MN/mm^2. If the external diameter of the column is 35 cm, determine the internal diameter. 4

4. (a) Define stress-strain curve. Describe different material properties which can be obtained from it. 2+8=10

(b) A boiler is subjected to an internal steam pressure of 4 N/mm^2. The thickness of the boiler plate is 2 cm and permissible tensile stress is 120 N/mm^2. Find out the maximum diameter, when efficiency of longitudinal joint is 90% and that of circumferential joint is 40%. 5+5=10

5. (a) Distinguish between Hoop stress and Longitudinal stress. Derive an equation for Longitudinal stress. 2+8=10

(b) Calculate :

(i) the change in diameter

(ii) change in length and

(iii) change in volume of a thin cylindrical shell 110 cm diameter, 1 cm thick and 5m long when subjected to internal pressure of 3 N/mm^2. Take $E = 2 \times 10^5 N/mm^2$ and Poisson's ratio, $\mu = 0.3$. 3+3+4=10

6. (a) Derive Lame's equation for a thick cylindrical shell. 10

(b) Find the thickness of metal necessary for a cylindrical shell of internal diameter 160 mm to withstand an internal pressure of 8 N/mm^2. The maximum Hoop stress in the section is not to exceed 40 N/mm^2. 10

7. Write short notes on : 4×5=20

(a) Classification of pressure vessel

(b) Poisson's ratio

(c) Modulus of elasticity and Modulus of rigidity

(d) Efficiency of joint.