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S.E. (Chemical) (II Semester) EXAMINATION, 2019

PRINCIPLES OF DESIGN

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) Assume suitable data, if necessary.

(*iv*) Use of calculator is allowed.

1. (*a*) Derive a relation for the shear stress developed in a shaft when it is subjected to torsion. [6]

(*b*) A steel rod of 30 mm diameter, 280 mm long is subjected to axial forces alternating between maximum compression of 15 KN and a maximum tension of 5 KN. Find the difference between the greatest and least lengths of the rod, E = 210 GPa. [6]

Or

2. (*a*) Distinguish between codes and standards state the engineering aspects covered in standard specifications. [6]

P.T.O.

(*b*) Horizontal beam ABE is hinged at A and supported on rollers at B. Span AB = 5 m and BE = 2 m. It carries point loads of 2400 N, 3600 N and 1400 N at C, D and E respectively. AC = 1.5 m, CD = 2 m, DB = 1.5 m. All the point loads act vertically. Calculate supports ions and draw S.F. and B.M. diagrams. [6]

3. (*a*) A shaft rotating at a constant speed is subjected to variable load. The bearing support the shaft are subjected to stationary equivalent radial load of 3 KN for 10% of time, 0.2 KN for 20% of time, 1 KN for 30% of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions of 95% reliability, calculate dynamic load rating of the ball bearing. [7]

(*b*) Discuss the function of coupling. Give at least three practical application. [6]

Or

4. (*a*) How are ends of belts joined ? For horizontal belts which side (tight or slack) of the belt should run on the top and why ? [6]

(*b*) A shaft 80 mm diameter transmits power at maximum shear stress of 63 MPa. Find the length of a 20 mm wide key required to mount a pulley on the shaft so that the stress in the key does not exceed 42 MPa. [7]

5. (*a*) What are various types of welding joints used in pressure vessels ? Discuss with neat sketch. [6]

(*b*) A thick walled high pressure vessel has 500 mm inside diameter. It is subjected to an internal pressure of 6000 bar, the yield strength of material is 5000 kg/cm^2. Ultimate tensile strength of material is 6500 kg/cm^2. Calculate the thickness of vessel according to the various theories of failure. Factor of safety is 1.4.

Also estimate the tangential stress and radial stress variation along the vessel wall. [6]

Or

6. (*a*) Explain with a neat sketch various types of flanged joints used in pressure vessels. [6]

(*b*) A vessel having 1.6 m outside diameter is to operate at a pressure of 5 kg/cm^2. The permissible strees of the material used for fabrication 1020 kg/cm^2. Welded joint efficiency is 85%. Calculate the thickness required for a cylindrical vessel and a spherical vessel ? Which vessel should be selected for operation. Design pressure = 5 × 1.1 = 5.5 kg/cm^2 ? [6]

7. (*a*) The inside diameter of cylinder is 25 cm and is subjectated to an internal pressure of 600 kg/cm^2. Allowable tensile stress of the material is 1400 kg/cm^2. What should be the minimum thickness of the vessel ? [7]

(*b*) With neat sketch explain stresses induced in thick vessel subjected to internal pressure. [6]

Or

8. (*a*) Write a short note on Autofrettaging of monoblock Pressure vessels. [6]

(*b*) A cylindrical pressure vessel 1.8 m in diameter and 5 m in height is subjected to an internal pressure of 8 kg/cm^2. Corrosion allowance is 2 mm. If the vessel is fabricated as : Class B vessel with J = 0.85. [7]