

**End Semester Examinations - 2015-16 Even Semester - May 2016**

**14ME3023 Design of Mechanical System Elements**

**Set B**

**Time : 3 hrs**  
**Total Marks: 100**

1. **Permitted to use the approved data sheets and Data book**

(a) Find out the radial and hoop stress in a thin ring cylinder which is subjected to a pressure 100 N/sq.mm. The thickness of the cylinder is 15mm and the diameter of the cylinder is

100 mm.

(6)

(b) Describe the concept of thermal stress and strain acting on a component with suitable example.

(6)

(c) With help of a block diagram and suitable examples explain the various types material handling equipments.

(8)

**OR**

2. (a) With an example explain the thermal stress and derive an equation of principal stresses for various conditions. (6)

(b) How the hoop stress and longitudinal stress of a conical vessel can be determined? Explain in detail with help of a sketch. (6)

(c) Write the reason and severity of discontinuity stress in detail.

(8)

3. (a) A multiplate clutch is to designed to transmit a power of 50 kW at 500 rpm. Assuming suitable materials and data, determine the main dimensions of friction

lining used in that clutch.

(10)

(b) Design a 12 speed gear box to transmit 10 kW power .The minimum speed is 31.5 pm and the maximum speed is 1410 rpm. Sketch the Lay diagram and Ray

diagram .

(10)

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**OR**

4. (a) It is required to determine the size of wire rope for infinite life. The weight of the hoist and the material to be lifted is 6 kN.

The load has to be raised from a depth of 100m. the maximum speed of the rope is 6m/s and it is attained in 6sec.Determine the

size of the rope and induced the stress induced in the rope due to starting with an initial slack of 0.25m. (15)

(b) Determine the hourly capacity of a helicoids spiral conveyor if the diameter of the helicoids is 300 mm ,velocity is 15 m/s and

the bulk weight is 1.5 tons / m<sup>3</sup> .

(5)

5. (a) A power of 20 kW, is to be transmitted through a cone clutch at 500 rpm. For uniform wear condition, find the main dimensions of clutch and shaft. Also determine the axial force required to engage the clutch. Assume the coefficient of friction as 0.25, the maximum normal pressure on the friction surface is not to exceed 0.08 MPa and the design stress for the shaft material as 40 MPa. (12)
- (b) Describe the effect of stress concentration in the machines components with suitable examples. (8)

**OR**

6. (a) The spindle of a pillar drill is to run at 12 different speeds in the range of 100 rpm and 355 rpm. Design a three stage gear box with a standard step ratio. Sketch the layout of the gear box, indicating the number of teeth on each gear. The gear box receives 5kW from an electric motor running at 360 rpm. Also sketch the speed diagram. (12)
- (b) Briefly explain the theory of reinforcement in the structural components and its applications. (8)
7. (a) Show the arrangement of a vertical and horizontal screw conveyor and mention its design aspects in detail. (10)
- (b) Design a forged single hook of a crane which is used to lift a load of 5 tons. The grabbing tongs weight is 1 tons. Also find out the stresses acting on the inner and outer fibre of the hook (10)

**OR**

8. (a) Show the various arrangement of pneumatic and hydraulic conveyor and explain in detail. (10)
- (b) Write the applications of vibrating conveyor and explain its working principle. (5)
- (c) Explain the application of an escalator and describe its design concepts. (5)
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9. (a) A rectangular bar has to carry a load of 100kN. What must be the thickness of bar of 110mm width with a rivet hole of 22mm diameter on its centre line? Take the working stress for the bar is 75 Mpa. (8)
- (b) A plate of uniform thickness 't' has two widths of 45 mm and 30 mm with a fillet radius of 5 mm. the smaller width portion has a transverse hole of 15 mm diameter. For the plate material the ultimate tensile strength is 200 N/sq.mm considering stress concentration effect, and assuming a factor of safety of 2.5, find the thickness of plate for maximum tensile load of 5 kN. (12)