Roll No. ..... Total Pages : 04

BT-5/D-14 **8538**

MACHINE DESIGN–I

ME-309-E

(Common with Automobile)

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks. Any missing data may be assumed suitably.

Unit I

1. (a) Enumerate the factors and properties of materials a designer is required to consider while designing a machine part.

   (b) How is the factor of safety evaluated for different types of loading ?

2. Explain the modified Goodman diagram for Bending Stresses.

Unit II

3. A welded connection as shown in figure below is subjected to an eccentric force of 7.5 kN. Determine the size of the welds if the permissible shear stress for the weld is 100 N/mm^2. Assume static conditions.

4. It is required to design a knuckle joint to connect two steel rods of equal diameter. Each rod is subjected to an axial tensile force of 50 kN. Design the joint and specify its main dimensions on a neat sketch.

Unit III

5. A lever safety valve is 75 mm in diameter. It is required to blow off at 1.3 N/mm^2. Design the mild steel lever of rectangular cross-section if the permissible stresses are 70 MPa in tension, 52.5 MPa in shear and 24.5 MPa in bearing. The pin is made of the same material as that of the lever. The distance from the fulcrum to the dead weight of the lever is 800 mm and the distance between the fulcrum pin and the valve spindle link pin is 80 mm.

6. The layout of an intermediate shaft of a gear box supporting two spur gears B and C is shown in Fig. 1. The shaft is mounted on two bearings A and D. The pitch circle diameters of gears B and C are 900 and 600 mm respectively. The material of the shaft is steel FeE 580 (S_{ut} = 770 and S_{yt} = 580 N/mm^2). The factors k_b and k_t of ASME code are 1.5 and 2.0 respectively. Determine the shaft diameter using the ASME code. Assume that the gears are connected to the shaft by means of keys.

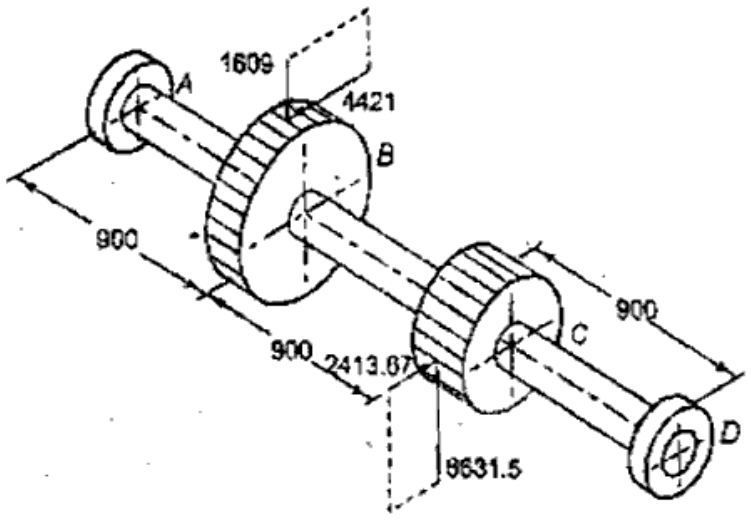

Figure-1

Unit IV

7. It is required to design a split muff coupling to transmit 50 kW power at 120 rpm. The shafts, key and clamping bolts are made of plain carbon steel 30C8 (S_{yt} = 400 N/mm^2). The yield strength in compression is 150% of the tensile yield strength. The factor of safety for shafts key and bolts is 5. The number of clamping bolts is 8. The coefficient of friction between sleeve halves and the shaft is 0.3.
   (a) Calculate the diameter of the input and output shafts.
   (b) Specify the length and outer diameter of the sleeve halves.
   (c) Find out the diameter of clamping bolts assuming that the power is transmitted by friction.
   (d) Specify bolt diameter using standard empirical relations.
   (e) Specify the size of key and check the dimensions for shear and compression criteria.

8. Design completely an oval flanged pipe joint for pipes of internal diameter 150 mm subjected to a fluid pressure of 8.5 N/mm^2. The maximum tensile stress in the material is not to exceed 64 N/mm^2. The material of the pipe is cast iron. The test pressure for the pipe joint is 23 N/mm^2.