

27/0/13

Duration : 3 Hours

Max. Marks:100

Answer ALL questions. (Use of PSG Design data book is permitted)

Part – A (2 x 10 = 20 marks)

1. Write a short note on preferred numbers and explain why they are used.
2. What is factor of safety ? Why is it necessary?
3. What is critical speed of a shaft ? Why is it important in design?
4. What are the important factors in the design of keys? Name 2 types of keys.
5. Write a note on eccentric loading of bolted joints.
6. Write a note on welded joints.
7. What are the specifications of a helical compressions spring?
8. Why are flywheels used?
9. Write a note on the hydrodynamic theory of lubrication.
10. Write a note on the design of connecting rods for IC engines.

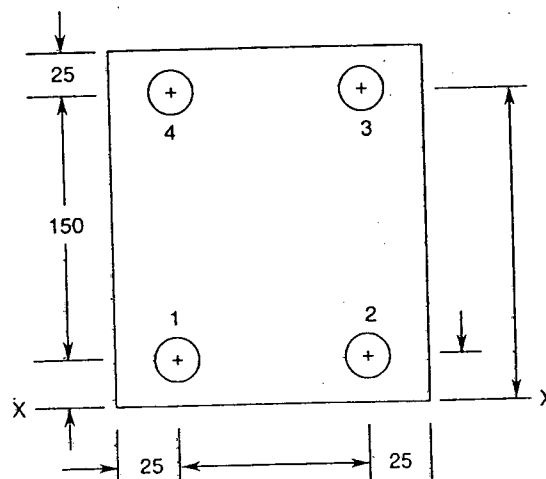
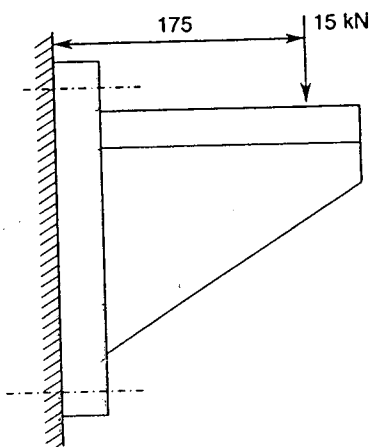
Part – B (5 x 16 = 80 marks)

Q 11 is compulsory, from Q 12 onwards answer either (a) or (b)

11. A bolt is subjected to a direct load of 25 kN and shear load of 15 kN. Considering various theories of failure, determine a suitable size of the bolt, if the material of the bolt is C15 having 200 N/mm² yield strength.
- 12a). A turbine shaft transmits 500 kW at 900 rpm. The permissible shear stress is 80 N/mm² while twist is limited to 0.5° in a length of 2.5 m. Calculate the diameter of shaft. Take $G = 0.8 \times 10^5$ N/mm². If the shaft chosen is hollow with $d_i/d_o = 0.6$, calculate the percentage saving in the material.

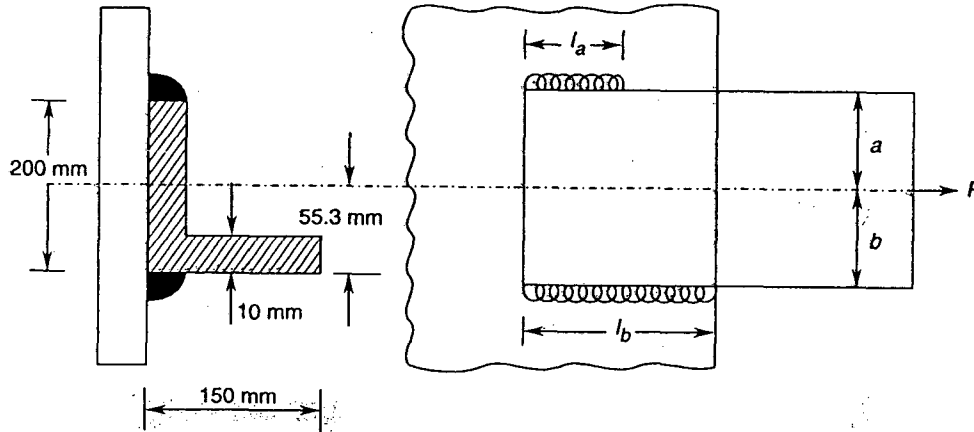
(OR)

- 12b). Design and draw a cast iron protected type flange coupling to connect two shafts of 36 mm diameter transmitting 15 kW at 720 rpm. The overload capacity is 1.25 times the average torque. The bolts and keys are made of C20 steel and the flanges are made of FG 200.
- 13a). A steel bracket, as shown in figure below, is secured to a wall by means of four steel bolts. The load on the bracket is 15 kN which acts at a distance of 175 mm from the wall. Determine the size of the bolt.



(OR)

- 13b). An angle of size 200 mm x 150 mm x 10 mm is required to be welded to a steel plate by a fillet weld as shown in the following figure. If the angle is subjected to a static load of 100 kN, determine the top and bottom weld lengths. The allowable shear strength for static loading may be taken as 65 N/mm².



- 14a). Design a closed-coil helical spring for a boiler safety valve which is required to blow off steam at the pressure of 1.5 N/mm². The diameter of the valve is 50 mm. The initial compression of the spring is 40 mm and the lift is limited to 20 mm.

(OR)

- 14b). Design a flywheel for a single-cylinder, four-stroke vertical cylinder diesel engine developing 4 kW at 1500 rpm. Assume coefficient of speed fluctuation, $C_s = 0.01$.
- 15a). Design a journal bearing for a 10 MW, 1000 rpm steam turbine which is supported by two bearings. Consider the bearing to be an average industrial bearing.

[OR]

- 15b). A shaft rotating at 1440 rpm is supported by two bearings. The forces acting on each bearing are 6000 N radial load and 3500 N axial thrust. If the shaft diameter is 40 mm and the expected life of the bearing is 500 h, select a suitable bearing.