Design of Machine Element-I (BMEE1- 51)

Section A

1. Define the term Adaptive Design.
2. Define the term “Empirical Design”.
3. What is meant by hole basis system?
4. Differentiate between Crushing and Bearing.
5. Give the composition of 45C8 plain carbon steel.
6. Give the composition of 40C8 plain carbon steel
7. How grey cast iron designated in Indian standard?
8. Define mechanical property of an engineering material.
9. What is stress concentration? What are the methods of reducing stress concentration?
10. What are advantages of standardization? What are the basic types of standards used in design office?
11. Explain briefly any five basic requirements of a machine element.
12. Differentiate between repeated stress and reversed stress.
13. Explain the factor of safety.
14. Define limit, fit and tolerance
15. Define Tearing and Crushing.
16. What is the difference between endurance limit and endurance strength?
17. What types of stresses are induced in shafts? Is hollow shaft stronger or weaker than a solid shaft of same diameter?
18. Distinguish between cotter joint and knuckle joint.
19. Distinguish clearly, giving examples axle and shaft.
20. State the functions of coupling.
21. Explain the difference between rigid and flexible coupling
22. Differentiate between a cotter and key
23. What is first and second type lever? Give their examples.

Section B

1. Discuss the design procedure for developing a new product. What is aesthetic design?
2. Explain the procedure used to design a machine element.
3. Discuss the important properties of a material. Why the material in their pure form are unsuitable for industrial use?
4. Explain the factors which are considered in the selection of material for a machine component.
5. Design and draw a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa ; compressive stress 140 MPa ; and shear stress in the rivet 56 MPa. Assume C = 3.5.
6. A steel plate 80 mm wide and 10 mm thick, is joined to another steel plate by means of a single transverse and double parallel fillet weld, as shown in figure. The joint is subjected to a maximum tensile force of 80kN. The permissible tensile and shear stresses for the weld material and plates are 100 and 70 N/mm2 respectively. Find the length of each parallel weld. Assume that the tensile force passes through the centre of gravity of three welds.
7. Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa ; shear stress = 35 MPa and crushing stress = 90 MPa.
8. Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 300 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 2 kW at 100 r.p.m. The angle of lap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa.
9. Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa.
10. A lever loaded safety valve is 70 mm in diameter and is to be designed for a boiler to blow-off at pressure of 1 MPa gauge. Design a suitable mild steel lever of rectangular cross-section using the following permissible stresses :

Tensile stress = 70 MPa; Shear stress = 50 MPa; Bearing pressure intensity = 25 MPa.

The pin is also made of mild steel. The distance from the fulcrum to the weight of the lever is 880 mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 80 mm.

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