9. Sketch a protective type flange coupling and indicate there on its leading dimensions for shaft size of '*d*'.
10. What are flexible couplings and what are their applications ? Illustrate your answer with suitable examples and sketches.
11. Write short note on universal coupling.
12. Why are two universal joints often used when there is angular misalignment between two shafts ?

OBJECTIVE TYPE QUESTIONS

1. The taper on a rectangular sunk key is
   (*a*) 1 in 16 (*b*) 1 in 32
   (*c*) 1 in 48 (*d*) 1 in 100
2. The usual proportion for the width of key is
   (*a*) *d*/8 (*b*) *d*/6
   (*c*) *d*/4 (*d*) *d*/2
   where *d* = Diameter of shaft.
3. When a pulley or other mating piece is required to slide along the shaft, a ..... sunk key is used.
   (*a*) rectangular (*b*) square (*c*) parallel
4. A key made from a cylindrical disc having segmental cross-section, is known as
   (*a*) feather key (*b*) gib head key
   (*c*) woodruff key (*d*) flat saddle key
5. A feather key is generally
   (*a*) loose in shaft and tight in hub (*b*) tight in shaft and loose in hub
   (*c*) tight in both shaft and hub (*d*) loose in both shaft and hub.
6. The type of stresses developed in the key is/are
   (*a*) shear stress alone (*b*) bearing stress alone
   (*c*) both shear and bearing stresses (*d*) shearing, bearing and bending stresses
7. For a square key made of mild steel, the shear and crushing strengths are related as
   (*a*) shear strength = crushing strength (*b*) shear strength > crushing strength
   (*c*) shear strength < crushing strength (*d*) none of the above
8. A keyway lowers
   (*a*) the strength of the shaft (*b*) the rigidity of the shaft
   (*c*) both the strength and rigidity of the shaft (*d*) the ductility of the material of the shaft
9. The sleeve or muff coupling is designed as a
   (*a*) thin cylinder (*b*) thick cylinder
   (*c*) solid shaft (*d*) hollow shaft
10. Oldham coupling is used to connect two shafts
    (*a*) which are perfectly aligned (*b*) which are not in exact alignment
    (*c*) which have lateral misalignment (*d*) whose axes intersect at a small angle

ANSWERS

1. (*d*)	2. (*c*)	3. (*c*)	4. (*d*)	5. (*b*)
6. (*c*)	7. (*a*)	8. (*c*)	9. (*d*)	10. (*c*)

CHAPTER

14

Shafts

14.1 Introduction

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines.

Notes: 1. The shafts are usually cylindrical, but may be square or cross-shaped in section. They are solid in cross-section but sometimes hollow shafts are also used.

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