

B.E DEGREE EXAMINATIONS: JUNE/JULY 2013

Fifth Semester

MECHANICAL ENGINEERING

MCT112: Design Of Machine Elements

(Use of PSG DATA Book Is Permitted In The University Examination)

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The material commonly used for crane hooks is
 - a) Cast iron
 - b) Wrought iron
 - c) Mild steel
 - d) Aluminium
2. Which of the following material has the maximum ductility?
 - a) Mild steel
 - b) Copper
 - c) Zinc
 - d) Aluminium
3. The factor of safety for steel and for steady load
 - a) 2
 - b) 4
 - c) 6
 - d) 8
4. The ratio of linear stress to linear strain is called
 - a) Modulus of elasticity
 - b) Modulus of rigidity
 - c) Bulk modulus
 - d) Poisson's ratio
5. 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
6. The usual proportion for the width of key is
 - a) $d/8$
 - b) $d/6$
 - c) $d/4$
 - d) $d/2$
7. According to Indian standards, the diameter of rivet hole for a 24 mm diameter of rivet, should be
 - a) 23 mm
 - b) 24 mm
 - c) 25 mm
 - d) 26 mm
8. The objective of caulking in a riveted joint is to make the joint
 - a) Free from corrosion
 - b) Stronger in tension
 - c) Free from stresses
 - d) Leak-proof
9. When a helical compression spring is subjected to an axial compressive load, the stress induced in the wire is

- | | |
|-------------------|-----------------------|
| a) Tensile stress | b) Compressive stress |
| c) Shear stress | d) Bending stress |
10. The cross-section of the flywheel arms is usually
- | | |
|-------------------|----------------|
| a) (a) Elliptical | b) Rectangular |
| c) (c) I-section | d) L-section |

PART B (10 x 2 = 20 Marks)

11. What are the various phase of design process?
12. Explain size factor in endurance strength.
13. Define the term critical speed.
14. Write any two of the rigid and flexible coupling?
15. What are the advantages of welding?
16. What stresses act on screw fastenings?
17. What are the various types of springs?
18. What are the uses of foot levers?
19. Define the term bearing life.
20. Define coefficient of fluctuation of speed in case of flywheels.

PART C (5 x 14 = 70 Marks)

21. a) A circular bar is simply supported with a span of 0.5m and is subjected to a concentrated cyclic load and its mid span. The load varies from a minimum value of 20KN to maximum value of 45 KN. The load direction is transfer to the shaft axis. Decide upon the diameter of the bar taking a factor of safety of 1.5 and factors of 0.85 and 0.89 respectively for size effect and surface finish. Take often following values for material properties.

1. Ultimate strength = 650 N/mm²
2. Yield strength = 450 N/mm²
3. Endurance strength = 350 N/mm²

(OR)

- b) Discuss in detail design for variable loading with examples
22. a) Compare the weight and strength and stiffness of a hollow shaft of same internal diameter as that of a solid shaft. The inside diameter of the hollow shaft is being 0.6 times the external diameter. Both shafts have same material and strength.

(OR)

b) Determine the dimensions of flange coupling that converts a motor and pump shaft. The power to be transmitted is 2 KW at a shaft speed of 960 rpm. Select suitable materials for the parts of the coupling and list the dimensions.

23. a) A cast iron cylinder head is fastened to a cylinder of 500mm bore with 8 stud bolts. The maximum pressure inside the cylinder is 2 MPa. The stiffness of the part is thrice the stiffness of the bolt. What should be the initial tightening load so that the joint is leak proof at the operating pressure? Also choose a suitable bolt for the above application.

(OR)

b) A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of single transverse and double parallel fillet welds. Determine the length of the weld run in each case, if the joint is subjected to varying loads. The recommended design stress in tension is not to exceed 70 N/mm^2 and in shear 56 N/mm^2 for static loading.

24. a) A helical valve spring is to be designed for an operating load range of 90N to 135 N. The deflection of the spring for this load range is 7.5 mm. Assume a spring index of 10, a permissible shear stress of 480 N/mm^2 and a modulus of rigidity of $0.8 \times 10^5 \text{ N/mm}^2$ for the material, determine the dimensions of the spring.

(OR)

b) An automobile semi-elliptical spring is 1.5 m long and carries a load of 8000N. The spring consists of 10 leaves with 2 full-length leaves. All leaves are 500 mm wide. Find the thickness of leaves. Also find the maximum stress induced for a deflection of 60mm.

25. a) Select a bearing for a 40 mm diameter shaft at 4000 rpm. Due to a bevel gear mounted on the shaft, the bearing will have to withstand a 5000N radial load. The life of the bearing is expected to be at least 1000 hrs.

(OR)

b) The speed of a C.I flywheel is limited to 5m/s at mean radius. The flywheel runs at 50 rpm and supplies 12000 N-m energy during punching. The actual punching time occupies 30° rotations of wheel and speed drops by 20%. Find the cross section of the rim and check the same for maximum induced stress.
