

Register Number:

B.E., DEGREE EXAMINATIONS: NOV/DEC 2012

Fifth Semester

MECHATRONICS ENGINEERING

MCT112: Design of Machine Elements

(Use of approved design data book is permitted)

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Factor of safety for brittle material is based on
 - a) Yield point stress
 - b) Ultimate stress
 - c) Maximum shear stress
 - d) None of these
2. The transverse fillet weld is designed for
 - a) Tensile strength
 - b) Compressive strength
 - c) Shear strength
 - d) None of these
3. A bolt is specified as M30 x 2 , here 30 and 2 are respectively
 - a) Nominal diameter and pitch
 - b) Core diameter and pitch
 - c) Pitch and area of the threads
 - d) Area of threads and pitch
4. Stress ratio for completely reversed stresses is
 - a) 1
 - b) 0
 - c) -1
 - d) 0.5
5. Parallel Fillet welds (joints) are designed for
 - a) Compressive strength
 - b) Tensile strength
 - c) Bending strength
 - d) Shear strength
6. Designing of shaft is done on the basis of
 - a) Strength
 - b) Rigidity
 - c) stiffness
 - d) all
7. The diameter of bearing and journal for a hydrodynamic journal bearing are 20cm and 16 cm respectively. What will be the value of diametrical clearance ratio?
 - a) 5
 - b) 4
 - c) 1/5
 - d) 1/4
8. In the cross head of steam engines, the bearing used is a
 - a) Rolling contact bearing
 - b) Sliding contact bearing
 - c) Radial bearing
 - d) Thrust bearing

9. Modulus of resilience is defined as the ratio of
- | | |
|------------------------------|------------------------|
| a) Proof resilience / volume | b) Resilience / volume |
| c) Proof resilience / area | d) Resilience / area |
10. The purpose of making a bolt of uniform strength is to make it
- | | |
|-----------------------|-------------------------|
| a) Weaker and heavier | b) Stronger and lighter |
| c) Weaker and lighter | d) Stronger and heavier |

PART B (10 x 2 = 20 Marks)

11. What are causes for stress concentration factor?
12. What do you mean by curved beams?
13. What do you mean by flexible coupling?
14. What do you mean by Mechanical Key?
15. What do you mean by critical pressure of the journal bearing?
16. Why hollow shaft is preferred over solid shaft?
17. What is nipping in leaf spring?
18. What are the types of design?
19. What do you mean by flywheel?
20. What do you mean by crank effort diagrams?

PART C (5 x 14 = 70 Marks)

21. a) A Cylindrical Shaft made up of yield strength 7000 Kgf/cm^2 is subjected to a static load consists of bending moment 1000 kgf - m and torsional moment of 3000 kg - m . Find diameter of the shaft using all theories of failures. Assuming $n = 2$, and $E = 2.1 \times 10^6 \text{ Kgf/cm}^2$ and poisson ratio = 0.25

(OR)

- b) A steel rod is subjected to reverse axial loading of 180KN . Find the diameter of rod for a factor of safety column has tensile strength of 1070N/mm^2 and yield strength of 910N/mm^2 . Correction factors are taken as axial loading factor 0.7, machining surface factor 0.8, size factor 0.85, stress concentration factor = 1
22. a) Design a C.I Flange coupling for a M.S Shaft transmitting 120HP at 250rpm . Allowable shear stress in shaft = 400 Kgf/cm^2 and angle of twist is not to exceed 1° in a length of $20d$ allowable shear stress in coupling bolt is 300 Kgf/cm^2 . The shear stress for C.I = 80 Kgf/cm^2 . Material of shaft and key is same with crushing stress of key as twice as shear stress and take rigidity modulus as 8.4 Kgf/mm^2 .

(OR)

- b) A line shaft running at 1000 rpm transmits 20KW it carries a central load of 1000N. it is supported in bearing 100cm apart. For a permissible stress of 45 N/mm² and bending stress of 70 N/mm². Find the diameter of shaft assuming a minor shock loading?

23. a) Select a suitable deep groove ball bearing for a drilling machine spindle of 40mm diameter. Radial load is 2 KN, thrust load is 1.5 KN. Speed is 3000 rpm. Designed life is 3000 Hrs.

(OR)

- b) A 80mm diameter full journal bearing supports a radial load of 600 Kgf. The length of the bearing = 80mm. the speed of the shaft = 600 rpm. The oil film thickness = 0.03mm. The diametrical clearance = 0.17mm. Design the bearing.

24. a) A pull in a turn buckle of a rope in a electric post is 15 KN. Design turn buckle taking same stresses for rods and turn buckle as 75 MPa, 50MPa, and 90 Mpa in tension, shear and crushing respectively . take n = 1.3

(OR)

- b) A solid circular shaft 25mm in diameter is welded to a support by means of fillet weld. Find the leg dimensions of weld if permissible shear stress as 95 N/mm² subjected to a load of 5 KN with a cantilever length of 100mm.

25. a) Design a helical compression spring for a maximum load of 1000N for a deflection of 20mm. the value of spring index as 6. The maximum permissible shear stress = 400N/mm², C=84KN/mm²

(OR)

- b) The disc spring is made of 3mm sheet metal with an outside diameter of 125mm and an inside diameter of 50mm. the spring is dished 4.5mm, the maximum stress is 560N/mm² . design the spring.
