

**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE –
RAIGAD -402 103**

Winter Semester Examination – December - 2019

Branch:- Mechanical

Sem.:- V

Subject with Subject Code:- Machine Design –I(BTMECE503)

Marks:60

Date:- 13/12/2019

Time:- 3 Hr.

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

(Marks)

Q.1. Any two

- a) Define Machine Design. Explain various design considerations (6)
- b) Explain Aesthetic consideration in design with sketches. (6)
- c) Explain ergonomics consideration in design of control & display. (6)

Q.2. Any Two

- a) The load on a bolt consists of an axial load of 10 KN together with transverse shear force of 5 KN. Find the diameter of bolt required according to maximum shear stress theory. The permissible tensile stress at elastic limit = 100 MPa, and F.S. = 1 (6)
- b) Cotter joint to support a load of 30 KN. The material used is plain carbon steel with stresses, Tensile stress = 50 MPa, Shear stress = 35 MPa, Crushing stress = 100 MPa Find 1) Diameter of rod, d 2) Diameter of spigot end, d_2 3) Width of cotter, b 4) Thickness of cotter, t 5) Diameter of socket (6)
- c) Write design process of knuckle joint with suitable sketches (6)

Q.3. Any two

- a) What is stress concentration? What are the causes of stress concentration & remedies for stress concentration. (6)

b) Define (any three)

1) Fatigue failure, 2) Endurance limit, 3) Notch sensitivity, 4) Reversed stress
5) Repeated stress (6)

c) A steel rod subjected to reversed axial load of 180 kN. Find the dia. of the rod if F.S. = 2, Ultimate strength = 1070 MPa, Yield strength = 910 MPa, Endurance strength = half of ultimate strength, $K_a = 0.8$, $K_b = 0.85$, $K_c = 0.7$, $K_f = 1$. (6)

Q.4. Any two

a) Find the diameter of solid steel shaft to transmit 20 kW at 200 rpm. The safe shear stress = 45 MPa. If hollow shaft is to be used in place of solid shaft, find the inside & outside diameter when ratio of inside to outside diameter is 0.5 (6)

b) Prove that crushing stress is twice the shear stress when key is equally strong in crushing & shearing and also give sketches. (6)

c) Design muff coupling to transmit 40 kW at 350 rpm. For shaft & key, Shear stress = 40 MPa, Crushing stress = 80 MPa, For muff-Shear stress = 15 MPa. (6)

Q.5. Any two

a) A vertical two start square threaded screw of 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of lever which is 400 mm long in order to lift or to lower the load $\mu = 0.15$ & $\mu_1 = 0.20$. (6)

b) A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillet weld. The plates are subjected to static load of 80 kN. Find the length of weld if shear stress = 55 MPa. (6)

c) Explain with sketch bolt of uniform strength. (6)

Q.6.

a) Define the terms related to springs

1) Solid length

2) Free length

3) Spring index

4) Spring rate. (6)

b) Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm. Using spring index = 5, Shear stress = 420 MPa, Modulus of rigidity = 84000 MPa, consider effect of stress concentration. (6)