Total Number of Pages: 02   **B.TECH**
                                                                                   PCME4303

5th Semester Regular / Back Examination 2015-16
DESIGN OF MACHINE ELEMENTS
BRANCH: MECH, MANUTECH
Time: 3 Hours
Max marks: 70
Q.CODE: T258
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1   Answer the following questions: (2 x 10)
   a)   What do you understand by 50Cr1V<u>23</u> ?
   b)   How can you calculate the rivet diameter when the thickness of plate is
        less than 8 mm?

   c)   Under what circumstance is the knuckle pin subjected to bending?
   d)   The thread used in a turnbuckle is of 10mm lead. What will be the
        change in the distance between the two ends of the rods for one
        complete rotation of the coupler ?
   e)   Which key is used to resist torsion in one direction only?
   f)   What is the design consideration for a transmission shaft supporting
        pulleys and gears?
   g)   Explain briefly about nip in leaf spring.
   h)   Which end condition for a compression spring ensures the closest
        approach to axial loading?
   i)   Which lever is used to obtain a large leverage?

   j)   Compare the strength of parallel fillet weld and transverse fillet weld

Q2   Design and sketch a triple riveted double strap chain butt joint suitable   (10)
        for a longitudinal joint, for a pressure vessel having 1.5 m diameter and
        working pressure of 2 N/mm^2. The permissible stresses are 80 MPa in
        tension, 120 MPa in crushing & 60 MPa in shear.

Q3 a) An engine cylinder head is bolted to a 500 mm diameter cylinder by   (5)
        means of 24 studs. The studs are tightened just enough to prevent the
        joint opening under a pressure of 2 N/mm^2. What is the resultant force
        on each stud for an internal pressure of 1.5 N/mm^2. Assume stiffness
        constant as 0.2.

b) A 70 mm diameter solid shaft is to be welded to a plate by means of a fillet weld around the circumference of the shaft. Determine the size of the weld if the shaft is subjected to a torque of 4 kN m. The allowable shear stress in weld is 45 MPa. If the shaft is subjected to a bending moment of 4 kN m instead of torque, determine the size of the weld considering the permissible normal stress as 60 MPa. (5)

Q4 a) A shaft of 25 mm diameter is subjected to a torque of 60N-m and a bending moment of 90 N-m . Calculate the factor of safety according to maximum normal stress theory and maximum shear stress theory. Take yield strength of the shaft material as 400 MPa. (7)

b) A shaft is transmitting a torque of 3 kN-m while being subjected to a bending moment of 4 kN-m. Determine the maximum torque the shaft can transmit. (3)

Q5 Design a cast iron flange coupling of protected type to connect two mild steel shafts transmitting 70 kW at 240 rpm. The permissible shear stress for shaft, key, bolt and flange material may be taken as 45 MPa, 50 MPa, 40 MPa, and 15 MPa respectively. The permissible crushing stress for both bolt and key material may be assumed as 90 MPa. (10)

Q6 a) A bumper consists of two helical steel springs of circular section. It brings to rest a rail way wagon of mass 1500 kg and moving at a speed of 1.5 m/s. By doing so the springs are compressed by 200mm. The mean diameter of coil is 6 times the diameter of the wire. Design the spring if the permissible shear stress is 350 MPa and the rigidity modulus is 0.85×10^5 N/mm^2. (5)

b) Design a right angled bell crank lever of rectangular cross section and having one arm of 100 mm length. A load of 2 kN is to be raised through the pin at the forked end of 100 mm arm. An effort is to be applied at the end of 150 mm arm through a pin at the fork. The lever is supported by a fork and the pin is fixed in the fork. Allowable stresses in tension, shear, and compression are 70, 56 and 100 MPa respectively. Allowable bearing pressure in the pin is 20 MPa. (5)

Q7 Design a cotter joint of spigot and socket type which may be subjected to a pull of 25 kN. The permissible stresses in tension, shear and crushing for all the components may be taken as 55, 40 and 70 MPa respectively. (10)

Q8 Design a square threaded screw jack to raise a load of 15 kN through a height of 250 mm. The compressive strength of screw material is 330 MPa. The Rankine constant is 1/7500 for column hinged at both ends. Use a factor of safety 4. The permissible shear stress for nut material is 25 MPa and its bearing pressure is 10 MPa. The coefficient of friction for threads as well as for collar may be assumed as 0.14. (10)