USN | | | | | | | | | |

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Design of Machine Elements – I

Time: 3 hrs.   Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting*
atleast TWO questions from each part.
2. Use of design data hand book is permitted.

PART – A

1 a. How will you designate the following materials?
   i)   Grey cast iron with an ultimate tensile strength of 300N/mm².
   ii) Plain carbon steel with a minimum yield strength of 200N/mm².
   iii) Plain carbon steel with 0.4% carbon and 0.8% manganese.
   iv) Alloy steel with composition of carbon 0.35% to 0.45% and chromium 0.90% to
        1.20%.   **(04 Marks)**
   b. Define factor of safety and explain the criteria for selection of factor of safety.   **(06 Marks)**
   c. A machine member shown subjected by axial, radial and twisting loads/moments. Find the
      maximum normal and shear stressed induced by considering loads/moments separately.
                                                                                       (10 Marks)
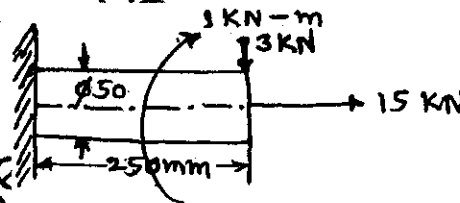
2 a. Explain the theories of failures.   **(06 Marks)**
   b. What are the causes of stress concentration? Explain the methods of reducing stress
      concentration.   **(06 Marks)**
   c. The brasses of an automobile engine connecting rod have worn so as to allow play which
      gives shock loading equivalent to a weight 6000N falling through a height 0.2mm. The
      connecting rod is 250mm long and has a cross-sectional area 300mm². Determine the max
      stress induced in connecting rod and resilience in tension or compression.   **(08 Marks)**

3 a. Derive Soderberg equation.   **(06 Marks)**
   b. A steel connecting rod made of C-14 steel is to be subjected to a reversed axial loading
      180kN. Determine the required diameter of rod using factor of safety 2.   **(14 Marks)**
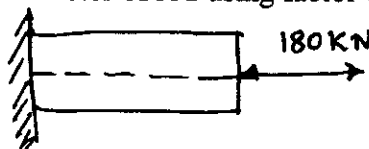

Fig.Q.3(b)

4 a. Determine the required length of square key, if key and shaft are made up of same material.
                                                                                       (05 Marks)
   b. Design a socket and spigot type cotter joint to sustain an axial load of 100kN.The material
      selected have the following properties. The allowable stresses are 120MPa in tension,
      160MPa in crushing, 80MPa in shear.
                                                                                       (15 Marks)

PART – B

5   A solid steel shaft running at 600rpm is supported on bearings 600mm apart. The shaft receives 40kN through a 400mm diameter pulley weighing 400N located 300mm to the right of left bearing by a vertical flat belt derive. The power is transmitted from the shaft through another pulley of diameter 600mm weighing 600N located 200mm to the right of right bearing. The belt drives are right angles to each other and ratio of belt tensions is 3. Determine the size of shaft if allowable shear stress is 40MPa.   (20 Marks)

6   a.   What are the advantages of threaded joints?   (04 Marks)
    b.   What are the uses of screw threads?   (02 Marks)
    c.   A steam engine of effective diameter 300mm is subjected to steam pressure 1.5MPa. The cylinder head is connected by 8 bolts having yield point 330MPa and endurance limit 240MPa. The bolts are tightened with an initial preload of 1.5 times steam load. A soft copper gasket is used to make the joint leak proof. Assuming factor of safety 2. Find the size of bolt required.   (14 Marks)

7   a.   A double riveted lap joint is made between 15mm thick plates. If the ultimate stresses are 400MPa in tension, 620MPa in crushing and 330MPa in shear. Take factor of safety 4. Find the efficiency of joint.   (10 Marks)
    b.   Find the efficiency of a double riveted butt joint to connect two plates 20mm thick. The joint is zig-zag riveted and has equal width cover plates. The allowable tensile stress for the plate is 100Mpa, shear 60MPa and crushing 120MPa.   (10 Marks)

8   a.   A rectangular bar of size 100mm×50mm and length 200mm is welded to a vertical support by means of two 6mm fillet welds as shown in Fig.Q.8(a). If the permissible stress is limited to 90MPa, Determine load F.   (10 Marks)
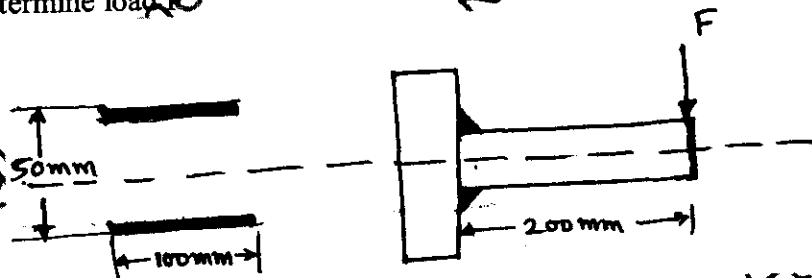

Fig.Q.8(a)

    b.   A square threaded power screw has a nominal diameter of 30mm and a pitch of 6mm with double threads. The load on the screw is 6kN and the mean diameter of thrust collar is 40mm. The coefficient of friction for the screw is 0.1 and for the collar is 0.09. Determine: i) Torque required to rotate the screw against the load; ii) Torque required to rotate the screw with the load; iii) Overall efficiency; iv) Is the screw is of self locking   (10 Marks)

* * * * *