Registration No. : | | | | | | | | | | |

Total number of printed pages – 4

B. Tech

PCME 4303

Fifth Semester Back Examination – 2014

DESIGN OF MACHINE ELEMENTS

BRANCH : MECH

QUESTION CODE : L 253

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **four** from the rest.*

The figures in the right-hand margin indicate marks.

Draw neat sketches wherever necessary. Assume any missing data suitably. Use of only BPUT Specified Design Data Book is permitted inside the examination hall.

1. Answer the following questions : 2×10

(a) Explain the different stages for designing of machine elements.

(b) What do you mean by Standardization ? Briefly explain about the importance of Standardization in the design of machine element.

(c) With neat sketch describe about diamond riveting also give one example where the designers use diamond riveting.

(d) Differentiate between first, second and third class levers. Why third-class is not recommended by the designer for use ?

(e) What types of stresses are induced in key ?

(f) What are the basic elements of chain drive ? What are the advantages and disadvantages of chain drive over other drive ?

(g) What do you mean by buckling of a spring ? How it can be prevented ?

(h) What is nipping in leaf spring ? Discuss its function in spring design.

(i) Why is the nut of a power screw made of a soft material ?

(j) State the types of stresses which are produced in a belt while transmitting power.

P.T.O.

2. (a) What do you mean by throat and leg of a weld ? Differentiate between parallel and transverse weld. 2.5

(b) Design an eccentrically loaded riveted joint (lap) as shown in the figure 2-a. The bracket plate is 40 mm thick. All rivets are to be same size. The load on the bracket is 60 kN. The rivet spacing is 100 mm and eccentricity is 300 mm. 10

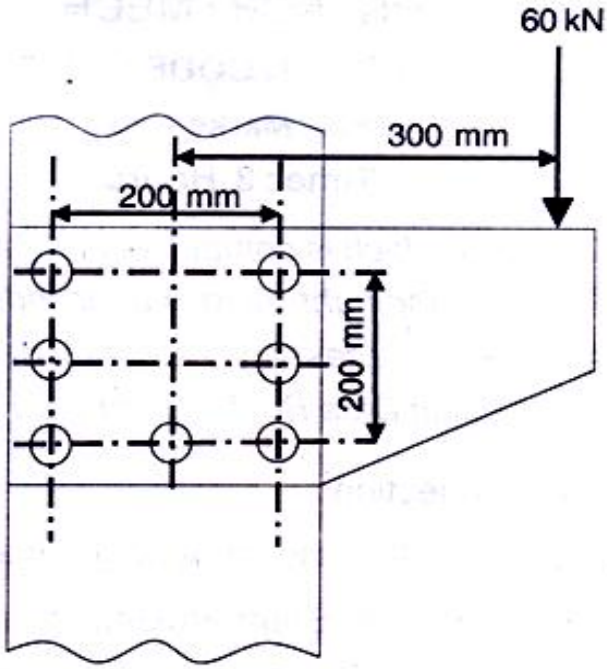

Figure 2-1

3. (a) Explain the bending failure of knuckle pin in knuckle joint. 2.5

(b) Design a socket and spigot cotter joint to connect two rods of equal diameter. Each rod is subjected to an axial tensile force of 30 kN. The rods are made of mild steel having allowable limits of tensile, shear and crushing strengths are 55 N/mm^2, 45 N/mm^2 and 90 N/mm^2. 10

4. (a) Discuss the various types of misalignments, which normally occur between two shafts. 2.5

(b) Which theories of failure are applicable for design of shaft ? Justify your answer. 2.5

(c) A shaft is made of 40Ni8Cr8V2 material. Name the percentage of different alloying element present in the shaft material. 2.5

(d) What do you mean by stiffness and rigidity of a shaft ? 2.5

(e) Give the standard proportions for industrial practice of a rectangular key. 2.5

5. (a) What is lever ? Explain the principle on which it works. 2.5

(b) A protected type of rigid flange coupling is used to connect to shafts of equal diameters and transmit 20 kW power at 450 rpm. The overload capacity is 1.25 times the average torque. Design the coupling.

The shaft, keys and bolts are made of plain carbon steel C40 having yield tensile strength 340 N/mm^2.

The flange is made of gray cast iron FG200 having ultimate tensile strength is 200 N/mm^2. 10

6. (a) What do you understand by surge in a spring ? How can it be prevented ? 2.5

(b) Design a helical compression spring which will be used to absorb the shock. The spring is subjected to a maximum force of 1.2kN. The deflection of the spring corresponding to the maximum force should be 42mm. The spring index is 6. Material of the spring is cold-drawn steel wire having ultimate tensile strength and modulus of rigidity as 1090 N/mm^2 and 81400 N/mm^2 respectively. The permissible shear stress for the spring wire is 57.7% of the ultimate tensile strength. The spring has square and ground ends and 1 mm gap should be maintained between two consecutive coils when the spring is subjected to the maximum force. 10

7. (a) What do you mean by a bolt of uniform strength ? State one method to make bolt of uniform strength. 3

(b) Enlist the merits and demerits of V-belt over flat belt. 3

(c) Design a simple lever of a safety valve for a boiler having a gauge pressure of 2.25 MN/m^2. The valve diameter is 100 mm. The lever is 90 cm long and the distance between the fulcrum and the valve point is 100 mm. The cross section of the lever is rectangular having width to height ratio is 4 : 1. The lever is made of C20 steel having allowable strength of 100 N/mm^2. The bearing pressure at the pin is 20 N/mm^2. 6.5

8. (a) What do you mean by tolerances ? Discuss its function in design of machine elements. 2.5

(b) What do you mean by the term Interchangeability ? What is its importance in design of machine elements ? 2.5

(c) What is a gib ? What is its function in a gib and cotter joint ? 2.5

(d) Explain the role of Preferred Numbers in design of machine elements. 2.5

(e) What is factor of safety and on what factors mainly it depends ? 2.5