

Code No: 55019

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech III Year I Semester Examinations, May/June - 2015

DESIGN OF MACHINE MEMBERS-I

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) What are the various properties of a material which can be considered while selecting for a machine element? Explain.
- b) What are the effects of alloying elements in steel formation? Explain with applications.
- Chromium.
 - Vanadium
 - Molybdenum .
- c) A wire rope of 100 mm^2 cross sectional area is made up of 1 mm diameter strands. The ultimate tensile strength of the rope is 150 kN. Factor of safety used for the rope is 10. The allowable tensile stress for the rope material is 50 MPa when 10 strands are broken; Is the rope fit for further use? Explain. [6+3+6]
- 2.a) Define the following terms with suitable example.
- Notch sensitivity
 - Endurance limit
 - Stress concentration.
- b) Why is Goodman's equation preferred to Soderberg's criterion for designing a machine part subjected to fluctuating loads? Explain.
- c) Calculate the fatigue strength for the specimen made of 30C8 steel with $S_e=280 \text{ MPa}$, $S_u=600 \text{ MPa}$ for a life of 200×10^3 cycles of stress reversals. S_f for 103 cycles is $0.9 S_u$. What would be the life of the specimen if the fluctuating reversible stress is 420 MPa? [6+3+6]
- 3.a) Two plates of 100 mm width and 12 mm thickness are to be joined by double Lap joint using 10 mm fillet welds. If the permissible shear stress is 80 MPa, Determine the necessary length of the weld, when the joint is subjected to an axial load of 30kN. Indicate the best possible manner of putting the weld.
- b) A boiler of 1m diameter is made by welding the plates longitudinally and circumferentially. The maximum pressure is 1.5 N/mm^2 . Design both the joints, using single V butt weld for the joints. The permissible tensile stress in the plate material is 70 MPa. Assume efficiency of the weld as 75%. [7+8]
- 4.a) A bracket is fitted to a vertical channel with 5 bolts, three at the top and two at the bottom with all the bolts equally spaced. The value of $P=20 \text{ kN}$, $e=200 \text{ mm}$, $l_1=50 \text{ mm}$, $l_2=250 \text{ mm}$. find the diameter of the bolt.
- b) Derive a relationship to calculate the load shared by the bolt in a preloaded joint when an external load F_c acts on the joint. [10+5]

- 5.a) Design a spigot and socket joint to connect two rods of 30C8 steel to carry a tensile and compressive load of 10 kN. Sketch the designed component.
- b) Differentiate Kennedy key and Feather key with suitable sketches and their applications [11+4]
- 6.a) What is BIS code? Write a note on it.
- b) Design a line shaft transmitting power to two machine tools. The power received by the shaft is 30 kW at 300 r.p.m. the power absorbed by pulley P_1 is 12 kW and the remaining power is absorbed by pulley P_2 . The diameter of pulley P_1 is 300 mm and its mass is 40 kg. The diameter and mass of pulley P_2 are 600 mm and 75 kg respectively. Assume the belt tension ratio of 2 for both pulleys and the shaft material as 30C8 steel with $k_m=2$ and $k_t=1.5$. Draw the B.M.D and torque diagram, assuming maximum shear stress theory. Assume shaft length of 1800 mm. pulley P_1 is located 600 mm from the right hand side, pulley P_2 is located 500 mm from the left hand side. [4+11]
- 7.a) Design a rigid CI flange coupling, required to transmit 18 kW at 1000 rpm. the coupling is to be connected between a motor and a centrifugal pump, each having their shaft diameters of 50 mm and 40 mm respectively.
- b) Why are annular recesses provided at the sides of the flanges in a protected flange coupling? Explain. [11+4]
- 8.a) Why is Wahl's factor to be considered in the design of a helical compression or tension springs? Explain.
- b) A bumper, consisting of two helical steel springs of circular section, brings to rest a railway wagon of mass 1500 kg moving at 1.2 m/s while doing so the springs are compressed by 150 mm. the mean diameter of the coil is 6 times the wire diameter and the permissible shear stress is 400 Mpa. Take $G = 0.84 \times 10^5$ MPa. Determine
- Maximum force on each spring
 - Wire diameter of the spring
 - Mean diameter of the coils
 - Number of active coils.
- [4+11]

---ooOoo---