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Total No. of Questions : 09

B.Tech.(AE) (Sem.–5)
AUTOMOTIVE DESIGN - I
Subject Code : AE-301
Paper ID : [A0713]

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**
4. **Use of only P.S.G. design data book is permitted. All dimensions indicated in figures are in mm.**

SECTION-A

l. **Write briefly :**

(a) What are the basic requirements for design of machine element?

(b) Why is heat dissipation necessary in clutches?

(c) Give the composition of 35 Mn 2 Mo 45 steel. List its main uses.

(d) What is the difference between caulking and fullering?

(e) Discuss on bolts of uniform strength giving examples of practical applications of such bolts.

(f) Why gibs are used in a cotter joint?

(g) What do you understand by overhauling of screw.

(h) What are the thermal considerations in brake design?

(i) What are flexible couplings and what are their applications?

(j) What is shear stress as per ASME code of shaft design?

SECTION-B

2. A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20.

3. An automotive type internal expanding double shoe brake is shown in Figure. The face width of the friction lining is 40 mm and the maximum intensity of normal pressure is limited to 1 Mpa. Taking $\theta_1 = 0°$, $\mu = 0.32$, determine the actuating force P and the torque absorbing capacity of brake.
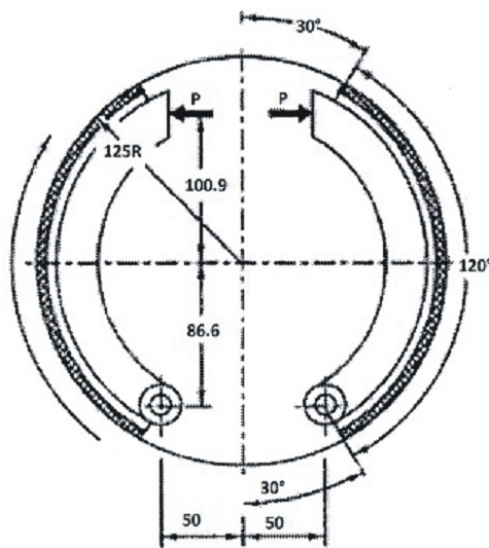
4. A multiple disk clutch, steel on bronze, is to transmit 4.5 kW at 750 r.p.m. The inner radius of the contact is 40 mm and outer radius of the contact is 70 mm. The clutch operates in oil with an expected coefficient of 0.1. The average allowable pressure is 0.35 N/mm^2. Find :

   (a) the total number of steel and bronze discs;

   (b) the actual axial force required;

   (c) the actual average pressure;

   (d) the actual maximum pressure.

5. For each of the following applications calling for steel, choose between (1) 0.1 percent carbon and 0.4 percent carbon and between (2) plain carbon and alloy steel.

   (a) A machine frame requiring extreme rigidity (when massive enough to satisfy this requirement, stresses will be very low).

   (b) A small, round rod subjected to high bending and torsional stresses.

(c) A large, irregularly shaped part subjected to high stresses.

(d) A rail car wheel (interior stresses low but surface must be carburized to resist wear).

6. A vertically loaded bracket attached to a fixed member by three identical bolts. Select a suitable material for bolts and determine an appropriate bolt size.
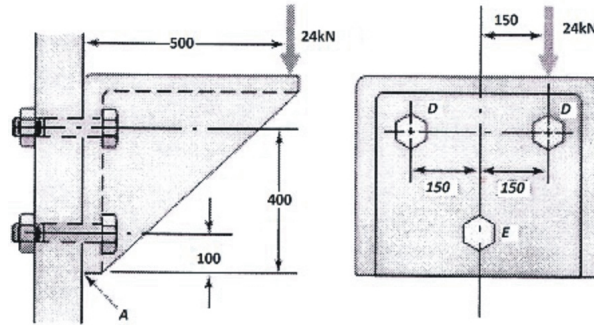
SECTION-C

7. Design a bushed pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 rpm. The service factor is 1.2 and the material properties are as follows : The allowable shear and crushing stress for the shaft and key material is 40 MPa and 80 MPa, respectively.

   The allowable shear stress for flanges made of cast iron is 15 MPa.

   The allowable bearing pressure for rubber bushes is 0.8 MPa.

   The material of pin is same as that of shaft and key. Factor of safety is assumed as 3.

8. A multiple disc clutch, steel on bronze, is to transmit 4 kW at 750 rpm. The inner and outer radii of contact are 40 mm and 70 mm, respectively. The clutch operates in oil with an expected coefficient of friction 0.1. The average allowable pressure is 350 kN/m^2.

   (a) How many total discs of steel and bronze are required?

   (b) What is the average pressure?

   (c) What axial force is required?

   (d) What is the actual maximum pressure?

9. The distance between the king-pins of a car is 130 cm. the track arms are 15.25 cm long and the length of the track rod is 120 cm. For a track of 142 cm and a wheelbase of 285 cm, find the radius of curvature of the path followed by the near side front wheel at which correct steering is obtained when the car is turning to the right.