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Total No. of Pages: 04
Total No. of Questions: 09

B.Tech. (Sem.-5th)
AUTOMOTIVE DESIGN-I
Subject Code: AE-301
Paper ID: [A-0713]

Time: 3 Hrs.   Max. Marks: 60

INSTRUCTIONS TO CANDIDATE:

1. **Section –A, is Compulsory.**

2. **Attempt any four questions from Section-B.**

3. **Attempt any two questions from Section-C.**

Section –A   **(10x2=20)**

Q.1.

(a)   Name few sources of material data available to a designer.

(b)   What is the difference between rigid coupling and flexible couplings?

(c)   Why is the semi cone angle of cone clutch made 12.5^0?

(d)   What is meant by working stress and how it is calculated from the ultimate stress or yield stress of a material?

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

(f)   What type of stresses is developed in bolts in a flange coupling?

(g)   How does the helix angle influence on the efficiency of square threaded screw?

(h)   What are the materials used for lining of friction surfaces in clutches and brakes?

(i)   What is self- energizing brake? When a brake becomes self- locking.

(j)   What are the design considerations for a passenger vehicle?

Section –B   (4x5=20)

Q.2.   An automotive internal expanding brake is shown in figure 1. The face width of the friction lining is 50 mm and the coefficient of friction is 0.4. The maximum intensity of pressure on the lining is 0.8 N/mm^2. The angle   can be assumed as Zero. calculate the actuating force and torque capacity of brake.
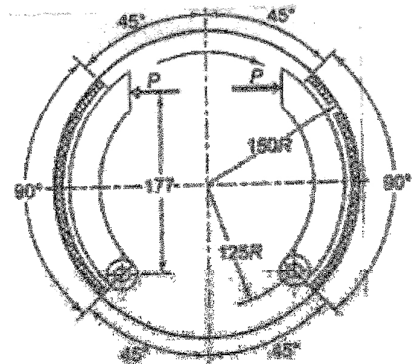

Figure 1

Q.3.   A car has a wheel base of 2743m and pivot centre of 1.065m. The front and rear wheel track is 1.1217m. calculate the correct angle of outside lock and turning circle radius of the outer front and inner rear wheels when the angle of inside lock is 40^0.

Q.4.   An angle of size 200mm x 100 mm x 10 mm is required to be welded to steel plate by a fillet weld a shown in the figure 2.. If the angle is subjected to an axial static load of 150 kN and the permissible she stress for the weld is 70 N/mm^2, determine the top and bottom weld lengths.
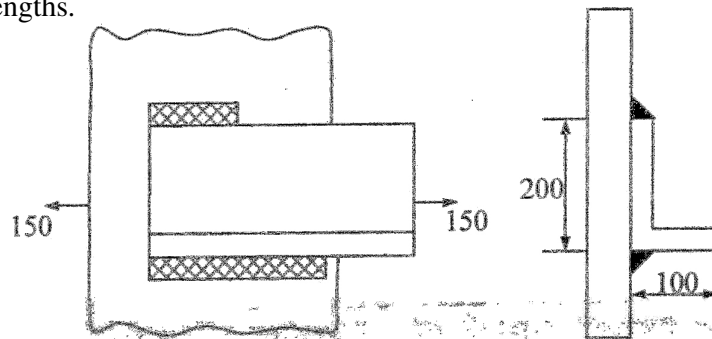

Figure 2

Q.5.   A plate clutch has three discs on the driving shaft and two discs on the driven shaft, providing four pai of contact surfaces. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm assuming uniform pressure and   , find the total spring load pressing the plates together to Transm 25kW at 1575 r.p.m. If there are 6 springs each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted assuming uniform wear.

Q.6. For each of the following applications calling for steel, choose between (1) 0.1 percent carbon and 0. 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).

Section-C   (2x10=20)

Q.7. Two shafts, the axles of which intersect but are inclined at 20^0 to each other, are connected by Hooke joint. If the driving shaft has a uniform speed of 1000 rpm find from first principles the variation speed of the driven shaft. The driven shaft carries a rotating mass which weighs 15 Kgf and has a radius of gyration of 25 cm. Find the accelerating torque on the driven shaft for the position when the drive shaft has turned 45^0 from the position in which its fork end is in the plane containing the two shafts.

Q.8. A bracket is attached to steel channel by means of nine identical rivets as shown in figure 3. Determine the diameter of rivets if the permissible shear stress is 60 N/mm^2.
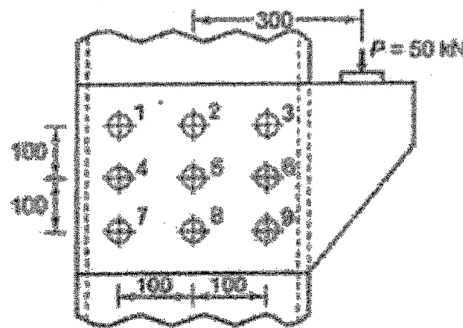

Figure 3

Q.9. Power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collor are 50 mm and 20 mm respectively. the coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm^2 find:

(a) The torque required to rotate the screw;

     (b)   The stress in screw; and

     (c)   the number of threads of nut in engagement with screw.

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