Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech(AE) (2011 Onwards) (Sem.–5)

DESIGN OF AUTOMOTIVE COMPONENTS

Subject Code : BTAE-504

Paper ID : [A2064]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION 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 has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1. Write briefly :

i. What do you mean by factor of safety?

ii. Why the double helical gears are preferred instead of single helical?

iii. What are the bending stresses? How they are related with bending moment?

iv. State the maximum shear stress theory of failure. Also draw its curves

v. What do you understand by self-energizing brakes?

vi. Explain why flywheels are used in punching machines. Does the mounting of a flywheel reduce the stress induced in the shafts?

vii. What is the function of a spring? In which type of spring the behaviour is non-linear?

viii. Why it is necessary to dissipate the heat generated when clutches operate?

ix. A weight is brought to rest by applying brakes to the hoisting drum driven by an electric motor. How will you estimate the total energy absorbed by the brake?

x. Distinguish clearly between pin, axle and shaft.

SECTION-B

2. Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2. Also calculate the maximum shear stress induced.

3. What are the design considerations for crankshaft of an internal combustion engine? Also mention the criteria of material selection for it.

4. The intercepted areas between the output torque curve and the mean resistance line of a turning moment diagram for a multi-cylinder engine, taken in order from one end are as follows : –35, +410, –285, +325, –335, +260, –365, +285, –260 mm^2. The diagram has been drawn to a scale of 1 mm = 70 N-m and 1 mm = 4.5°. The engine speed is 900 r.p.m. and the fluctuation in speed is not to exceed 2% of the mean speed.

   Find the mass and cross-section of the flywheel rim having 650 mm mean diameter. The density of the material of the flywheel may be taken as 7200 kg / m^3. The rim is rectangular with the width 2 times the thickness. Neglect effect of arms, etc.

5. The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm^2. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa.

6. Draw a flow chart of design procedure and explain its components in details.

SECTION-C

7. Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used :

   Shear stress for shaft, bolt and key material = 40 MPa

   Crushing stress for bolt and key = 80 MPa

   Shear stress for cast iron = 8 MPa

8. Fig. 1 shows the arrangement of two brake shoes which act on the internal surface of a cylindrical brake drum. The braking force F_1 and F_2 are applied as shown and each shoe pivots on its fulcrum O_1 and O_2. The width of the brake lining is 35 mm. The intensity of pressure at any point A is 0.4 sin θ N/mm^2, where θ is measured as shown from either pivot. The coefficient of friction is 0.4. Determine the braking torque and the magnitude of the forces F_1 and F_2.

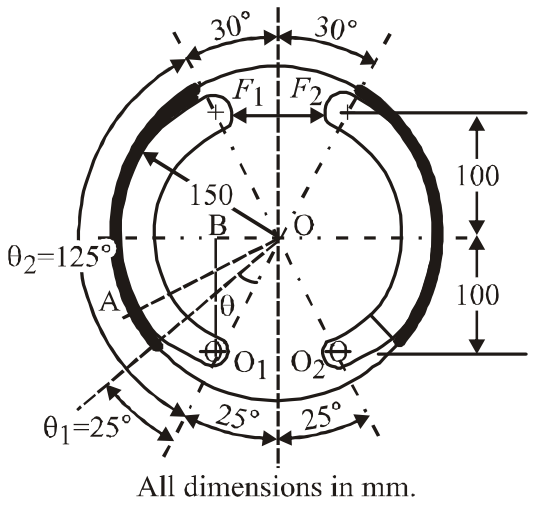

Fig. 1

9. A mild steel shaft transmits 20 kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearings 2.5 m apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56 MPa. What size of the shaft will be required, if it is subjected to gradually applied loads?