1416

B. Tech 5th Semester Examination

Design of Automobile Component-I (O.S.)

AU-5002

Time : 3 Hours   **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note :   Section E is compulsory. Candidates are required to attempt all the questions in section E. In addition to that candidates are also required to attempt 4 (four) questions selecting at least one question from each section A,B,C,D. Marks of questions are indicated against each question. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitably if any and specify the same.

SECTION - A

1. (i)   What are the factors to be considered for selection of materials for the design of automobile components? Discuss.

    (ii)   State and explain the procedure and differences between B.I.S. system of designations of steel and cast iron.

                                                    (6+9=15)

2. (i)   Draw a simple sketch of a screw thread and define the following terms for ISO designated metric screw threads: (a) depth of thread, (b) pitch diameter, (c) crest, (d) slope.

    (ii)   A 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 collar 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 is 5.8 N/mm^2. Find (a) the torque required to rotate the screw and (b) stress in the screw.   **(7+8=15)**

SECTION - B

3. (i) What is an eccentric loaded welded joint? With consider an example discuss the procedure for designing such joint.

(ii) A plate of 75 mm wide and 12.5 mm thick is joined with another plate by a single transverse weld and a double parallel fillet weld. The maximum tensile and shear stresses are 70 MPa and 56 MPa respectively. Draw a simple sketch for the joint and determine the length of each parallel fillet weld if the joint is subjected to static loading.   **(2+6)+7=15**

4. (i) Discuss the design procedure of Knuckle joint.

(ii) Design a Knuckle joint to transmit 150 kN. The design stresses are given below.

Tensile stress = 75 MPa, compressive stress =150 MPa, shear stress = 60 MPa, Draw simple sketch for designing of this joint.   **(4+11=15)**

SECTION - C

5. (i) Derive an expression for length of a flat belt used in open belt drive. Take d_1 and d_2 be the diameter of the larger and smaller pulleys respectively. Distance between the centre of two pulleys is 'x'.

(ii) Design a flat belt to drive an exhaust fan transmitting power from an electric motor. Following data are given as diameter of motor pulley is 400 mm, diameter of fan pulley is 1600 mm, angle of warp for motor pulley is 2.5 radians and for fan pulley is 3.78 radians. Coefficients of frictions are 0.3 and 0.25 for motor and fan pulleys respectively. Speed of motor pulley is 700 r.p.m. Power transmitted is 22.5 kW. Permissible stress for belt material is 2.3 MPa. Thickness of belt is 5 mm.

(7+8=15)

6. Design a rigid flange coupling to transmit a torque of 250 N-m between two co-axial shafts. Four bolts are used to couple the flanges. The shafts are keyed to the flange hub. Given shear stress for shaft is 100 MPa, bearing stress for shaft is 250 MPa. Shear and bearing stresses for key are 100 MPa and 250 MPa respectively. Shear stress for cast iron coupling is 200 MPa. Shear stress for bolts is 100 MPa.

Draw a neat sketch of the designed coupling and showing the important dimensions.   **(10+5=15)**

SECTION - D

7. (i) Name the different types of clutches. Describe with the help of a neat sketch the working principles of a friction clutch.

(ii) An engine developing 45 kW at 1000 r.p.m. is fitted with a cone clutch built inside the flywheel. The cone has a face angle of 12.5° and a maximum mean diameter of 500 mm. the coefficient of friction is 0.2. The normal pressure on the clutch face is not to exceed 0.1 N/mm^2. Determine (a) the face width of the clutch, (b) axial force necessary to engage the clutch.   **(7+8=15)**

8. (i) What is back stop action in band brakes? Discuss the various types of brakes giving at least one practical application for each.

(ii) A band brake acts on the 0.75 part of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the anticlockwise direction.   **(3+5)+7=15**

SECTION - E

9. Multiple Choice Questions (compulsory)

(i) Ductility of a material can be defined as

(a) ability to undergo large permanent deformations in compression,

(b) ability to recover its original form,

(c) ability to undergo large permanent deformations in tension, (d) all of the above

(ii) Ball bearings are usually made from

(a) low carbon steel, (b) high carbon steel, (c) medium carbon steel, (d) none of the above.

(iii) A basic shaft is one whose

(a) lower deviation is zero, (b) upper deviation is zero, (c) lower and upper deviations are zero, (d) none of these.

[P.T.O.]

(iv)   Maximum horse power is transmitted by a belt drive when its velocity is such that the tight side driving tension in belt is equal to

(a) centrifugal tension, (b) 2 x centrifugal tension, (c) 3 x centrifugal tension, (d) 4 x centrifugal tension,

(v)   In order to have smooth operation, the minimum number of teeth on the smaller sprocket, for moderate speeds, should be (a) 15, (b) 17, (c) 21, (d) 25.   **(5×2=10)**

10. Short Questions (compulsory)

(i)   What is screw joint? Where and when it is used? Explain.

(ii)   Why are the edges of welding parts prepared before welded joint?

(iii) Explain B.I.S. system of fits.

(iv)   Free hand sketches of a two views of bolted joint in tension and level the various regions.

(v)   Write the advantages and disadvantages of eccentrically loaded welding joints.

(vi)   Write various steps for designing of a V-belt drive.

(vii) How belts are selected for transmission of powers in different engineering applications?

(viii) Which theory can be used for designing of clutch and why?

(ix)   What should be the basic requirement in designing of rimmed flywheel?

(x)   Write the advantages and disadvantages of rope and chain drive.

(xi)   What are the salient features in designing of a coupling?

(xii) How does the friction of a brake differ from that of a clutch?

(xiii) When frictional force helps to apply the brake then brake is said to be self energizing brake. Explain how frictional force helps to apply brake?

(xiv) What type of force is required for engaging a cone clutch and how it is related to the normal force acting on the contact surface?

(xv)   Draw a free hand sketch of a rectangular key and level all regions. Write its specific advantages.   **(15×2=30)**