BAS-010

B.Tech. AEROSPACE ENGINEERING (BTAE)
Term-End Examination
June, 2018

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BAS-010 : MACHINE DESIGN

Time : 3 hours   *Maximum Marks : 70*

*Note : Attempt any **seven** questions. Assume missing data, if any. Use of non-programmable calculator and Machine Design Data Book is permitted.*

1. (a) Define the following terms used in Limit System :   *5*
   (i) Tolerance
   (ii) Limits
   (iii) Allowance

   (b) Explain the following terms with the help of sketches :   *5*
   (i) Clearance fit
   (ii) Interference fit

2. (a) Explain the following terms :   *4*
   (i) Modulus of elasticity
   (ii) Modulus of rigidity

(b)   The figure below shows a joint used in suspension links. The joint is subjected to a tensile load of 50 kN. Thickness of each side plate is 12 mm. Assuming that the plates and pin are made of the same material, with permissible stress values in tension, compression and transverse shear as 60, 80 and 45 MPa respectively, design the joint.   *6*
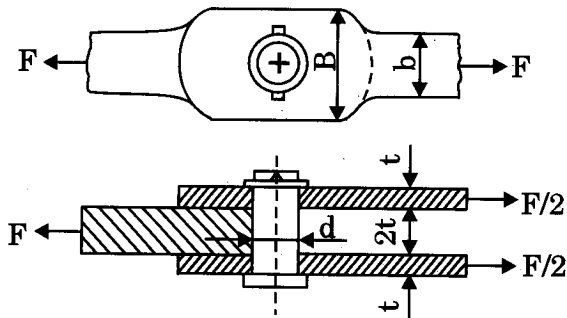
3.   (a)   Define the following :   *5*

   (i)   Elastic Limit

   (ii)   Poisson's Ratio

   (iii) Moment of Inertia

(b)   A solid shaft of length 1 m, transmits 100 kW at 180 rpm. If the permissible shear stress for the shaft material is 60 MPa, and the angle of twist in the shaft is not to exceed 0·5°, determine the diameter of the shaft. Take modulus of rigidity as 84 GPa.   *5*

4. (a) Describe the following with the help of suitable sketches :   *4*

    (i)   Kennedy key

    (ii) Woodruff key

  (b) A rectangular sunk key of 14 mm width, 9 mm thickness, and 75 mm length is required to transmit 1200 N-m torque from a 50 mm diameter shaft. If the permissible shear and crushing stresses are 60 and 90 MPa respectively, determine whether the length of key is safe or not.   *6*

5. (a) Explain the following with the help of neat sketches in relevance to the classification of gears :   *4*

    (i)   Spur gearing

    (ii) Straight bevel gearing

  (b) Draw a neat sketch of a spur gear and explain the following :   *6*

    (i)   Thickness of tooth

    (ii) Pitch circle

    (iii) Addendum

6. (a) Draw neat sketches of the following springs : 5

   (i) Helical tension and compression springs

   (ii) Leaf spring

   (iii) Belleville spring

   (b) Design a helical compression spring, to be used for a balance to measure 0 − 1200 N over a scale of length 100 mm. The spring is to be enclosed in a space of 35 mm diameter. Approximate number of turns is 25. Take the modulus of rigidity as 0.84×10^5 MPa. Also calculate the maximum shear stress induced. 5

7. A propeller shaft is made up by joining together a number of solid shafts. The joint is made by forging the ends of the shaft in the form of a flange and bolting the flanges together by means of 8 bolts. If the shaft transmits 60 kW at 120 rpm, determine the size of the shaft, the diameter and thickness of the flange, and the diameter and pitch circle diameter of the bolts. Permissible stresses are

$\tau = 35$ MPa, and $\sigma_c = 45$ MPa. 10

8. In a crossed belt drive, the diameters of the driver and follower pulleys are 200 mm and 400 mm respectively. The centre distance of the drive is 2 m. The driver pulley rotates at 400 rpm. Find the following : *10*

   (a) The angle of contact between belt and both the pulleys

   (b) Length of the belt required

   (c) The power capacity of the drive, if the permissible tension in the belt is 1·2 kN and the coefficient of friction between the belt and both the pulleys is 0·25.

9. (a) Briefly describe the effects of the following alloying elements : *5*

      (i) Nickel

      (ii) Chromium

      (iii) Tungsten

   (b) Mention the typical uses of the following : *5*

      (i) Phosphor Bronze

      (ii) Duralumin

      (iii) Gun metal (Tin bronze)

10. (a) Describe the following types of screw threads with the help of suitable sketches : 5

(i) Square thread

(ii) Buttress thread

(iii) V-thread

(b) A balancing mass of 20 kg is attached to the crank-web of a single cylinder overhung crank of an IC engine by two studs. The crank rotates at 480 rpm, and the radius of the balancing mass is 200 mm. Determine the size of the studs, if the permissible tensile stress in the stud material is 60 MPa. 5

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