BAS-010

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2018

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BAS-010 : MACHINE DESIGN

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt any **seven** questions. Assume missing data suitably. Use of scientific calculator and Machine Design Data Book is permitted. All questions carry equal marks.*

1. (a) Draw the stress-strain curve for mild steel and cast iron. Name the salient points.

   (b) Briefly explain the advantages of hollow shafts over solid shafts.   5+5

2. (a) Explain self-locking and overhauling in power screws.

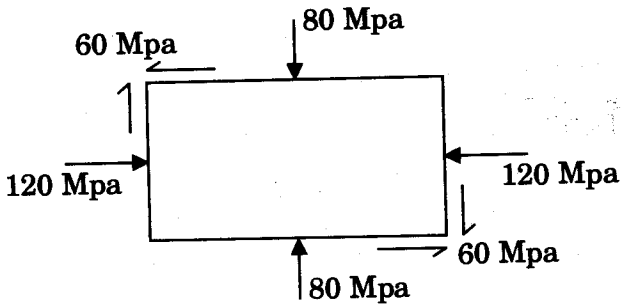(b) Stresses in a two-dimensional stressed body are as shown in Figure 1.

Figure 1

Determine :

(i) Principal stresses and their directions.

(ii) Maximum shear stress and their planes. *5+5*

3. (a) List the factors affecting the endurance limit.

(b) Describe the following with the help of suitable sketches :

(i) Kennedy key

(ii) Woodruff key *5+5*

4. A square threaded power screw has nominal diameter of 30 mm and a pitch of 6 mm with double start. Load on screw is 6 kN and mean diameter of thrust collar is 40 mm. The coefficient of friction for screw is 0·1 and for collar is 0·09.

Determine :

(a) torque required to rotate the screw against the load,

(b) torque required to rotate the screw with the load,

(c) overall efficiency, and

(d) Is the screw self-locking ?   10

5. (a) Explain stress versus number of cycles (S-N) curve for ferrous and non-ferrous metals with the aid of experimental sketch and characteristic curves.

(b) What is mechanical engineering design ? State the steps involved in mechanical engineering design.   5+5

6. Design a cotter joint for an axial load of 50 kN which alternately changes from tensile to compressive, assuming allowable stresses in the components under tension and compression as 52·5 N/mm², bearing stress as 63 N/mm² and shearing stress as 35 N/mm².   10

7. A mild steel shaft of 60 mm diameter is subjected to bending moment of 25×10^5 N-mm and torque M_t. If the yield stress in tension is 300 N/mm^2, find the maximum value of torque without causing yielding of the shaft according to
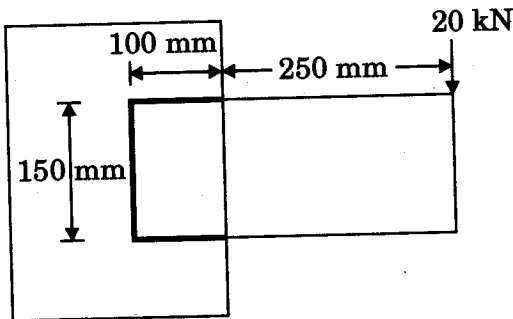
   (a) maximum shear stress theory of failure, and

   (b) maximum distortion theory of failure.

   Take a factor of safety of 1·5.   10

8. Determine the size of the weld for a welded joint loaded, if the permissible shear stress for the weld material is 75 MPa.   10

9. Define and explain the following terms :   5×2=10

   (a) Free Vibrations

   (b) Force Vibrations

   (c) Damped Vibrations

   (d) Poisson's Ratio

   (e) Frequency

10. (a) What is the difference between brakes and dynamometers ?

(b) What do you understand by the terms cam and follower ? State the different types of followers. $5+5$