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BAS-010

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B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

June, 2014

BAS-010 : MACHINE DESIGN

Time : 3 Hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. Assume missing data if any. Use of calculator is **permitted**. Use of machine Design Data Book is **permitted**.*

1. (a) What are the various design considerations ? 5

   (b) Clearly define the term "Stress Concentration Factor", giving at least one example. 5

2. (a) Define the following terms used in gears : 5

   (i) Pitch circle

   (ii) Pitch circle diameter

   (iii) Circular pitch

   (iv) Diametral pitch

   (v) Working depth

   (b) Explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. 5

3. Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a beltdrive. The pulley weighs 200 N and is located at 300 mm from the centre of bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 rpm. The angle of lap of the belt is 180° and co-efficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa. **10**

4. A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint. If the above joint is subjected to a load such that factor of safety is 4, find out the actual stresses developed in the plates and the rivets. **10**

5. A lever loaded safety valve has a diameter of 100 mm and the blow off pressure is 1.6 N/mm^2. The fulcrum of the lever is screwed into the cast iron body of the cover. Find the diameter of the threaded part of the fulcrum if the permissible tensile stress is limited to 50 MPa and the leverage ratio is 8. **10**

6. (a) Discuss the design procedure of spur gears. **5**

   (b) What are the advantages of welded joints over riveted joints ? **5**

7. Design a flange coupling to connect two co-axial shaft of an electric motor and a worm and worm wheel reducer. The shafts transmit 7 kW of power at 300 rpm. The permissible stresses are : **10**

Shearing stress in shaft = 50 N/mm^2

Shearing stress in key = 25 N/mm^2

Shearing stress in coupling = 3 N/mm^2

Shearing stress in bolts = 25 N/mm^2.

The result must consist of shaft diameter (d), which has to be increased by 25% to take care of keyway, number of bolts (n), diameter of bolts (d_1), pitch circle diameter of bolts (D_c), dia. of hub (D), length of hub (L). Assume a square key of size "$\frac{d}{4}$", thickness of flange (t), outside flange diameter (D_0).

8. (a) What are the applications of springs ? Define the terms pitch and solid length used in connection with compression springs. **7**

(b) What are the commonly used materials for sliding contact bearings ? **3**

9. A plate of 100 mm width and 12.5 mm thickness is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld so that the maximum stress does not exceed 56 MPa. Consider the joint first under static loading and then under fatigue loading. Take stress concentration factor for parallel fillet welding as 2.7. **10**

10. Write short notes on **any two** of the following : **2x5=10**

(a) Heat treatment of steels

(b) Maximum shear stress theory

(c) The distortion energy theory