01154

B.TECH. (AEROSPACE ENGINEERING) PROGRAMME (BTAE)

Term-End Examination

December, 2010

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.*

1. (a) Describe in brief the 'Materials' used in engineering design. 5+5

   (b) Write down the materials used for the following :

   bolts, laminated spring, bracket, shaft and flange.

2. (a) Give the reasons for the following : 3+3+4

   (i) Fly wheel is made of cast-iron

   (ii) Automobile body is made of low carbon steel.

   (b) What are the various design considerations ?

   (c) Clearly define the term "Stress concentration factor," giving at least one example.

3. (a) Classify iron-carbon alloys on the basis of carbon content. Give few applications of each category. 5+5

(b) A hole is dimensioned as $25^{+0.033}_{+0.0}$

and the shaft is dimensioned as $25^{-0.040}_{-0.061}$.

Determine the hole tolerance, the shaft tolerance and allowance of the fit. What type of fit shall be established ?

4. (a) Describe endurance limit. List and discuss three modifying factors for endurance limit. 5+5

(b) Why are tolerances provided on dimensions of the components ? Explain each type of fit with suitable examples.

5. Design and make a neat sketch of a muff coupling which is used to connect two steel shafts transmitting 50 HP at 360 rpm. The material for the shaft and key is plain carbon steel for which allowable shearing and crushing stresses may be taken as 40 N/mm^2 and 80 N/mm^2 respectively. The material for the muff is cast iron for which allowable shear and crushing stresses may be taken as 20 N/mm^2 and 60 N/mm^2 respectively. 10

6. Discuss the following (Any five). 5x2=10

(a) Need of factor of safety

(b) Design for Rigidity

(c) Ergonomics

(d) Tribology

(e) Different types of belts and their materials

(f) Cams and followers.

7. A spring of a truck has 10 leaves of graduated length. The spring supports are 1.06 m apart and the central band is 87.5 mm wide. The central load is to be 5000N with a permissible stress of 300 N/mm^2. Determine the width and thickness of the steel spring leaves and the deflection when loaded. The spring should have a ratio of total depth to width of about 2.5. 10

8. A belt pulley is mounted on a shaft midway between two supporting bearings, that are 1m apart. The shaft receives 20 kW power at 500 rmp through a coupling which is located to the left of left-hand bearing. The shaft transmits this power to the pulley, which is 500 mm in diameter. The angle of wrap of the belt on the pulley is 180° and belt tensions act vertically downward. The ratio of belt tensions is 2.5. The shaft is made of steel FeE 300 (S_{yt} = 300 N/mm^2) and factor of safety is 3. Determine the diameter of shaft on the basis of maximum shear stress. 10

9. The nominal diameter of a triple-threaded square screw is 50 mm, while the pitch is 8 mm. It is used with a collar having outer diameter of 100 mm and inner diameter as 65 mm. The coefficient of friction at the thread surface as well as at the collar surface can be taken as 0.15. The screw is used to raise a load of 15 kN. Using the uniform wear theory for collar friction, calculate **10**

(a) Torque required to raise the load,

(b) Torque required to lower the load, and

(c) The force required to raise the load, if applied at a radius of 500 mm.

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

(a) Fatigue failure and Failure theories

(b) The maximum shear stress theory

(c) The distortion energy theory

(d) Design procedure for laminated springs.