No. of Printed Pages : 4

BAS-010

B.Tech. AEROSPACE ENGINEERING (BTAE)

00405

Term-End Examination

June, 2015

BAS-010 : MACHINE DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Assume any missing data and clearly specify the assumptions. Use of scientific calculator and Design Data Handbook is permitted.*

1. (a) Define alloy steel. Discuss the effects of nickel, chromium and manganese on steel. *6*

(b) Compare the weight, strength and stiffness of a hollow shaft of the same external diameter as that of solid shaft, the inside diameter of the hollow shaft being half the external diameter. Both the shafts have the same material and length. *8*

2. (a) List and explain the different types of welded joints. *6*

(b) A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm diameter rivets at 100 mm pitch. The permissible stresses are

σ_t = 120 MPa ; τ_s = 100 MPa ; σ_c = 150 MPa.

Find the efficiency of the joint, taking the strength of the rivet in double shear as twice than that of single shear. *8*

3. (a) Explain in detail the overhauling of screw. *6*

(b) Find the diameter of a solid steel shaft to transmit 20 kW at 200 r.p.m. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8.

If a solid shaft is to be replaced by a hollow shaft, find the inside and outside diameter when the ratio of inside to outside diameter is 0·5. *8*

4. (a) Classify different types of springs according to their shapes. *6*

(b) Design a leaf spring for the following specifications : *8*

Total load = 140 kN

Number of springs supporting the load = 4 ; Maximum number of leaves = 10 ; Span of the spring = 1000 mm ; Permissible deflection = 80 mm. Take Young's modulus, E = 200 kN/mm^2 and allowable stress in spring material as 600 MPa.

5. (a) What is meant by hydrodynamic lubrication ? Explain in brief. *6*

(b) An 80 mm long journal bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radial clearance of 0·05 mm and the viscosity of the oil is 0·021 kg/m-s at the operating temperature. If the bearing is capable of dissipating 80 J/s, determine the maximum safe speed. *8*

6. (a) Explain gear drives giving their merits and demerits. *6*

(b) A pulley made of grey cast iron FG 150, transmits 10 kW of power at 720 r.p.m. The diameter of the pulley is 500 mm. The pulley has four arms of elliptical cross-section, in which the major axis is twice of the minor axis. Determine the dimensions of the cross-section of the arm, if the factor of safety is 5. *8*

7. A multiple disc clutch, steel on bronze, is to transmit 4·5 kW at 750 r.p.m. The inner radius of the contact is 40 mm and the outer radius of the contact is 70 mm. The clutch operates in oil with an expected coefficient of 0·1. The average allowable pressure is 0·35 N/mm^2.

Find *14*

(i) The total number of steel and bronze discs

(ii) The actual axial force required

(iii) The actual average pressure

(iv) The actual maximum pressure

8. Write short notes on any ***four*** of the following :

$4 \times 3\frac{1}{2} = 14$

(a) Ergonomic consideration in design

(b) St. Venant's theory

(c) Self-locking screw

(d) Fatigue design under combined stress

(e) Tribology