No. of Printed Pages : 3

**BAS-010**

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

## Term-End Examination

## June, 2013

## BAS-010 : MACHINE DESIGN

01130

*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) How does carbon content affect cast iron, wrought iron and steel with reference to hardness and toughness ? **6**

   (b) What are the important non-metallic materials of construction in machine design ? **4**

2. Under what conditions the Euler's formula, Rankine's formula, Rankine Gorden formula and J.B. Johnson formula are applicable ? **10**

3. Explain "Hole-Basis System" and "Shaft-Basis system". **10**

4. A triple riveted lap joint is to be made between 6.5 mm plates. The allowable stresses are $f_t = 35.0 N/mm^2$, $f_s = 29.0 N/mm^2$ and $f_c = 52.5 N/mm^2$. Calculate the rivet diameter, rivet pitch and back pitch, zig-zag riveting is to be used. Indicate how the joint will fail. **10**

5. Design the longitudinal joint for a 1.25m diameter steam boiler carrying a steam pressure of $5N/m^2$. The allowable stress of the plate material is $80N/m^2$ in tension. Length of the shell of boiler is 5m. Take allowable stress for shielded arc weld = $95N/m^2$ **10**

6. The lead screw of a lathe has a 50mm Acme thread, one thread per cm. To drive the tool carriage, this screw must exert an axial pressure of 3000N. The thrust is carried on a collar 110mm outside diameter and 55mm inside diameter. The lead screw revolves at 3.14 rad/s. **10**

   (a) Determine the efficiency of the screw and collar assuming a coefficient of friction of 0.15 for thread and 0.12 for collar.

   (b) Determine the power required to drive the screw.

7. A loaded narrow gauge car weighing 16 kN and moving at a velocity of 1.2 m/s is brought to rest by a bumper consisting of two helical steel springs of square section. The mean coil diameter of the springs is six times the side of the square. In bringing the car to rest the springs are compressed by 200 mm. The permissible shear stress is not to exceed $400N/mm^2$. Find the following : **10**

(a) Maximum load on each spring

(b) side of square section of wire

(c) mean diameter of coils

(d) number of active coils

Take $C = 0.84 \times 10^5 N/mm^2$

[C-modulus of rigidity]

8. Two shafts 0.3 m apart transmitting 18.75 kW are to be connected by a steel pinion meshing with a cast iron gear. The velocity ratio is to be 3 to 1 and the smaller gear is to run at 600 rev/min. The ultimate strength of the material for gear is 168 MPa and the factor of safety is 4. Design the arms for the gear and find the diameter of the gear shaft. Number of arms are 5 and fs = 110 MPa. 10

9. (a) How can you increase the capacity of a disk clutch ? 4

(b) What is a self-actuating or self-energizing brake ? When a break becomes self-locking? 6

10. (a) What effect has a keyway on the strength of a shaft ? 5

(b) What do you understand by cold rolled and cold drawn shafting ? 5