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**BAS-010**

**B. Tech. Aerospace Engineering  
(BTAE)**

**Term-End Examination**

**June, 2019**

**BAS-010 : MACHINE DESIGN**

*Time : 3 Hours*

*Maximum Marks : 70*

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*Note : Attempt any seven questions. All questions carry equal marks. Assume missing data suitability. Use of scientific calculator and machine design data is permitted.*

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1. (a) Discuss the factors to be considered for selecting of an appropriate material for a machine element in the design process. 5
- (b) What are the relative advantages and disadvantages of chain and belt drives ? 5
2. (a) Prove that a hollow shaft is stronger and stiffer than a solid shaft of same length. 5

(A-7) P. T. O.

- (b) What is stress concentration factor ? What are the methods to determine stress concentration factor ? 5
3. A plate of 80 mm wide and 15 mm thick is to be joined with another plate by a single transverse weld and a double parallel weld. Determine the length of the parallel weld if the joint is subjected to both static and fatigue loading. Take tensile stress  $\sigma_1 = 90$  MPa, shear stress  $\tau = 55$  MPa as allowable stresses and stress concentration factor as 1.5 for transverse weld and 2.7 for parallel weld. 10
4. Design a triple rivetted lap joint of zig-zag type for a pressure vessel of 1.5 m diameter. The maximum pressure inside the vessel is 1.5 MPa. Allowable stresses in tension, crushing and shear are 100 MPa, 125 MPa and 75 MPa respectively. 10
5. (a) Explain briefly the selection of factor of safety in engineering design. 5

- (b) Design a rod of solid circular cross-section of length 200 mm (placed vertically) to sustain an axial compressive load of 1000 N, heat falls on it from a height of 10 mm. The material selected has a design stress of  $80 \text{ N/mm}^2$  and  $E = 2.1 \times 10^5 \text{ N/mm}^2$ . 5
6. (a) Explain the stresses induced in a screw fastening subjected to static, dynamic and impact loading. 5
- (b) A bolt is subjected to initial loading of 5 kN and final tensile load of 9 kN. Determine the size of the bolt, if the allowable stress is 80 MPa and  $k = 0.05$ . 5
7. Design a double rivetted lap joint with chain rivetting for a mild steel plate of 20 mm thick taking the allowable values of stress in shear, tension and compression to 60 MPa, 90 MPa and 120 MPa respectively. 10
8. A hollow shaft of 40 mm diameter and 25 mm inner diameter is subjected to a twisting moment of 118 N-m, a axial thrust of 9806 N and a bending moment of 79 N-m. Calculate the maximum compressive and shear stresses. 10

9. For a flat belt drive, prove that : 10

$$\frac{T_1}{T_2} = e^{\mu\theta},$$

where :

$T_1$  = Tension on the tight side of the belt.

$T_2$  = Tension on the slack side of the belt.

$\mu$  = Coefficient of friction between the belt and pulley surface.

$\theta$  = Angle of contact between the belt and the pulley.

10. Define any *five* of the following : 5×2

- (a) Spur gear
- (b) Level gear
- (c) Helical gear
- (d) Module
- (e) Addendum
- (f) Pressure angle
- (g) Slip and Creep of a belt
- (h) Ergonomics