| BAS-010 |

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2016

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BAS-010 : MACHINE DESIGN

Time : 3 hours   *Maximum Marks : 70*

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

1. (a) Define factor of safety. Explain the phases and interactions of the design process.   6

   (b) Explain the various aspects of material strength and stiffness to be considered while designing a component.   4

2. (a) Define Stress and Principal Stress.   2

(b) Determine the principal stress and the principal plane when an elemental body is subjected to two mutually perpendicular stresses and a shear stress as shown in the figure below. *8*
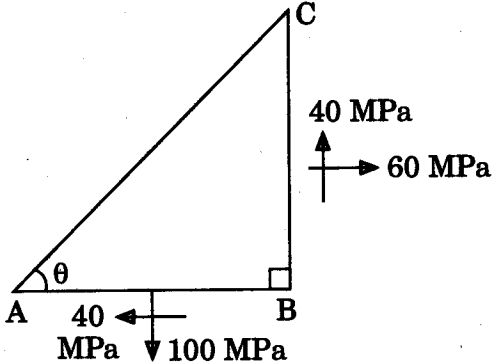
3. A 12 × 25 mm rectangular section bar carries a static load of 16·5 kN. It is welded to a gusset plate with an 18 mm fillet weld 25 mm long on both sides with an E70XX electrode as shown in the figure below. Use the welding code.

(a) Is the weld strength satisfactory ?

(b) Is the attachment strength satisfactory ? *10*
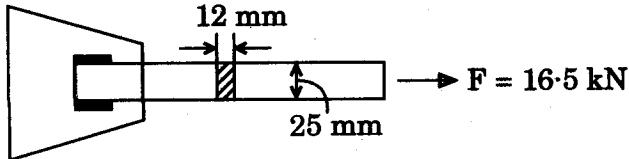
4. The safe working stress of a double riveted (lap) joint is 95 N/mm^2 in tension, 68 N/mm^2 in shear and 123 N/mm^2 in crushing. Calculate the rivet pitch and the distance between the rows of rivets. State how the joint will fail.　　　**10**

5. Design a solid muff coupling made of CI to connect two shafts transmitting 35 kW at 150 rpm with a capability of 25% maximum torque greater than mean torque. The shaft and key are made of M.S. for which permissible shear and crushing stresses are 30 MN/m^2 and 80 MN/m^2 respectively.　　　**10**

6. It is required to design a helical compression spring subjected to a maximum force of 7·5 kN. The mean coil diameter should be 150 mm. The spring rate is 75 N/mm. The spring is made of oil hardened and tempered steel wire with UTS 1250 N/mm^2. The permissible shear stress for the spring wire is 30% of UTS. Take G = 81370 N/mm^2. Calculate the wire diameter and the number of active coils.　　　**10**

7. It is required to select a flat-belt drive for a compressor running at 720 rpm, which is driven by a 25 kW, 1440 rpm motor. Space available for centre distance is 3 m. Design an open belt drive.　　　**10**

8. (a) Write a note on ergonomic considerations in design. *4*

(b) Calculate tolerances and fundamental deviations for the shaft designated as 40 H8/f7. *6*

9. (a) Define plain carbon steel. How is it designated according to Indian standards ? *4*

(b) How do you classify materials for engineering use ? *4*

(c) Define (i) toughness, and (ii) hardness. *2*

10. A simple plate clutch is designed to transmit 10 kW power at 2000 rpm. The equivalent mass and radius of gyration of the input shaft are 25 kg and 75 mm respectively. The equivalent mass and radius of gyration of the output (O/P) shaft are 35 kg and 125 mm respectively. Calculate (a) the time required to bring the O/P shaft to the rated speed from rest, and (b) the heat generated during the clutching operation. *10*