

**B.Tech. AEROSPACE ENGINEERING
(BTAE)**

Term-End Examination

June, 2016

00178

BAS-010 : MACHINE DESIGN

Time : 3 hours

Maximum Marks : 70

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

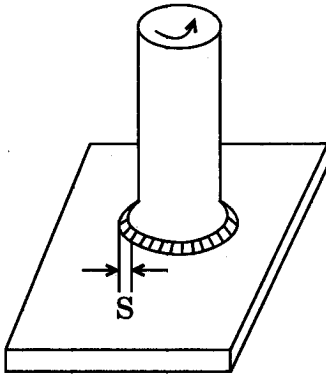
1. (a) Explain with the help of sketches the following types of fits : 5
 - (i) Clearance fits
 - (ii) Interference fits
 - (iii) Transition fits

- (b) Explain with the help of sketches the following for limit system : 5
 - (i) Hole basis system
 - (ii) Shaft basis system

2. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell, 1.5 m in diameter, subjected to a steam pressure of 0.95 N/mm^2 . Assume joint efficiency as 75%, allowable tensile stress in the plate as 90 MPa; compressive stress as 140 MPa; and shear stress in the rivet as 56 MPa. 10

3. A 50 mm diameter solid shaft is welded to a flat plate by a 10 mm fillet weld as shown in the figure. Find the maximum torque that the welded joint can sustain, if the maximum shear stress intensity in the weld material is not to exceed 80 MPa.

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4. A transmission shaft is supported on two bearings which are 1 m apart. Power is supplied to the shaft by means of a flexible coupling which is located to the left of the left hand bearing. Power is transmitted from the shaft by means of a belt pulley, 250 mm diameter, which is located at a distance of 300 mm from the left hand bearing. The mass of the pulley is 20 kg and the ratio of belt tension on tight and slack sides is 2 : 1. The belt tensions act vertically downwards. The shaft is made of steel having $S_{yt} = 300 \text{ N/mm}^2$ and the factor of safety is 3. Determine the shaft diameter, if it transmits 10 kW power at 360 rpm from the coupling to the pulley.

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5. (a) List the mechanical properties of metals. Discuss any five of them in brief. 5
- (b) What are the various manufacturing processes used in industry ? Discuss any five in brief. 5
6. (a) With the help of neat diagrams, explain Lap Joint and the Butt Joint. 4
- (b) A plate, 100 mm wide and 10 mm thick, is to be welded to another plate by means of a double parallel fillet. The plates are subjected to a static load of 80 kN. Find the length of the weld, if the permissible shear stress in the weld does not exceed 55 MPa. 6
7. (a) Define the following terms in respect of springs : 4
- (i) Solid length
- (ii) Free length
- (iii) Spring index
- (iv) Spring rate/Spring constant
- (b) A compression coil spring made of an alloy steel has the following specifications :
- Mean diameter of the coil = 50 mm
- Wire diameter = 5 mm
- Number of active coils = 20
- If the spring is subjected to an axial load of 500 N, calculate the maximum shear stress (neglect the curvature effect) to which the spring material is subjected. 6

8. (a) Discuss the failure modes of a riveted joint. 4
- (b) A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and the pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint. 6
9. Describe the following briefly with the help of sketches : 10
- (a) Tap bolt
- (b) Stud
- (c) Lock nut
- (d) Castle nut
- (e) Set screw
10. (a) Discuss the advantages and disadvantages of gear drives. 4
- (b) Define the following terms used in gears, with the help of sketches : 6
- (i) Pitch circle
- (ii) Addendum
- (iii) Diametral pitch
- (iv) Backlash
- (v) Face width
- (vi) Pitch circle diameter