

# CBCS SCHEME

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15AE54

## Fifth Semester B.E. Degree Examination, June/July 2018 Aircraft Structures – I

Time: 3 hrs.

Max. Marks: 80

**Note: Answer any FIVE full questions, choosing one full question from each module.**

### Module-1

- 1 a. A 50mm dia steel rod supports a 9kN load in addition it is subjected to a torsional moment of 150 N-m as given in figure. Determine the maximum tensile and maximum shear force.

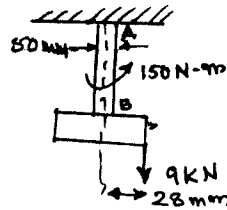


Fig Q1(a)

(08 Marks)

- b. Design a spindle of milling machine to transmit 15kW @ 1000rpm. The angular twist is not to exceed 0.5°/meter. The material for spindle is C<sub>45</sub> steel ( $\sigma_y = 353\text{MPa}$ ). The outside diameter is twice that of internal diameter. Take FOS = 2

(08 Marks)

OR

- 2 a. Bureau of Indian standards have standardized a number of items. What are they and whom does it help? (06 Marks)
- b. A circular rod of 50mm diameter is subjected to loads as shown. Determine the nature and magnitude of stresses at A and B.

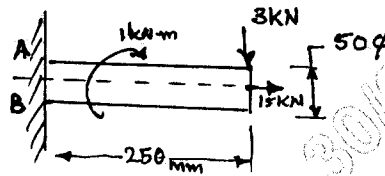


Fig Q2(b)

(10 Marks)

### Module-2

- 3 a. Name the various theories of failure. (03 Marks)
- b. A cylindrical boiler 2 meter diameter made of steel sheet metal 20mm thick is subjected to an internal pressure of 1.5MPa. Find the various factor of safety for the various theories of failure.  
1 bar = 0.1MPa, Sea Level Pressure = 0.1013MPa. (13 Marks)

OR

- 4 a. A cantilever beam made of cold drawn carbon steel ( $\sigma_u = 550\text{MPa}$ ,  $\sigma_{yt} = 450\text{MPa}$ ,  $\sigma_{en} = 275\text{MPa}$ ) of circular cross section is subjected to load which varies from  $-F$  to  $3F$ . Determine the max load that this member can withstand for an infinite life using a factor safety of 2.

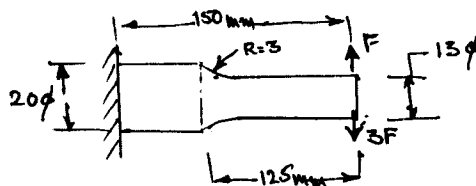


Fig Q4(a)

(08 Marks)

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- b. Derive Soderberg's criteria for fatigue. (08 Marks)

**Module-3**

- 5 a. Draw a V-n diagram and explain. (04 Marks)  
b. What are the desirable properties of a good aircraft metals. (08 Marks)  
c. What is  $\alpha$ ,  $\beta$  and  $\alpha \beta$  titanium? (04 Marks)

OR

- 6 a. What are the different types of loads coming on various parts of an airplane? (08 Marks)  
b. Why is Aluminium alloys chosen in aircraft construction and give the various Aluminium alloys with their properties. (08 Marks)

**Module-4**

- 7 a. Derive the equilibrium equation for an elastic body under forces. (08 Marks)  
b. Direct stresses of  $160\text{N/mm}^2$  (tension) and  $120\text{N/mm}^2$  (compression) are applied at a particular point in an elastic material on two mutually perpendicular planes. The principal stress in the material is limited to  $200\text{N/mm}^2$  (tension). Calculate the allowable value of shear stress at the point on the given plane. Calculate the value of the other principal stress and max. value of shear stress at that point. (08 Marks)

OR

- 8 a. What are statically determinate and indeterminate structures? Give examples. (08 Marks)  
b. The two span continuous beam is given in figure Q8 (b). Determine the various reactions. (08 Marks)

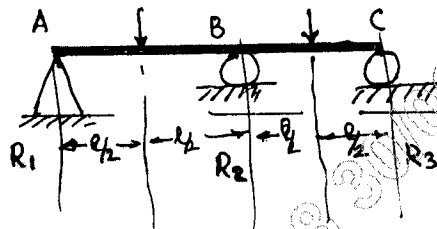


Fig Q8(b)

**Module-5**

- 9 a. What is meant by Buckling? Derive the expression for the critical load for a column with hinged ends. (08 Marks)  
b. A hollow cylinder of external diameter 200mm and thickness 5mm is 6 meter long. For the material properties of the column, a column is considered short if the slenderness ratio less than or equal to 70 and long if it is more than 100. For intermediate column, a linear variation on critical stress from yield stress of 280MPa to a proportional limit of 210 MPa may be used. Find the load capacity of the column. (08 Marks)

OR

- 10 a. Derive Maxwell's Reciprocal theorem. (10 Marks)  
b. A steel section ISMB450 of 4 meter long is used as a column with both ends hinged. What is the minimum length of the column for the Euler's formula to be applicable. Find the load carrying capacity of the column given  $E = 200\text{GPa}$  and the proportional limit of the steel is 200MPa, the minimum radius of gyration about y-axis is 30.1mm  $I_{yy} = 834 \times 10^4 \text{mm}^4$ . (06 Marks)

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