CBCS SCHEME

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18AS43

Fourth Semester B.E. Degree Examination, July/August 2022
Aerospace Structures – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Write short notes on design considerations. **(04 Marks)**

b. At a point in a stressed body, the stresses act as shown is Fig.Q1(b). Determine the following :
Normal and tangential stresses on a plane inclined at 45° with the vertical
The principal stresses and orientation
Maximum shear stresses and its direction.

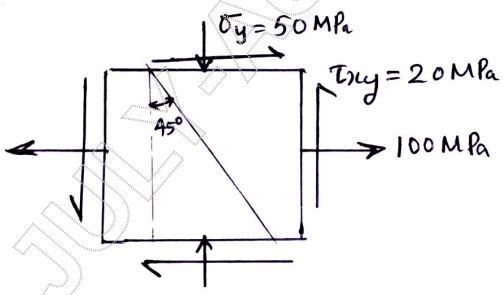

Fig.Q1(b) **(08 Marks)**

c. A circular rod of diameter 50mm shown in Fig.Q1(c) is subjected to a point load at its end and a torque of 300Nm. Determine the stresses induced is the rod.

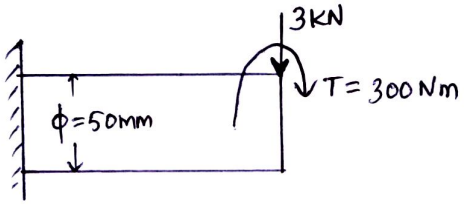

Fig.Q1(c) **(08 Marks)**

OR

2 a. Briefly discuss the various methods for determination of stress concentration factor. **(04 Marks)**

b. Briefly explain :
i) Distortion energy theory
ii) Strain energy theory. **(08 Marks)**

c. If a position along one member with diameter 'd' the loading is found to consist of 10kN together with an axial tensile load of 20kN. If the elastic limit is tension of the material is 270MPa and factor of safety of 4. Estimate the magnitude of 'd' required according to :
i) Maximum principal stress theory
ii) Maximum shear energy theory.
Take Poisson's ratio = 0.283. **(08 Marks)**

Module-2

3 a. Derive an expression for impact stress due to axial impact load. **(10 Marks)**

b. A cantilever beam of width 50mm and depth 150mm is 1.2 meter long is struck by a load 1000N which falls from a height of 20mm at its free end. Determine :

i) Maximum deflection
ii) Maximum stress
iii) Impact factor
iv) Maximum load intensity

Take E = 200 GPa. **(10 Marks)**

OR

4 a. List the endurance limit modifying factors and briefly explain their effect endurance limit. **(08 Marks)**

b. Formulate Soderberg's equation for fatigue design. **(08 Marks)**

c. Formulate an equation for Miner's rule for cumulative fatigue damage. **(04 Marks)**

Module-3

5 a. Discuss the functions of various structural components of aircraft. **(10 Marks)**

b. Draw a V – n diagram and explain. **(10 Marks)**

OR

6 a. Write short notes on :

i) Titanium alloys used in aircraft
ii) Aluminium alloys used is aircraft
iii) Desirable properties of aircraft materials. **(10 Marks)**

b. Explain symmetric maneuver loads for

i) Level flight
ii) Steady pull out
iii) Correctly banked turn. **(10 Marks)**

Module-4

7 a. Briefly explain state of stress at a point. **(04 Marks)**

b. Derive the equations of compatibility for strain three dimensional systems. **(10 Marks)**

c. Consider the displacement field $u = [y^2i + 3yzj + (4 + 6x^2)K]10^{-2}$. What are the rectangular strain components at point P(1, 0, 2)? Use only linear terms. **(06 Marks)**

OR

8 a. Formulate Clapeyron's three moment equation for continues beam. **(12 Marks)**

b. Distinguish statically determinate and indeterminate structures. **(08 Marks)**

Module-5

9 a. Formulate equation for strain energy due to :
   i) Axial load
   ii) Bending moment. **(06 Marks)**

b. State and prove Maxwell's reciprocal theorem. **(06 Marks)**

c. State Castiglino's theorem and find the deflection at the free end of the cantilever beam shown in Fig.Q9(c) using Castiglino's theorem.

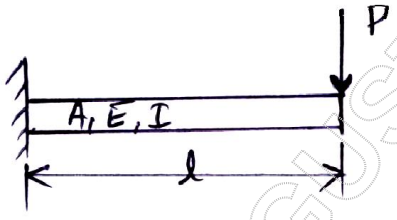

Fig.Q9(c) **(08 Marks)**

OR

10 a. Derive an expression for Euler's buckling load for a column fixed at both the ends. **(08 Marks)**

b. Formulate equation for Rankine formula for bulking. **(06 Marks)**

c. Calculate the critical load of a strut, which is made of a bar, which is circular in section, 5m long and is pin joined at both ends. The same bar when used as simply supported, gives a mid span deflection of 10mm, with a load of 10N at the centre. **(06 Marks)**

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