CBCS Scheme

USN | | | | | | | | | | |

15AE34

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive equilibrium equations for a 3D stress system. **(10 Marks)**

b. State of stress at a point is given follows:

$\sigma_x = x^3yz + x^2y^2$, $\sigma_y = 3y^2z + yz$, $\sigma_z = x^2y^2z^2 + xz$,

$\tau_{xy} = x^2yz$, $\tau_{yz} = xy^2z$, $\tau_{xz} = xyz^2$.

In the absence of body forces determine the equilibrium conditions are satisfied or not at points (3, -4, 2). **(06 Marks)**

OR

2 a. Define the terms load factor and allowable stress. **(04 Marks)**

b. Express and state the Von Mises criterion. **(04 Marks)**

c. A thick walled cylindrical pressure vessel has inner radius of 150 mm and outer radius of 185 mm. Draw a sketch showing the radial pressure and hoop stress distribution in the section of cylinder wall, when an internal pressure of 10 MN/m^2 is applied. **(08 Marks)**

Module-2

3 a. List out the Euler-Bernoulli assumptions and its implications. **(06 Marks)**

b. A 1m long Cantilever beam with T section is subjected to a point load 10 kN at its free end. The size of flange is 140 mm × 10 mm and the overall depth of the section is 150 mm. Thickness of web is 10 mm. Determine the maximum tensile stress and maximum compressive stress induced in the section draw the bending stress distribution. **(10 Marks)**

OR

4 a. Define the principal centroidal axis of bending and explain how its orientation is obtained. **(10 Marks)**

b. What are the equilibrium equations for a beam subjected to transverse loads? **(06 Marks)**

Module-3

5 a. A hollow shaft is subjected to a torque 8 kNm. The angle of twist in the shaft is to be limited to 1.7° in a length equal to twenty times the outer diameter. Taking the inner diameter to outer diameter ratio as 0.7, determine: (i) Inner diameter and outer diameter, and (ii) Maximum shear stress induced. Take G as 80 GPa. **(10 Marks)**

b. What is the constitutive law for the torsional behavior of the beam and mention the equilibrium equations. **(06 Marks)**

OR

6 a. Explain the procedure to determine the shear flow distribution over the open cross section of a thin walled beam subjected to transverse shear forces. **(08 Marks)**

b. List out the equations involved with thin walled beam subjected to axial forces and bending moments. **(08 Marks)**

Module-4

7 a. Explain the steps involved in unit load method applied to truss structures. **(06 Marks)**

b. Define the principle of virtual work for a particle. Obtain the equilibrium of a particle. **(10 Marks)**

OR

8 a. Explain Maxwell's theorem. **(08 Marks)**

b. Define a conservative force and obtain the work done by conservative force along any path joining two points. **(08 Marks)**

Module-5

9 a. Explain Tresca's criterion and Von Mises criterion. **(08 Marks)**

b. A steel tube of 25 mm external diameter and 18 mm interval diameter enclose a copper rod of 15 mm diameter. The ends are rigidly fastened to each other. Calculate the stress in the rod and the tube when the temperature is raised from 15°C to 200°C. Take $\alpha_{st} = 11 \times 10^{-6}/°C$, $\alpha_{cu} = 18 \times 10^{-6}/°C$, $E_{st} = 200$ GPa, $E_{cu} = 100$ GPa. **(08 Marks)**

OR

10 a. Obtain the solution for simply supported circular plate of radius R_0 under linear pressure distribution as shown in Fig.Q10(a).

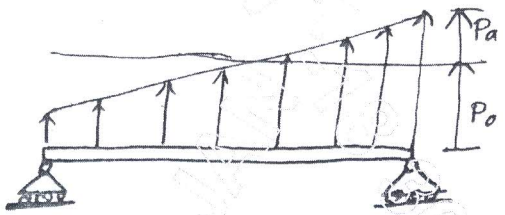

Fig.Q10(a) **(08 Marks)**

b. What is Kirchoff plate theory and mention its assumptions. **(08 Marks)**

* * * * *