29.1.09

(1)

B. E. 7th Semester (Civil Engg.) Examination, January, 2009

STRUCTURAL ANALYSIS – III
(CE-701)

Time : 3 hrs | Full Marks : 70

Answer any <u>six</u> questions taking <u>three</u> from each half

Two marks are reserved in each half for to the point answer.
Answer each half in separate books.

1st Half

1. a) What are basic assumptions of thin plate theory ?

   b) Assuming M_x, M_y and M_{xy} in terms of displacement, find the differential equation of thin plate under udl 'q' per unit area.

2. A rectangular thin plate (a x b) subjected to udl 'q' per unit area is simply supported over the all edges. Find the central deflection of the plate taking only first term.

3. a) A circular dome is subjected to gravitational load due to its self weight. Calculate the membrane forces.

   b) An inverted cone filled with liquid of density 'ρ' has a radius 'r' and the height 'h'. Calculate the membrane forces acting in the shell and its maximum magnitude.

4. a) What is plane stress and plane strain problems.

   b) Show that for plane stress, the compatibility equation may be expressed due to gravitational load as

$$\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)(\sigma_x+\sigma_y)=0$$

5. a) What is Airy's stress function ?

   b) Obtain the differential equation of plane stress problem in terms of stress function neglecting the body forces.

2nd Half

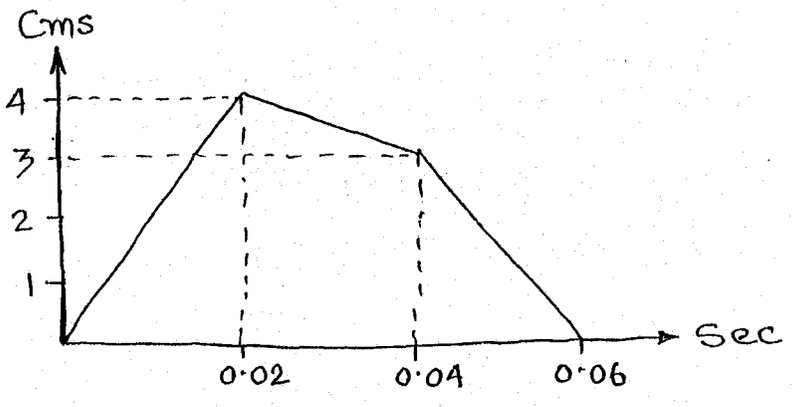
6. a) Deduce the equation of vibration for free vibration with damping for under damping condition.

   b) A body vibrating with viscous damping makes 6 complete oscillations per second. Calculate the Logarithmic decrement if after a lapse of 10 seconds, the amplitude of vibration reduces by 50% with respect to initial.

7. A simply supported beam is used to support a machine which weighs 1500 kgs. The rotating part of the machine is 6 kgs and located at 20 cms distance from the Centre of rotation. Span of the beam = 5m, Ixx = 60000 cm^4 , Zxx = 2500 cm^3 and weight = 80 kg/m. Assuming amplification factor = 20 at resonance, check the stress in the beam at resonance. Also find what frequencies must be avoided to keep stress below 400 kg/cm^2.

8. For a two storied building lateral stiffness for Ground floor and First floor are 5 x 10^6 N/m and 3 x 10^6 N/m respectively. Lumped mass at 1st floor and roof level are 8000 kgs and 5000 kgs respectively. Obtain the eigen values and eigen vectors considering a shear building.

9. For an overhead water tank lateral stiffness K= 15x10^6 N/M and mass = 16000 kg. The foundation movement is as shown in the figure below. Obtain the maximum displacement considering the period of disturbance and the free vibration which results afterwards.



10. A continuous system in the form of a propped cantilever of span L, flexural rigidity EI and weight w per unit length is freely vibrating in vertical plane. Obtain the circular frequency of vibration.