Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER– II EXAMINATION – SUMMER 2015

Subject Code:X20603 **Date:05/06/2015**

Subject Name: STRUCTURAL ANALYSIS-I

Time: 10.30am-01.00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Derive generalized formula for torsion of circular shaft (with usual notation) **07**

$$\frac{T}{Ip} = \frac{\tau}{r} = \frac{C\theta}{L}$$

(b) i) Find out SI and KI of the structures shown in the fig.1 **04**

ii) Define Influence Line Diagram and give it's uses. **03**

Q.2 **(a)** Draw influence line diagram for R_A, M_A & M_x for cantilever beam having span 6 m with support A fixed. Point X is at 2 m from support A. **07**

(b) Three wheel loads of 35 kN, 30 kN & 25 kN, at a distance 1.2m and 1.8m respectively from each other, cross a simply supported beam of span 6 m. Draw the influence line for B.M & S.F for a point 2m from the left support. **07**

OR

(b) Draw I.L.D. for a member AB, BG and GH for the truss shown in the fig.2 **07**

Q.3 **(a)** Find the slope at A and deflection under B for the beam shown in the fig.3 using conjugate beam method. Take EI=3000 kNm^2 **07**

(b) Draw the S.F and B.M diagram for the frame loaded as shown in the fig.4 **07**

OR

Q.3 **(a)** Find the slope at point B and deflection at C for the beam shown in the fig.5 using Macauly's method. Take EI=3000 $kN.m^2$ **07**

(b) A steel rod is 2 m long and 50 mm in diameter. An axial pull of 100 kN is suddenly applied to the rod. Calculate the instantaneous stress induced and also the instantaneous elongation produced in the rod. E=200 GN/m^2. **07**

Q.4 **(a)** A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1 m and wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and change in diameter if it is subjected to an internal pressure of 1.5 N/mm^2. Take $E=2x10^5$ Mpa & μ=0.3. **07**

(b) A three hinged parabolic arch has a span 20m & central rise 3m. It carries a point load of 15 kN at 8 m from the left hinge. Calculate normal thrust, shear & B.M at a section 5 m from left end hinge. Also calculate maximum positive B.M & it's position. Draw B.M diagram. **07**

OR

Q.4 **(a)** A bar of diameter 20 mm and length of 2.2 m is attached with a collar at bottom. If the maximum stress developed is to be limited up to 180 N/mm^2, calculate the maximum value of weight that can be allowed to fall on the collar from 0.2m height. Assume E= $2x10^5$ N/mm^2. **07**

(b) A circular column has one end hinged and other end fixed with length of 6.0 m and diameter of 180 mm. If the yield strength of the material is 410 N/mm^2 and rankine's constant is 1/4800, calculate Euler's critical load and rankine's critical load. **07**

Q.5 **(a)** A rectangular column of width 200 mm and of thickness 150 mm carries a point **07**

load of 240 kN at an eccentricity of 10 mm from minor axis on left side on major axis. Determine the maximum and minimum stresses on the section.

(b) Determine the diameter of a solid shaft which will transmit 300 kW at 250 r.p.m. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1° in a shaft length of 2 m. Take modulus of rigidity = 1.1×10^5 N/mm^2. **07**

OR

Q.5 (a) Find the vertical deflection of joint D of truss shown in Fig.6 due to point load 20 kN at joint D. All the members have cross-sectional area $200mm^2$ and modulus of elasticity 210 GPa. **07**

(b) A cylindrical chimney 24 m high of uniform circular section is 4 m external dia. & 2m internal dia. It is subjected to a horizontal wind pressure of 1000 N/mm^2. If the coefficient of wind pressure is 0.66 & unit wt. of masonry is 22 kN/m^3. Find the max^m &min^m stresses at the base of the section. **07**

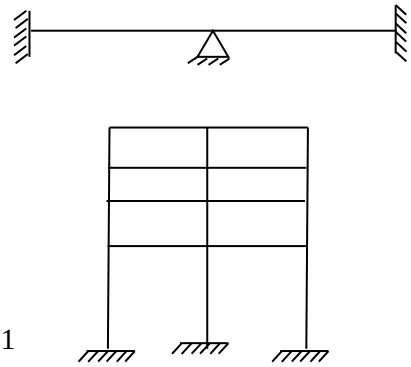
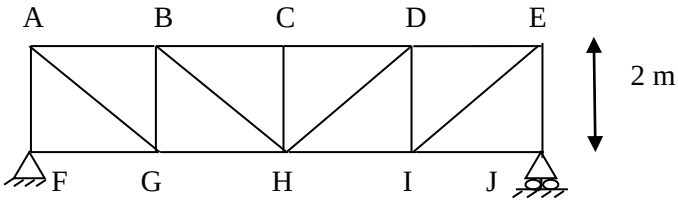


fig.1



2 m each panel

fig.2

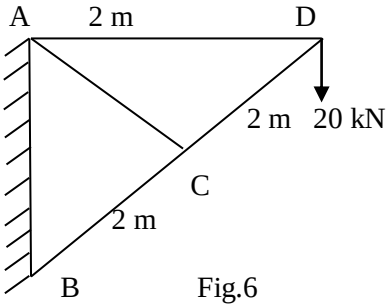


Fig.6

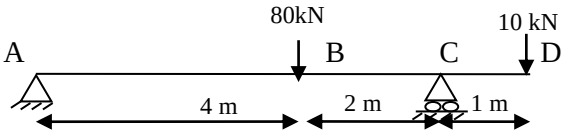


Fig.3

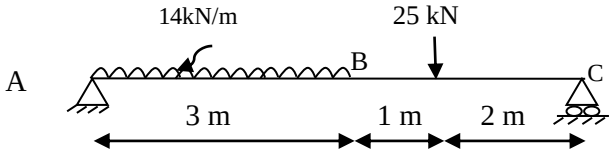


Fig.5

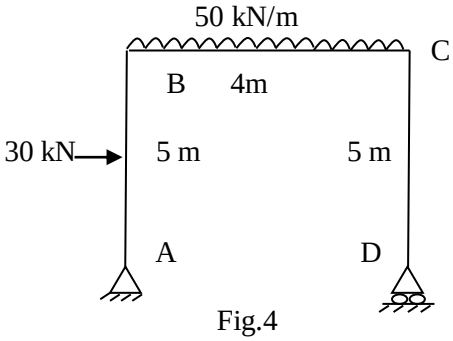


Fig.4