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## GUJARAT TECHNOLOGICAL UNIVERSITY <br> PDDC - SEMESTER-II • EXAMINATION - SUMMER • 2014

Subject Code: X20603
Date: 26-06-2014
Subject Name: Structural Analysis-I
Time: 10:30 am - 01:00 pm
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
Q. 1 (a) Define core of kernel. Sketch kern of rectangular section $500 \times 800 \mathrm{~mm}$ and circular section with 600 mm diameter.
(b) i) Find out SI and KI of the structures shown in the fig. 1

fig. 1
ii) Write the expressions for strain energy stored due to bending, shear and torsion. Write meaning of each term.
Q. 2 (a) Draw influence line diagram for $R_{A}, R_{B} \& M_{x}$ for simply supported beam having span 6
m and point X is at 2 m from support A .
(b) Two wheel loads of $50 \mathrm{kN} \& 25 \mathrm{kN}$, at a fixed distance apart of 2.2 m , cross a beam of span 8 m . Draw the influence line for B.M \& S.F for a point 3 m from the left support.

OR
(b) Draw the S.F and B.M diagram for the beam loaded as shown in the fig. 2


Fig. 2
Q. 3 (a) Find the slope and deflection at point B and C for the beam shown in the fig. 3 using

Macauly's method. Take EI=3000 kN.m ${ }^{2}$


Fig. 3
(b) Draw I.L.D. for a member U2L2, U2U3 \& $\mathrm{L}_{0} \mathrm{~L}_{1}$ for the truss shown in the fig. 4

fig. 4

## OR

Q. 3 (a) Find the slope at A and deflection under C for the beam shown in the fig. 5 using conjugate beam method. Take EI=3000 $\mathrm{kNm}^{2}$


Fig. 5
(b) A $300 \mathrm{~mm} \times 200 \mathrm{~mm}$ rectangular section is used for a column to transmit a load of 200
kN . The load line is eccentric, being 60 mm above XX axis and 30 mm to the right of YY axis. Find out the stress at all four corners.
Q. 4 (a) A thin seamless spherical shell of 1.5 m dia. is 8 mm thick. It is filled with a liquid, so that the internal pressure is $1.5 \mathrm{~N} / \mathrm{mm}^{2}$. Determine the increase in diameter \& capacity of the shell. Take $\mathrm{E}=2 \times 10^{5} \mathrm{Mpa} \& \mu=0.3$.
(b) A three hinged parabolic arch has a span $20 \mathrm{~m} \&$ central rise 3 m . It carries a point load of 15 kN at 8 m from the right hinge. Calculate normal thrust, shear \& B.M at a section 7.5 m from left end hinge. Also calculate maximum positive B.M \& it's position. Draw B.M diagram.

## OR

Q. 4 (a) A bar of diameter 22 mm and length of 2 m is attached with a collar at bottom. If the maximum stress developed is to be limited up to $150 \mathrm{~N} / \mathrm{mm}^{2}$, calculate the maximum value of weight that can be allowed to fall on the collar from 0.2 m height. Assume $\mathrm{E}=$ $2 \times 10^{5} \mathrm{~N} / \mathrm{mm}^{2}$.
(b) A column has both end fixed with length of 6.0 m . It is made up of a tube having external diameter of 180 mm and wall thickness of 10 mm . If the yield strength of the material is $410 \mathrm{~N} / \mathrm{mm}^{2}$ and rankine's constant is $1 / 4800$, calculate Euler's critical load and rankine's critical load.
Q. 5 (a) For torsion of a circular shaft, derive the equation $T / I P=\tau / R=C \theta / L$ with usual notations.
(b) A solid steel shaft has to transmit 120 kW at $600 \mathrm{r} . \mathrm{p} . \mathrm{m}$. Find the diameter of the shaft if the shear stress is to be limited to $100 \mathrm{~N} / \mathrm{mm}^{2}$. Estimate the possible percentage saving in the material of the shaft if hollow shaft of internal diameter equals 0.8 times external diameter is replaced against solid shaft.

## OR

Q. 5 (a) A light cable, 18 m long is supported at two ends at the same level. The supports are 16 m apart. The cable supports three loads of 20,25 and 30 N dividing the 16 m distance in four equal parts. Find the shape of the string and the tension in various portions.
(b) A cylindrical chimney 25 m high of uniform circular section is 5 m external dia.
\& 2 m internal dia. It is subjected to a horizontal wind pressure of $1400 \mathrm{~N} / \mathrm{mm}^{2}$.
If the coefficient of wind pressure is $0.6 \&$ unit wt. of masonry is $22 \mathrm{kN} / \mathrm{m}^{3}$. Find the $\max ^{\mathrm{m}} \& \mathrm{~min}^{\mathrm{m}}$ stresses at the base of the section.

