INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date: _____ Time: 2 Hrs, Full Marks: 40, Deptt: Aerospace

No. of Students: 46 Mid Spring Semester Examination 2013

Sub. No. AE 40008/AE 61038, Sub. Name: Aeroelasticity

4th Yr. B.Tech (H) / 1st Yr. M.Tech.

Instruction: Answer to all parts of a Q. at one place only.

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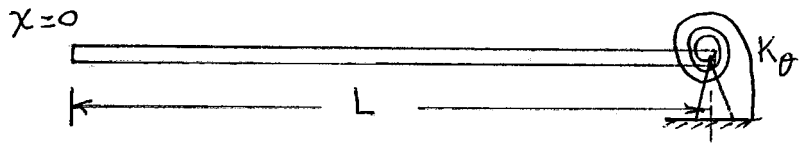
1. A uniform beam that is hinged at the right-end and restrained there by a rotational spring with $K_\theta = K_1 EI/L$. The Left-end is free, as shown.



The beam is subjected to transverse vibration.

Write down (i) Beam equation
(ii) Boundary conditions

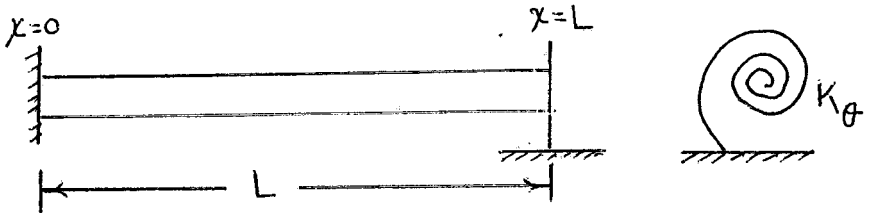
Find: Characteristic eq. for the frequencies
Roughly Sketch the mode shapes.

(12)

2. A beam undergoing torsional oscillation is shown in the figure. The beam is clamped at the root (x=0) end, and the other end is restrained with a rotational spring having spring constant $K_\theta = \varsigma GJ/L$, where ς is a dimensionless parameter.

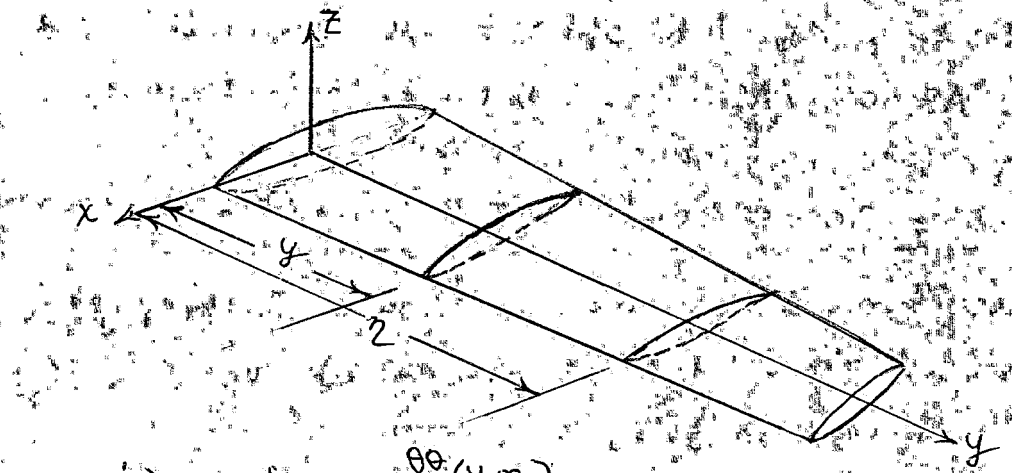
Write down (i) Beam equation
(ii) Boundary conditions

Find: Characteristic eq. for the frequencies
Approximately Sketch the mode shapes.



(12)

3. A cantilever wing is undergoing torsional deformation.



i) Define $C^{\theta\theta}(y,\eta)$

ii) Hence prove that

$$C^{\theta\theta}(y,\eta) = \int_0^y \frac{d\lambda}{GJ} \quad \text{for } \eta \geq y$$

$$= \int_0^\eta \frac{d\lambda}{GJ} \quad \text{for } y \geq \eta$$

(8)

4. Explain:- as completely as possible

a) Dynamic Loads problems

b) Wing Critical Speeds

c) Control Surface reversal

d) Torsional Divergence (8)