

試卷碼	CCUME101-4202352-F001					任課老師	林淑霞
學年	101	學期	下	日期	2013/06/10	試別	□期末考
科目	Mechanics of Materials II					評分	
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Final Exam - Part I (30%)

Time: 25 min

1. Please fill the spaces for the strain energies and internal virtual works caused by normal force N , shear force V , bending moment M , and torsional moment T . (8%)

Loads	Strain Energy	Internal Virtual Work
N	$\int_0^L \frac{N^2}{2AE} dx$	$\int_0^L \frac{nN}{AE} dx$
V	$\int_0^L \frac{f_s V^2}{2AG} dx$	$\int_0^L \frac{f_s vV}{GA} dx$
M	$\int_0^L \frac{M^2}{2EI} dx$	$\int_0^L \frac{mM}{EI} dx$
T	$\int_0^L \frac{T^2}{2GI} dx$	$\int_0^L \frac{tT}{GI} dx$

2. (a) Please show the deflection of a body under general loading conditions by Castigliano's theorem.

$$\Delta = \int_0^L \left(\frac{\partial N}{\partial P} \right) \frac{N}{AE} dx + \int_0^L \left(\frac{\partial V}{\partial P} \right) \frac{f_s V}{GA} dx + \int_0^L \left(\frac{\partial M}{\partial P} \right) \frac{M}{EI} dx + \int_0^L \left(\frac{\partial T}{\partial P} \right) \frac{T}{GI} dx + 4$$

(b) Please show the virtual work caused by temperature change.

$$\Delta L = \alpha \Delta T L$$

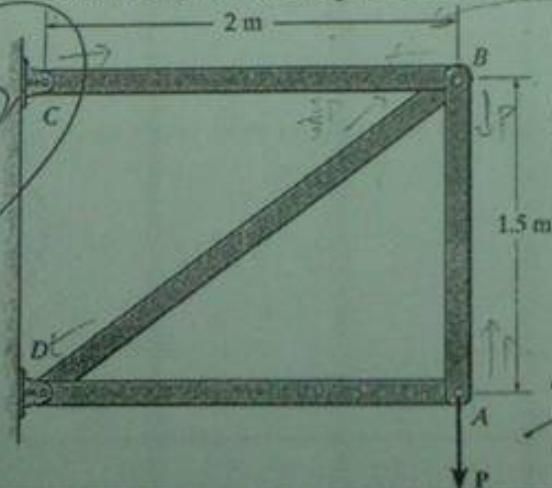
α : 熱膨脹係數

ΔT : 溫度變化量

L : 總長

ΔL : 因 temperature change 產生的長度變化

3. A steel truss made by beams is subjected a load P at point A. The beam has Young's modulus of E , a cross area of A , and a moment of inertia I . Please determine the vertical deflection at point B by (a) the virtual work approach, and (b) the Castigliano's theorem, respectively. Please show how to solve the deflection. The steps of derivations should be listed clearly. (6%)



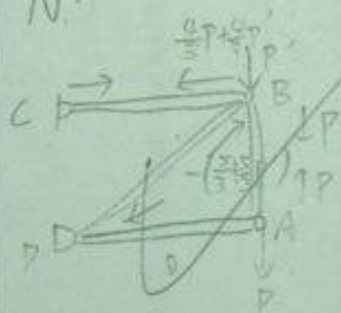
Member	Length L	Virtual Force n	Real Force N	Virtual Displacement δ
AB	0	0	P	0
BC	$\frac{2}{3}$	$\frac{2}{3}$	0	$\frac{12}{9}P$
AD	0	0	0	0
BD	$\frac{5}{3}$	$-\frac{5}{3}$	$-\frac{5}{3}P$	$\frac{125}{18}P$

$$\sum nNL = 10.5P$$

$$1 \times \Delta_B = \sum \frac{nNL}{AE}$$

$$\Delta_B = \frac{10.5P}{AE}$$

Steps

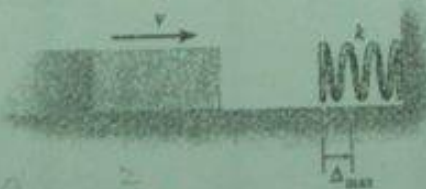
$$(a) = (b) \#$$


~~71 12.5~~

$$V_{\Delta f} = \sum \frac{N(\Delta f) L}{\Delta f}$$

steps

4. Please describe the advantages for the virtual work approach compared to the approach of energy conservation.



6. Please show how to improve the resistance of buckling for a column. (three suggestions)

6. Please show how to improve the resistance of buckling for a column.
resistance of buckling 和 $E \cdot I \cdot L$ 有關

E -stiffness, I - L -dimensional Per L $\frac{I}{L}$