國立交通大學 103 學年度碩士班考試入學試題

科目：材料力學(3112)　　考試日期:103年2月15日 第 3 節

系所班別：土木工程學系　　組別：土木系丁組一般生　　第 / 頁,共 2 頁

【可使用計算機】＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

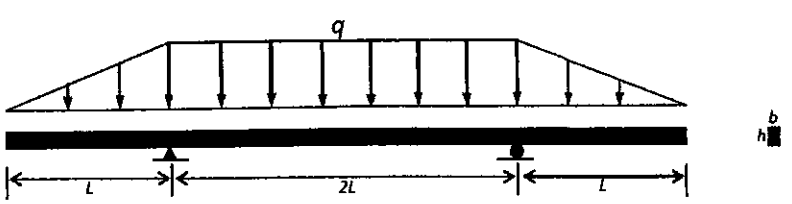
1. A rock cylinder with 12.5 cm length and 5 cm diameter is subjected to an axial compressive force of 10 kN. The rock exhibits isotropic, linear elastic behavior under the load. Assume that E=30 GPa and $\nu = 0.25$ for the rock. Determine the change in volume (mm^3) of the cylinder. (10)

2. A brick with dimensions 20cm x 10cm x 6 cm is compressed lengthwise by a force. If the ultimate shear stress is 10 MPa and the ultimate compressive stress is 25 MPa for the brick, what force P_{max} is required to break the brick? (10)

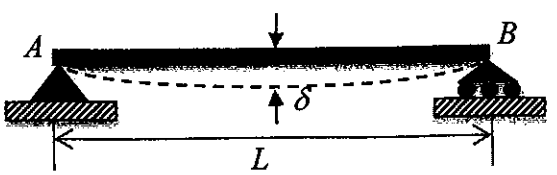
3. A circular tube with an outside diameter of 90 mm and an inside diameter of 60 mm is subjected to a torque T=5.0 kN m. The tube is made of one type of aluminum alloy (G=27GPa). (a) Determine the maximum shear, tensile and compressive stresses in the tube. (7.5) (b) Determine the corresponding maximum strains in the tube. (7.5)

4. E與ν分別代表某(完全等向性)彈性材料的楊式模數(Young's modulus)與包生比(Poisson's ratio)。一(此材料)方形試體承受雙向荷載，x 及 y 方向分別承受壓應力 p_1及 p_2 $(p_1>p_2)$，z 方向則不受力， 試問 (1)材料的剪力模數(shear modulus)為何？ (2) 此試體受載後體積應變為何？ (3)最大剪應力為何？其方向與水平面之夾角為何？ （15）

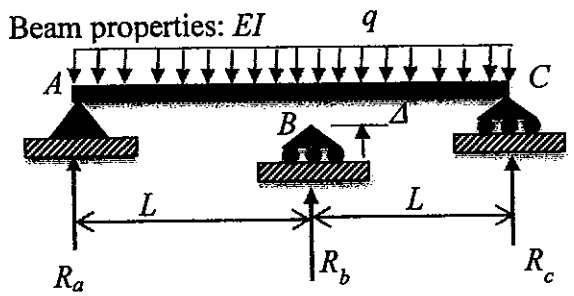
5. 如下圖所示:某一寬度 b 高度 h 的矩形樑由一個 hinge 及一個 roller 所支撐，此樑之總長 $4L$，承受梯形分佈載重，中段分佈載重 (每單位長)為 q，兩側漸減至 0。試問此樑中: (1)剪力最大值及其位置為何？ (2)彎矩最大值及其位置為何？ (3)於剪力值最大處，樑斷面內的最大剪應力值及在斷面上之位置各為何？ (4)於彎矩值最大處，樑斷面內的最大張應力值及在斷面上之位置各為何？（20）



6. A simple beam AB of length L is loaded in such a manner that its deflection curve is a parabola (symmetric about the midpoint) with midpoint deflection equal to δ, as shown in the figure belcw. How much strain energy U is stored in the beam? (10)



7. A two-span beam ABC rests on supports at A and C when there is no load on the beam. There is a small gap Δ between the beam and the support at B. When the uniform load of intensity q is applied to the beam, the gap closes and reactions develop at all three supports. What should be the magnitude of the gap Δ in order that all three reactions will be equal? (10)



8. An ellipse with major axis of length $2a$ and minor axis of length $2b$ is shown in the figure. (a) Determine the distance c from the centroid C of the ellipse to the principal point P on the minor axis (y axis). (b) For what ratio a/b do the principal points lie on the circumference of the ellipse? (c) For what ratios do they lie inside the ellipse. (10)