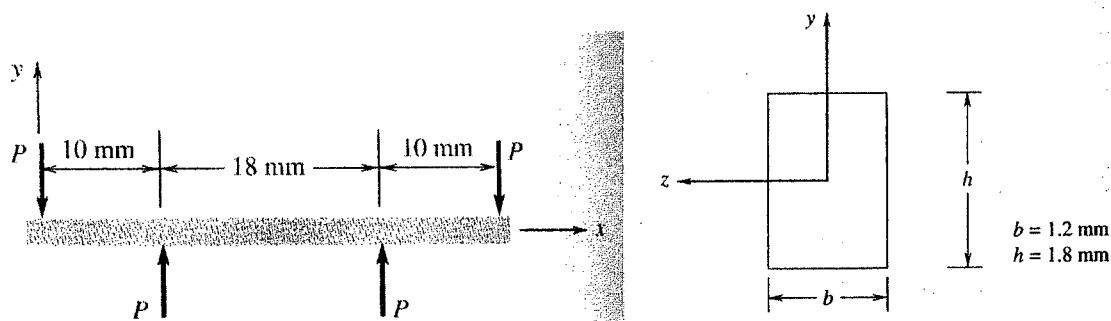| 招 生 學 年 度 | 101 | 招 生 類 別 | 碩士班 |
|---|---|---|---|
| 系 所 班 別 | 材料科學與工程學系碩士班 | | |
| 科　　　　目 | 材料力學 | | |
| 注 意 事 項 | 本考科可使用掌上型計算機 | | |

1. A small, **thin wall** pressure vessel is fabricated from a segment of a spirally welded pipe with a spiral angle of 50° by welding rigid end plates to each end of the segment, as shown below. The inside diameter of the vessel is 250 mm, the wall thickness is 6 mm, and the internal gas pressure is 2 MPa. Please determine the normal stress perpendicular to the spiral weld and shear stress parallel to the spiral weld. (20%)
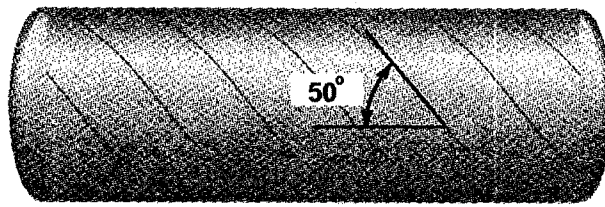


2. Consider a simply supported beam subjected to a concentrated bending moment $M_B$ acting at B, as shown in the figure below.　Please determine the shear stress and bending moment diagrams for this beam. (20%)
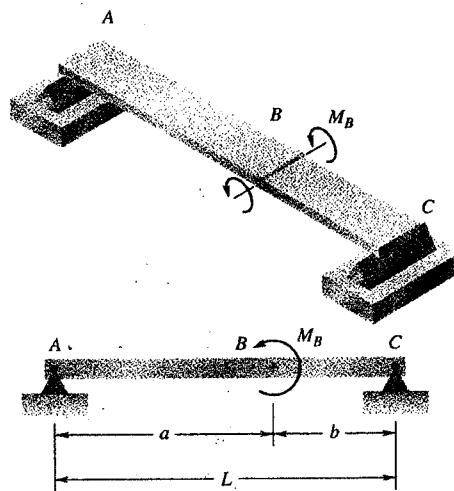


3. An alumina beam specimen is to be tested in a four-point bending test rig, as shown in the figure below. The specimen has a rectangular cross section with the dimensions b = 1.2 mm and h = 1.8 mm. Assuming that alumina fractures at a tensile stress of 240 MPa, please estimate the load P to cause fracture of the specimen in this test setup. (20%)

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4. The strain gauge rosette shown below gives the readings: $\varepsilon_a = -400\mu$, $\varepsilon_b = 600\mu$, $\varepsilon_c = -900\mu$ ($u = 10^{-6}$). Please determine the principle strains, maximum shear strain, principle directions, and directions of maximum and minimum shear strain; show their orientation with respect to the direction $a$ and $c$. (20%)
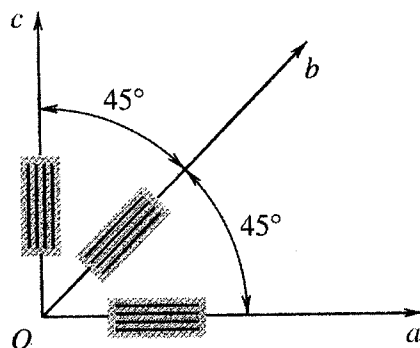


5. Three wood members are glued together, as shown below, to create an I-beam-shaped cantilever beam of length equal to 3.0 m.　If the glue strength between the members is $\tau = 100$ kPa, what is the maximum load $P_{max}$ that can be carried by this beam without exceeding the glue strength? Neglect the weight of the members.　Please also calculate the maximum normal stress and the maximum shear stress due to $P_{max}$ in this beam. (20%)



(a)

3 (50 × 100 mm) members

(b)