自觉遵守考场纪律 如考试作弊 此答卷无效

姓名_____ 学号_____

密 封 线

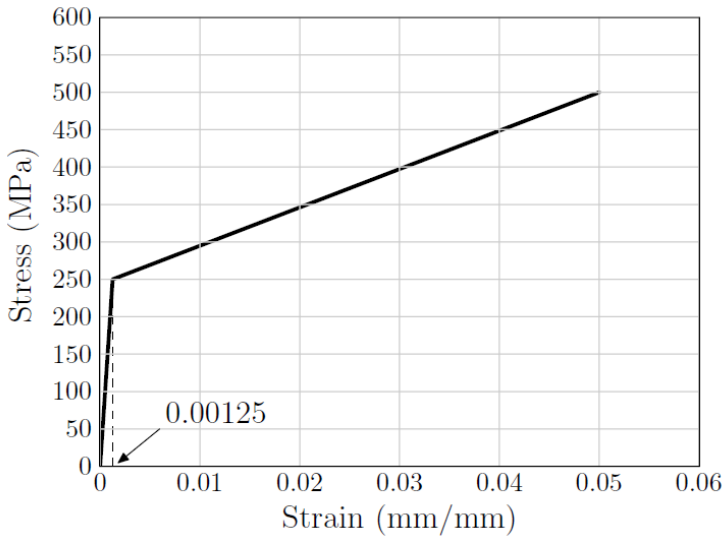
材 料 力 学 考 试 卷

课程名称 _____ 考试学期 _____ 得分 _____

适用专业 80 学时 考试形式 闭卷 考试时间长度 120 分钟

1. (20′) Blank filling and choice problems 【填空和选择题】

(1). (**4′**) The stress-strain curve from a tension test is shown below.【下图所示为某材料拉伸时的应力应变曲线】



Determine the following quantities: 【试确定下列各量的值】

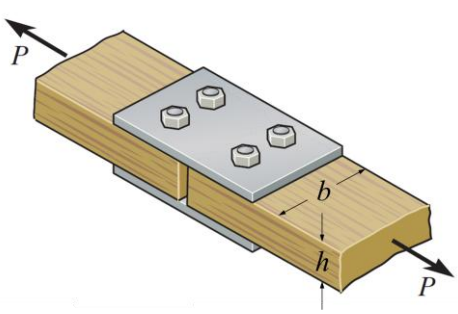
(a) Proportional limit 【比例极限】( ).

(b) Modulus of elasticity【弹性模量】( ).

(c) Ultimate strength【强度极限】( ).

(d) The plastic strain at the stress level of 400 MPa 【对应于400 MPa的塑性应变】( ).

(2). (**2′**) If the joint is subjected to an axial force of *P*, determine the average shear stress developed in each of the four bolts with diameter *d* 【试求如图所示螺栓接头中，每个螺栓(直径为*d*)所受的平均切应力】( ). Also, determine the average bearing stress acting in between the plate and each bolt 【并确定木板与螺栓之间的平均挤压应力】( ).



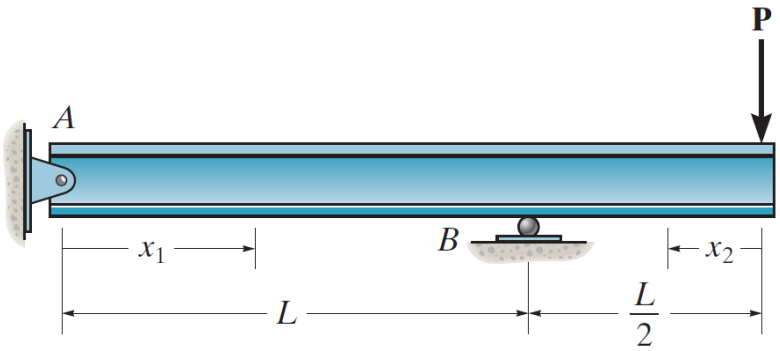
(3). (**2′**) Associate the beam below with ALL appropriate conditions necessary for solving the beam deflection $w(x)$. 【外伸梁如图所示，选出积分法求解挠曲线时的<u>所有</u>适用条件】( )

$(a): w(x_1 = 0) = 0$ $(b): w(x_1 = L) = 0$ $(c): w(x_2 = 0) = 0$ $(d): w(x_2 = L/2) = 0$

$(e): w'(x_1 = 0) = 0$ $(f): w'(x_1 = L) = 0$ $(g): w'(x_2 = 0) = 0$ $(h): w'(x_2 = L/2) = 0$

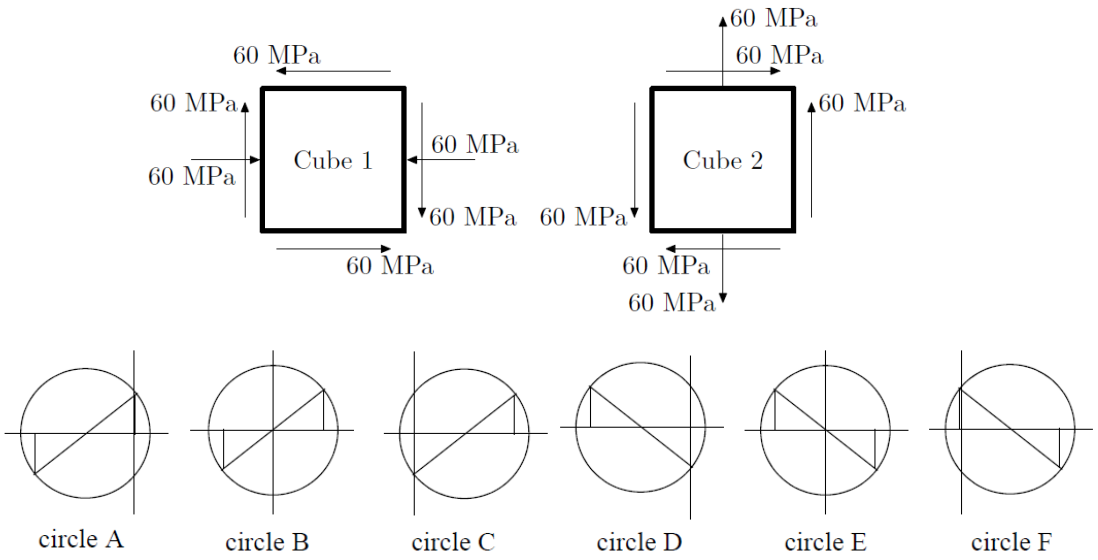
$(i): w(x_1 = L) = w(x_2 = L/2)$ $(j): w(x_1 = L) = -w(x_2 = L/2)$

$(k): w'(x_1 = L) = w'(x_2 = L/2)$ $(l): w'(x_1 = L) = -w'(x_2 = L/2)$

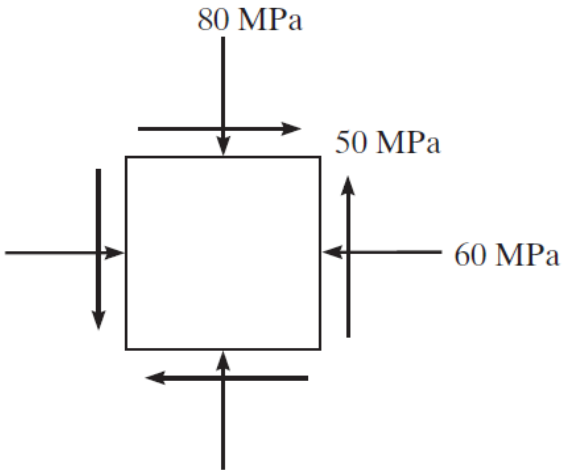


(4). (**2′**) Determine the location of the maximum transverse shear stress for a rectangular cross-section beam under transverse loading.【在横力弯曲的情况下，矩形截面梁横截面上最大弯曲切应力发生在何处】( ). How much is the ratio of this stress over the cross-sectional average?【最大弯曲切应力是截面平均切应力的多少倍】 ( )

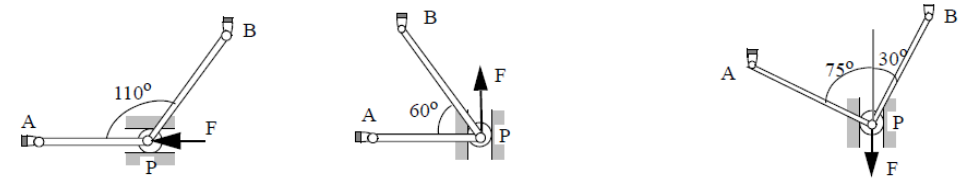
(5). (**2′**) Associate the two stress cubes with the appropriate Mohr's circle shown below. Cube 1 ( ); Cube 2 ( ).【为下列两个单元体选择相应的莫尔应力圆】



(6). (**3′**) The state of stress at a point is shown on the element. Determine the principal stresses and principal directions. Show directly the results on the original element.【已知一点的应力状态如图所示，试求其主应力大小和主方向，并在原图中作图标示】



(7). (**3′**) Identify the members in the two-bar structures that you would check for buckling. Structure 1(　　); Structure 2(　　); Structure 3(　　).【试分别确定下列三个两杆结构中需要进行稳定性分析的杆件】

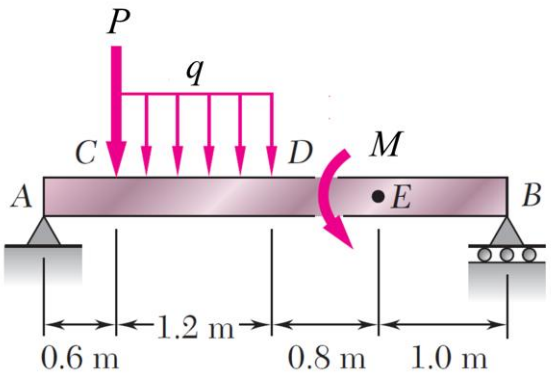


Structure 1　　Structure 2　　Structure 3

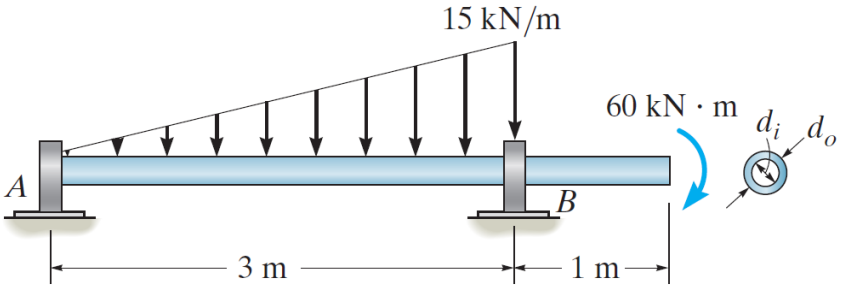
(8). (**2′**) For the linearly elastic beam subjected to the loads shown, identify the physical interpretation of the following partial derivatives based on the second theorem of Castigliano, with U denoting the elastic strain energy.【对于图示线弹性梁，试根据卡氏第二定理确定下列偏导数的意义，其中 U 表示梁内应变能】

$\frac{\partial U}{\partial P}$: (　　);

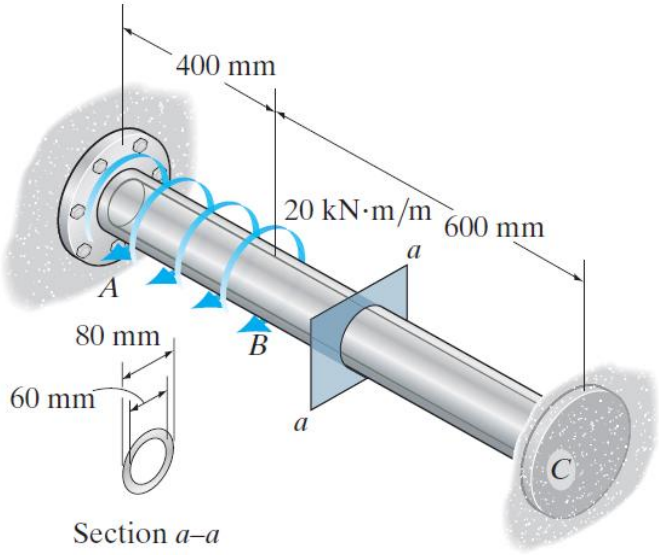
$\frac{\partial U}{\partial q}$: (　　).



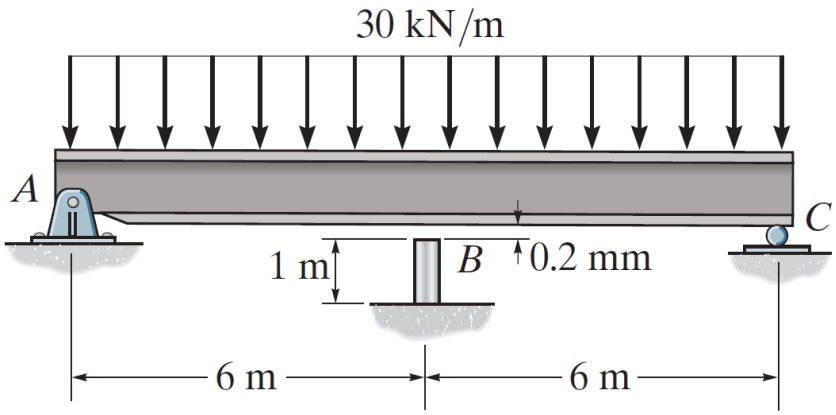
2. (**10′**) The tubular shaft (NOT thin-walled) is to have a cross section such that its inner diameter and outer diameter are related by $d_i = 0.8d_o$. Draw the shear and moment diagrams. Determine these required dimensions if the allowable bending normal stress is 155 MPa. 【已知图示空心圆杆（非薄壁）内外直径之比为 0.8，试作梁的剪力图和弯矩图，并求当许用弯曲正应力为 155 MPa 时，最小所需的空心圆杆内外直径】



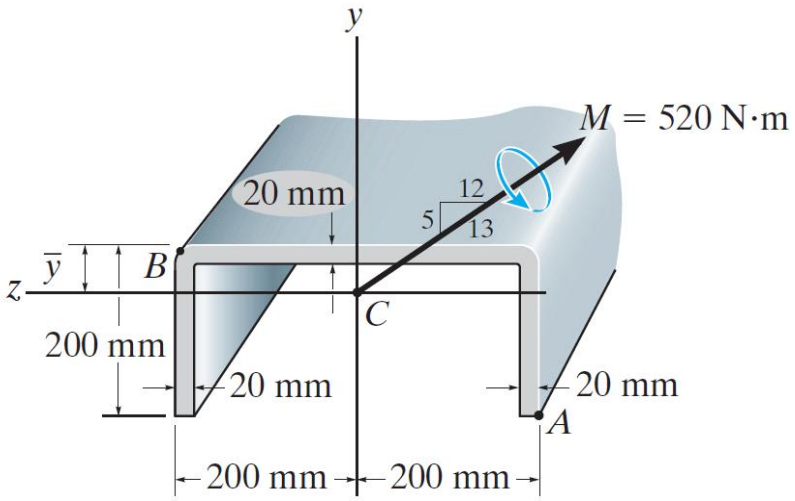
3. (**12′**) If the tubular shaft (NOT thin-walled) is subjected to a uniformly distributed torque of m = 20 kN·m/m as shown, determine the maximum shear stress developed in the shaft. The shaft is made from aluminum alloy and is fixed at *A* and *C*.【如图所示，空心圆轴（非薄壁）*AB* 段承受集度为 20 kN·m/m 的均布扭矩，*A* 和 *C* 两端固定，试求轴内承受的最大切应力】



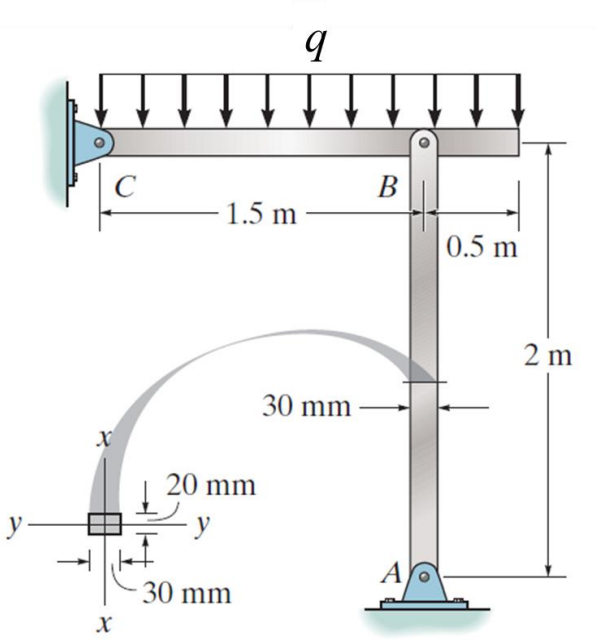
4. (**15′**) Before the uniformly distributed load is applied on the beam, there is a small gap of 0.2 mm between the beam and the post at *B*. Determine the support reactions at *A*, *B* and *C*. The post at *B* has diameter of 40 mm, and the moment of inertia of the beam is $I = 875(10^6)$ mm^4. The post and the beam are made of material having a modulus of elasticity $E = 200$ GPa. 【图示简支梁在均布荷载施加之前，在截面 *B* 与一支撑柱之间存在 0.2 mm 的间隙，若支撑柱直径为 40 mm，梁的惯性矩为 875×10^6 mm^4，且梁和支撑柱的弹性模量同为 200 GPa，试求梁在 *A*, *B* 和 *C* 处所受支反力】



5. (**15′**) The resultant internal moment acting on the cross section of the aluminum strut has a magnitude of M = 520 N·m and is directed as shown. Determine the maximum tensile and compressive bending normal stress developed on the cross section and the equation of the neutral axis. 【已知一铝杆某截面上的内力弯矩为 M = 520 N·m，作用方向如图所示，试求该截面所承受的最大弯曲拉应力和压应力，并确定截面中性轴方程。】



6. (**14′**) Determine the maximum allowable intensity q of the distributed load that can be applied to member BC without causing member AB to buckle. Assume that AB is made of steel and is pinned at its ends for x-x axis buckling and fixed at its ends for y-y axis buckling. Using a factor of safety with respect to buckling of 3. E = 200 GPa and σ_p = 360 MPa.【试求使得图示结构中压杆 AB 不发生失稳所允许的最大均布荷载集度 q。设 AB 的弹性模量 E = 200 GPa，比例极限 σ_p = 360 MPa，AB 两端为柱形铰，即在 yz 平面内(对 x-x 轴)失稳时为铰接，在 xz 平面内(对 y-y 轴)失稳时为固定连接，失稳安全系数为 3】



7. (**14′**) The wide-flange beam has a length of $2L$, a depth of $2c$, and a constant EI. Determine the maximum bending normal stress developed in the beam if a weight W is dropped from a height of h. 【如图所示，重物 W 自高度 h 处自由下落，冲击到外伸梁自由端，已知梁弯曲刚度为 EI，截面高度为 $2c$，试求梁在该冲击荷载下所产生的最大弯曲正应力。】