自觉遵守考场纪律　如考试作弊　此答卷无效

姓名＿＿＿＿＿＿

学号＿＿＿＿＿＿

线　封　密

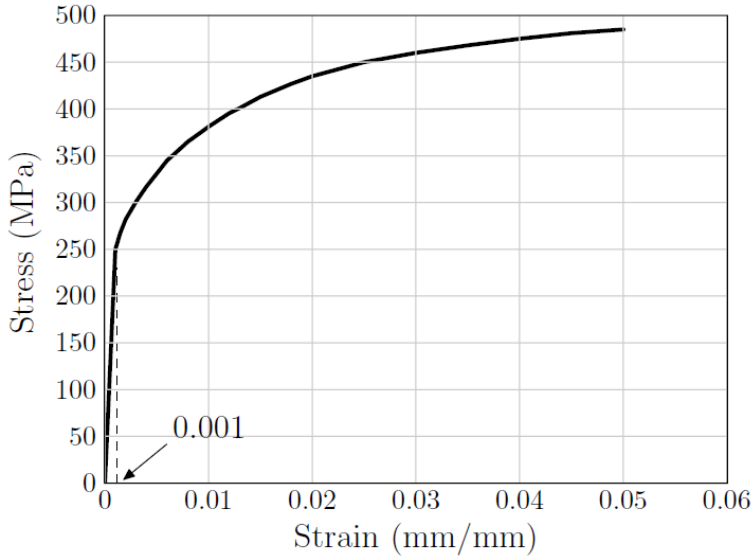
材　料　力　学　考　试　卷

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.【下图所示为一拉伸应力应变曲线】



Determine the following quantities: 【试决定下列各量的值】

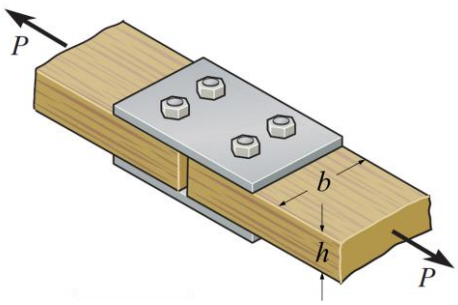
(a) Proportional limit【比例极限】(　　).

(b) Modulus of elasticity【弹性模量】(　　).

(c) Ultimate strength【强度极限】(　　).

(d) Determine the plastic strain at the stress level of 450 MPa【对应于 450 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 maximum normal stress acting on the cross-section of the plate【并确定木板横截面上的最大正应力】 (　　) .



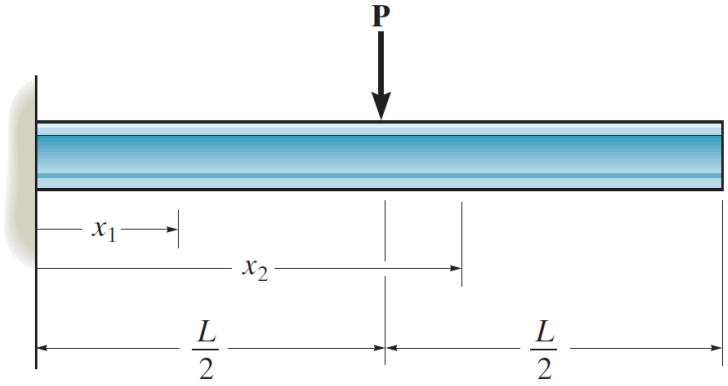
(3). (**2′**) Associate the beam below with ALL appropriate conditions necessary for solving the beam deflection $w(x)$.【悬臂梁如图所示，选出积分法求解挠曲线时的<u>所有</u>适用条件】( )

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

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

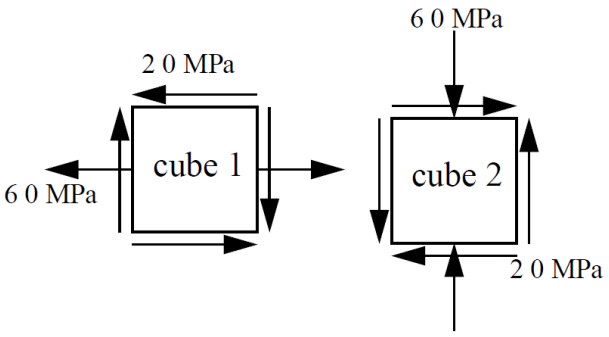
$(i): w(x_1 = L/2) = w(x_2 = L/2)$　$(j): w(x_1 = L/2) = -w(x_2 = L/2)$

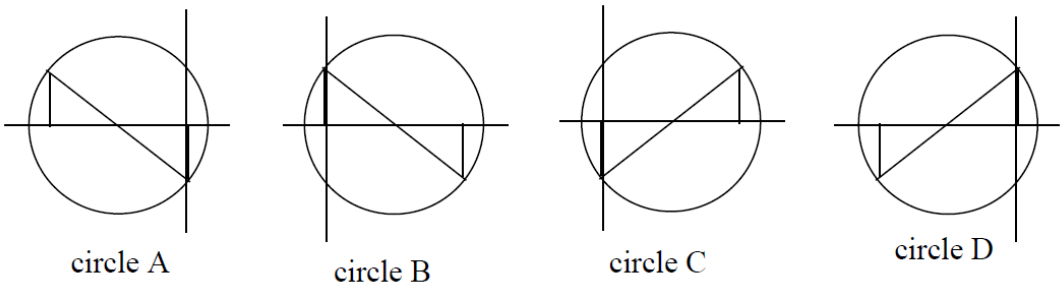
$(k): w'(x_1 = L/2) = w'(x_2 = L/2)$　$(l): w'(x_1 = L/2) = -w'(x_2 = L/2)$



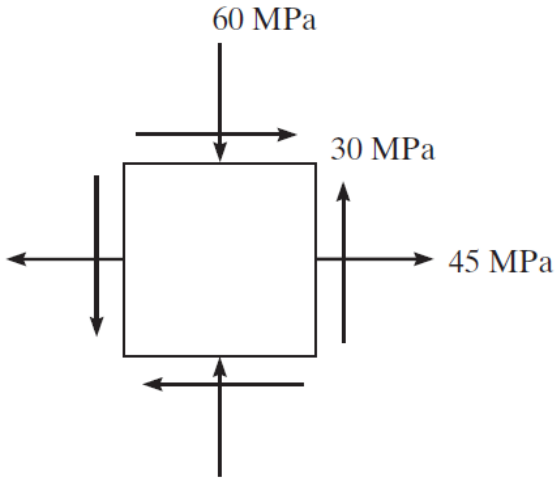
(4). (**2′**) Determine the location of the maximum transverse shear stress for a circular cross-section beam under transverse loading【在横力弯曲的情况下，圆截面梁横截面上最大弯曲切应力发生在何处】( ). How much is the ratio of this stress over the cross-sectional average?【最大弯曲切应力是截面平均切应力的多少倍】 ( )

(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】

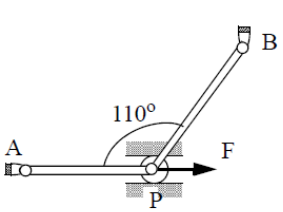




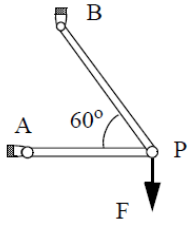
(6). (**3′**) The state of stress at a point is shown on the element. Determine the principal stresses and principal directions. Show directly the results on the original element.【已知一点的应力状态如图所示，试求其主应力大小和主方向，并在原图中作图标示】



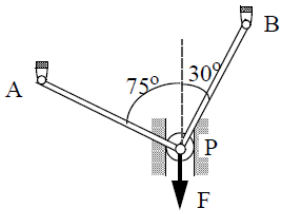
(7). (**3′**) Identify the members in the two-bar structures that you would check for buckling. Structure 1(　　) ; Structure 2(　　); Structure 3(　　);【试分别确定下列三个两杆结构中需要进行稳定性分析的杆件】



Structure 1



Structure 2

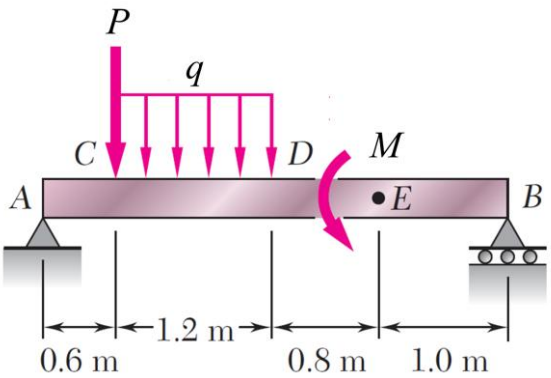


Structure 3

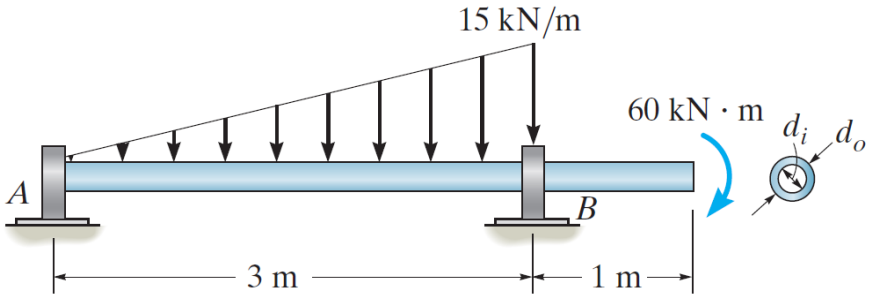
(8). (**2′**) For the linearly elastic beam subjected to the loads shown, identify the physical interpretation of the following partial derivatives based on the second theorem of Castigliano, with *U* denoting the elastic strain energy.【对于图示线弹性梁，试根据卡氏第二定理确定下列偏导数的意义，其中 *U* 表示梁内应变能】

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

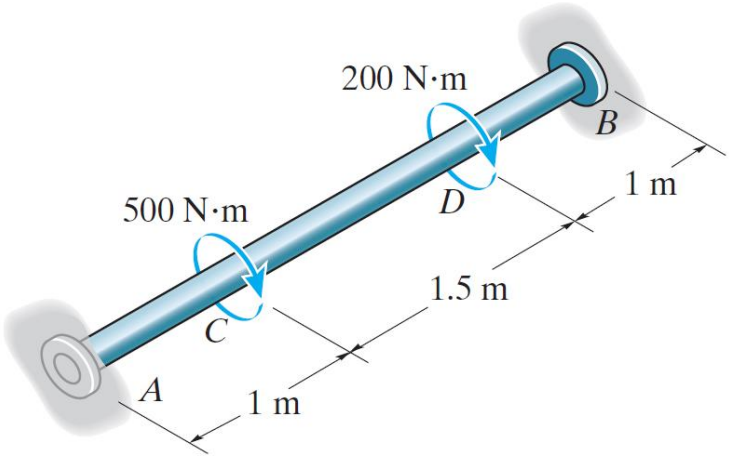
$\frac{\partial U}{\partial M}$: (　　).



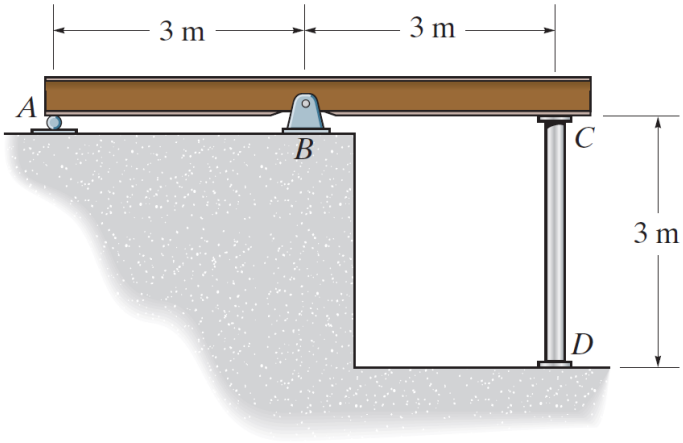
2. (**10′**) Draw the shear and moment diagrams. Determine the absolute maximum bending normal stress in the tubular shaft (NOT thin-walled) if d_i = 160 mm and d_o = 200 mm. 【试作图示梁的剪力图和弯矩图，并求当空心圆杆（非薄壁）内外直径分别为 d_i = 160 mm 和 d_o = 200 mm 时所承受的最大弯曲正应力】



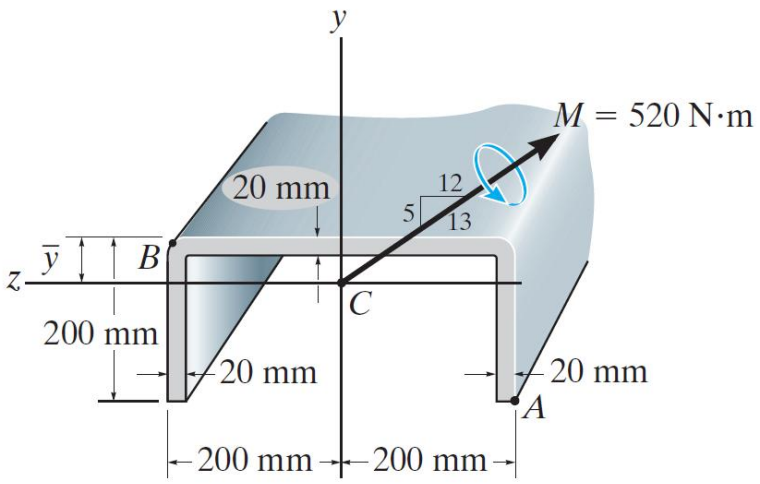
3. (**12′**) The steel shaft has a diameter of 60 mm and is fixed at its ends *A* and *B*. If it is subjected to the toques shown, determine the maximum shear stress developed in the shaft. 【已知图示钢轴直径为 60 mm，*A* 和 *B* 两端固定，承受如图所示的两个集中扭矩，试求轴内承受的最大切应力】



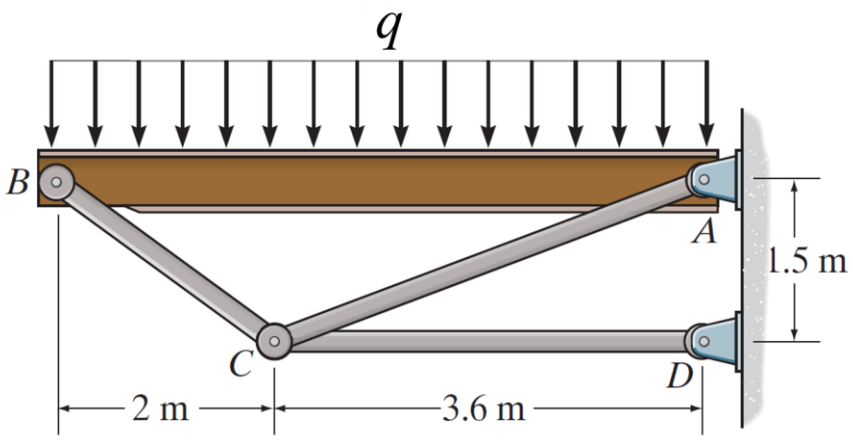
4. (**15′**) If the temperature of the 75-mm-diameter post *CD* is increased by 60^0C, determine the force developed in the post. The post and the beam are made of material having a modulus of elasticity E = 200 GPa and the coefficient of thermal expansion $\alpha = 12(10^{-6})\ ^0C^{-1}m^{-1}$. The moment of inertia of the beam is $I = 255\times 10^6\ mm^4$. 【图示结构中柱 *CD* 直径为 75 mm，试求当柱内温度上升 60^0C 时该柱所承受的轴力。设梁和柱的的弹性模量 E = 200 GPa，柱的热膨胀系数 $\alpha = 12(10^{-6})\ ^0C^{-1}m^{-1}$，且梁的惯性矩为 $I = 255\times 10^6\ mm^4$】



5. (**15′**) If 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 bending normal stress at point A and B. Also determine 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，试求该截面上 A 和 B 两点所受的弯曲正应力，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 on the beam without causing the compressive members of the supporting truss to buckle. The members of the truss are made from steel rods and have a 60-mm diameter. Use a factor of safety against buckling of 2. E = 200 GPa and σ_P = 250 MPa.【试求使得图示结构中支撑桁架内的压杆不发生失稳所允许的最大均布荷载集度 q。桁架构件均由直径为 60 mm 的钢杆组成，其弹性模量 E = 200 GPa，比例极限 σ_P = 250 MPa，失稳安全系数为 2】



7. (**14′**) The composite aluminum bar is made from two segments having diameters of 5 mm and 10 mm, respectively. Determine the maximum axial stress developed in the bar if the 5 kg collar is dropped from a height of h = 100 mm. E = 70 GPa, σ_p = 410 MPa. 【如图所示，试求当质量为 5kg 的套环从 h = 100 mm 的高度自由下落时在圆形截面铝棒内所产生的最大轴向应力。设 E = 70 GPa, σ_p = 410 MPa.】