國立臺北科技大學 101 學年度碩士班招生考試

系所組別：1202 製造科技研究所

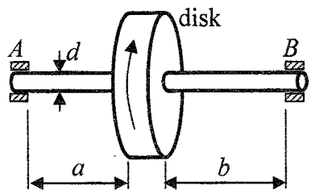
第二節　材料力學　試題（選考）

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、A shaft, supported by bearings at A and B as shown Fig. 1, carries a circular disk in rotation with constant speed n rpm. The mass of the uniform disk is m and its outside radius is R. Assume the solid shaft (shear modulus G) is with uniform diameter d and its mass can be ignored. When both the bearings are suddenly and simultaneously seized, i.e. the rotation of shaft stops at A and B completely, determine

1. the maximum angle of the twist in the shaft; (10%)
2. the maximum shear stress of the shaft due to torsion. (10%)



n = 600 rpm
m = 2 kg, R = 100 mm
a = 150 mm, b = 200 mm
d = 30 mm, G=70 GPa

Fig. 1.

二、The cross section of a slit square thin-walled tube of constant thickness is shown in Fig. 2. Determine the distance e from the corner of the cross section to the shear center S. (20%)

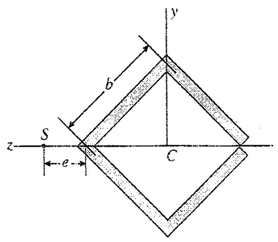


Fig. 2.

三、A cylindrical pressure vessel having radius r = 300 mm and wall thickness t = 15 mm is subjected to internal pressure p = 2.5 MPa. In addition, a torque T = 120 kN-m acts at each end of the cylinder (see Fig. 3).

1. Draw a 2-D stress element with sides parallel and perpendicular to the cylinder axis, and find the corresponding stresses; (10%)
2. Determine the corresponding maximum tensile stress σ_{max} and the maximum in-plane shear stress τ_{max} in the wall of the cylinder; (5%)
3. Draw the 3D Mohr's circles of the stresses at inner surface of the cylinder. (5%)

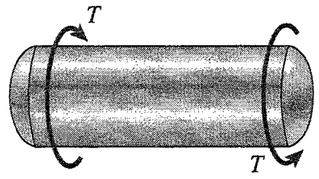


Fig. 3

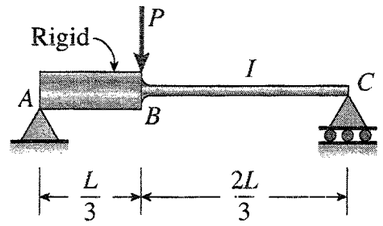


Fig. 4

四、A beam ABC has a rigid segment from A to B and a flexible segment with moment of inertia I from B to C (see Fig. 4). A concentrated load P acts at point B. Determine:

1. the angle of rotation θ_C at the left support C; (5%)
2. the deflection δ_B at point B; (5%)
3. the maximum deflection δ_{max}. (10%)

五、A truss ABC supports a load W at joint B, as shown in Fig. 5. The length L_1 of member AB is fixed. Strut BC has a solid circular cross section. Joint B is restrained against displacement perpendicular to the plane of the truss. Assuming that collapse occurs by Euler buckling of the strut, determine the angle θ for minimum weight of the strut. (20%)

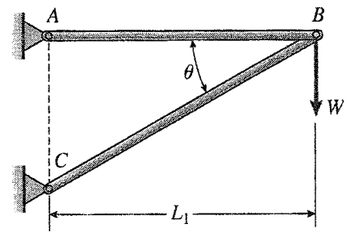


Fig. 5