QUESTION 1: THICK CYLINDERS

A steel cylinder is shrunk onto a bronze cylinder to form a compound cylinder. The inner diameter of the bronze cylinder is 200 mm and the outer diameter is 300 mm. An internal pressure of 25 MPa is applied to the compound cylinder causing the resultant hoop stress at the inner diameter to become 5 MPa (tensile) and the resultant maximum hoop stress in the steel cylinder becomes 65 MPa (tensile).

Calculate each of the following:

1.1	Resultant radial stress at 300 mm diameter	(5)
1.2	Resultant hoop stress in bronze at 300 mm diameter. (State the nature of the stress)	(2)
1.3	Diameter where resultant hoop stress in bronze cylinder is zero	(1)
1.4	Outer diameter of steel cylinder	(5)
		[13]

QUESTION 3: BENDING AND DEFLECTION

A steel pipe with an inside diameter equal to half the outside diameter is used as a cantilever with a length of 4 m. It carries a uniformly distributed load of 10 kN/m over the first 2,5 m from the fixed end as well as a concentrated load of 20 kN at the free end. The modulus of elasticity for the material is 200 GPa and the deflection at the free end is limited to 11 mm.

Calculate each of the following:

3.1	Required dimensions of pipe	(8)
3.2	H-profile that can replace pipe for same deflection limit	(1)
3.3	Maximum bending stress if selected H-profile is used	(3)
		[12]

QUESTION 5: RETAINING WALLS

A trapezium-shaped retaining wall with a height of 5 m and a density of 2 200 kg/m^3 retains water to the top of its vertical face. The top of the wall is 2 m wide. The minimum and maximum stresses at the heel and toe are 35,97 kPa and 107,91 kPa respectively (both compressive).

Consider 1 m length of the wall and calculate each of the following:

5.1	Width of base by considering stress limits	(10)
5.2	Direct and bending stress values beneath the base	(5)
		[14]

TOTAL : 40