

## ME 677 Laser Material Processing

### HW 4

Assigned: 4/04/2013

Due: 11/04/2013

1. Derive the expressions for bending angle for:
  - a. Thermal gradient bending (Trivial model/Two beam model)
  - b. Buckling
  - c. Upsetting

Draw the free body diagrams and state all the assumptions. Assume reasonable values of process parameters and compare the bend angle for all three cases.

2. Explain the mechanism of power attenuation in laser surface cladding and derive a formulation for power attenuation for a Gaussian beam. Also explain the heat partition for a ray incident at an angle of 45 deg.
3. Optical density (OD) is defined as  $OD = \log_{10} \frac{1}{T}$  where T is transmittance. Assuming Beer Lambert's Law, a thickness of glass to be 3 mm find the parameter  $\beta$  for ODs ranging from 1 to 7. Ignore reflection. Make suitable assumptions.