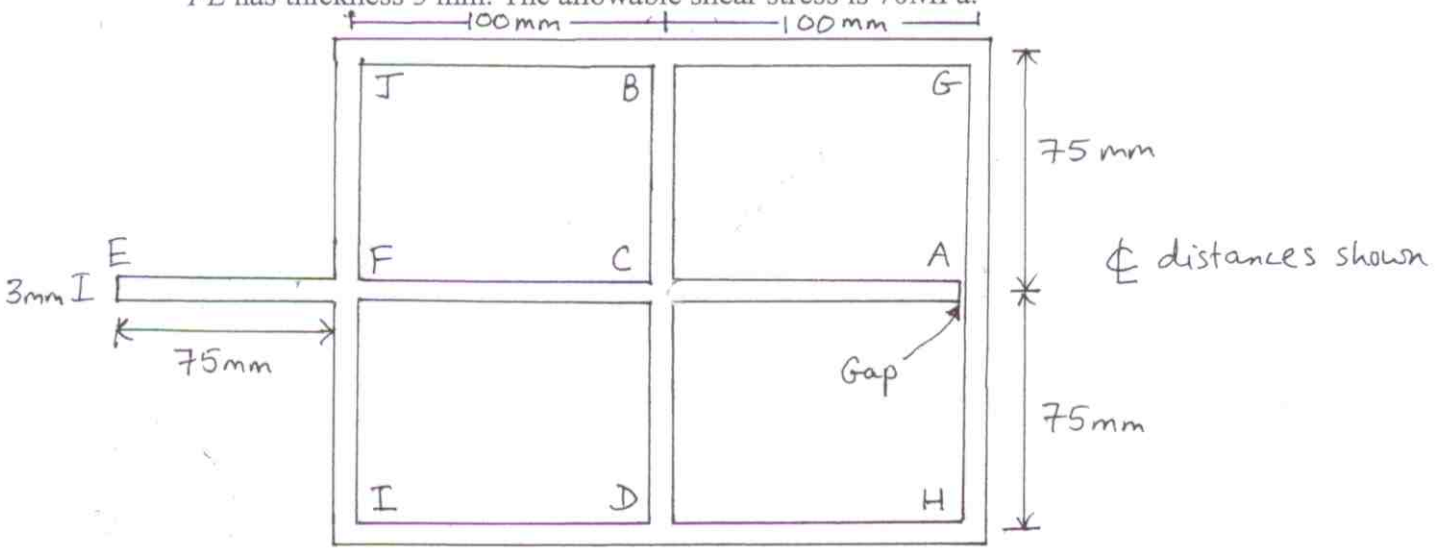
CE623 Advanced Mechanics of Solids Quiz-2 2/11/06

- Each question worth **20** marks
- Show all working.
- Attempt all parts of a question in a contiguous manner, i.e., dont scatter parts of the same question all over the answerbook.
- **Only one attempt per question will be graded**. So cancel out any attempt you do not want graded. The first not-cancelled attempt will be graded by default.
- **Open book, open notes exam**

1. Determine the moment carrying capacity of the thin-walled section shown, and the stresses in the legs *BC*, *CD*, *CF*. All legs except *FE* have thickness 5 mm. Leg *FE* has thickness 3 mm. The allowable shear stress is 70MPa.



2. A grinding wheel comprises a disk with inner radius 100 mm and outer radius 400 mm that is perfectly bonded to a rigid hub (steel shaft) at the inner radius. The wheel has density 2000 kg/m^3, Young's modulus 12 GPa, Poisson's ratio 0.32, and ultimate tensile strength 20 MPa. Testing is done at no-load condition in order to obtain the speed rating. Using a factor of safety of 2, determine the maximum allowable speed during testing, beyond which the wheel bursts.
Useful formulae for rotating disks are:

$$u_r = C_1 r + \frac{C_2}{r} - \frac{1-\nu^2}{8E}\rho\omega^2 r^3$$

$$\sigma_{rr} = \frac{E}{1-\nu^2}\left[(1+\nu)C_1 - (1-\nu)\frac{C_2}{r^2} - (3+\nu)\left(\frac{1-\nu^2}{8E}\right)\rho\omega^2 r^2\right]$$

$$\sigma_{\theta\theta} = \frac{E}{1-\nu^2}\left[(1+\nu)C_1 + (1-\nu)\frac{C_2}{r^2} - (1+3\nu)\left(\frac{1-\nu^2}{8E}\right)\rho\omega^2 r^2\right]$$