

Me413.3 Machine Design I

October 23, 2002

Midterm Examination 24 October 2002

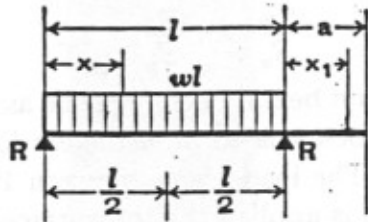
Time 90 minutes – Open Book –

Fundamentals of Machine Component Design Allowed by Juvinall and Marshek Allowed.

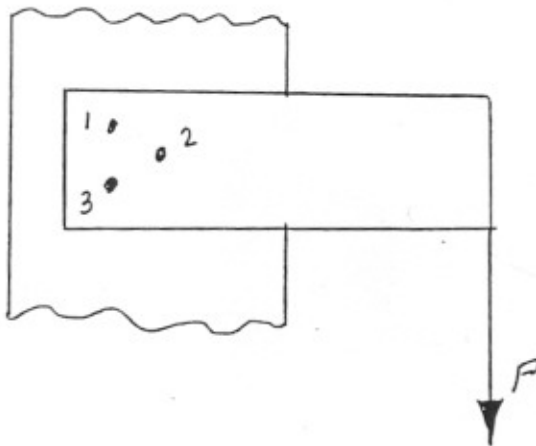
Candidates may use Calculators and should attempt three (3) of the four (4) questions.

All questions are of equal value.

1. Find the maximum deflection for the beam shown below. Note that w is the force per unit length. Note that the supports can carry a vertical load in either direction.

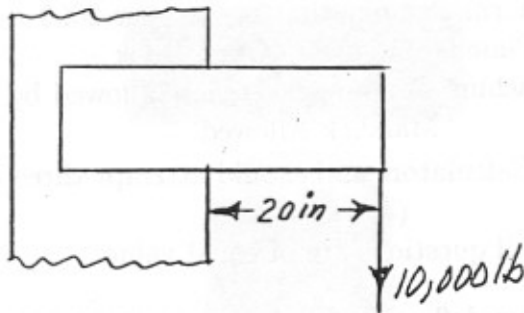


2. Find the loads on each of the rivets for the joint shown below. Neglect friction.



Note: rivet spacing is a , distance from the centroid of the rivet pattern to the line of load application is b .

3. Design a weld to attach a bracket to a column as illustrated below. Assume a E60XX rod was used and that no human life would be endangered by a failure. Explain the modifications required if human death could be caused by a failure.



4. Given that the Goodman fatigue failure criterion is

$$\frac{\sigma_m}{S_u} + k_f \frac{\sigma_a}{S_n} = 1/N$$

size a circular cross section beam for infinite life assuming that the Goodman equation governs. The beam is to be 5 meters long simply supported and loaded at its midpoint. The loads cycle between 19000N and 1000N. At the midpoint where the load is applied the top surface has been ground down to provide a flat area. This flat area has a K_t of 2.5

For this problem $S_u = 90$ MPa, $q = 0.7$, $S_n = 24$ MPa. Remember

$$K_f = 1 + (K_t - 1)q$$