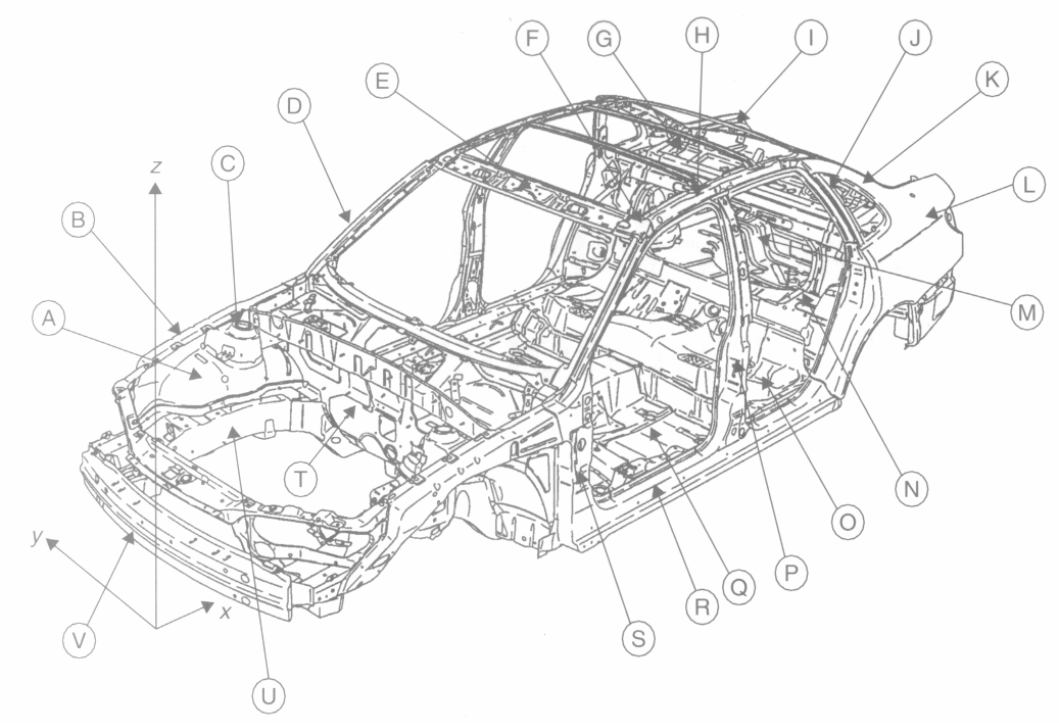
1. Fill in the part names. (2 pts each)



(1)	A	(2)	C	(3)	D	(4)	L	(5)	P
(6)	Q	(7)	R	(8)	S	(9)	T	(10)	U

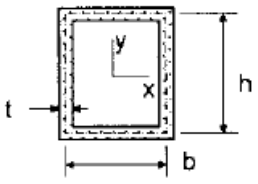
2. Body structure typically consists of beams with thin walled sections in which the width to thickness ratio, b/t is large ($b/t > 60$).

(1) Write an expression for the exact area moment of inertia about the x axis, I_{xx}. (5 pts)

(2) When t is very small compared to the other section dimensions, we can approximate the exact I_{xx} with an expression linear in t. Using either a Talyor expansion of (1) or by elimination of terms of t of second and higher order write the linear approximation for I_{xx}. (5 pts)

(3) For b = 50 mm, h = 100 mm, and $5 < b/t < 150$, plot I_{xx} versus b/t for the two expressions on the same graph. (5 pts)

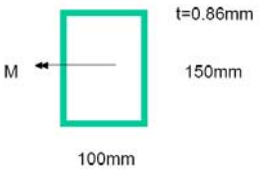
(4) For what range of b/t is the linear expression for accurate if we desire to be within ±5% of the exact value? (5 pts)



3. (15 pts)

(1) At what bending moment, M_{cr}, will top cap just buckle?

(2) What is the effective width of the top cap at $2.0\sigma_{cr}$ and the load to induce the maximum stress?



4. Determine the maximum loads at the front tire patch during the following mode: (30 pts)

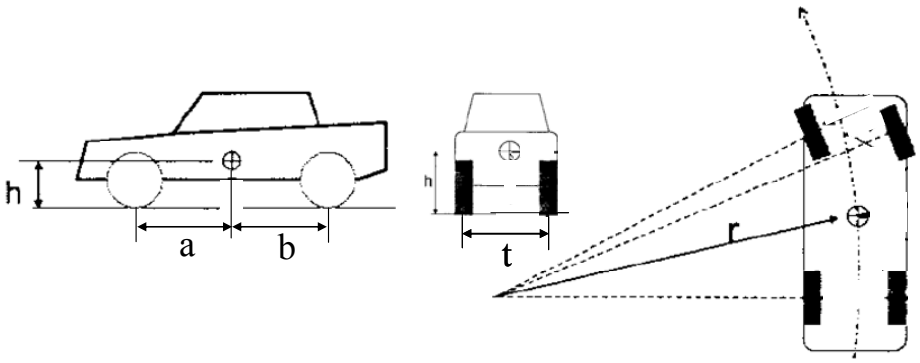
(1) At rest

(2) Braking (consider a steady state braking deceleration of *n* times the acceleration due to gravity)

(3) Cornering (steady state lateral cornering acceleration is given by *n* in g's)

(4) Roll over

mode	lateral	Fore-aft	Vertical
Static			
Braking			
Cornering			
Incipient Rollover			



5. Consider the top of the rocker a long, horizontal flat plate 0.62mm thick. (E=207,000N/mm^2, ν=0.3) (15 pts)

(1) Compute the stress at which it will buckle using hand calculation.

(2) At what bending moment does (1) occur? (explain how to approach)

$$\sigma_{cr} = k\frac{E\pi^2}{12\left(1-\nu^2\right)}\frac{1}{(b/t)^2}$$

Case	Boundary Condition	Loading	k
(a)	ss ss ss ss	Compression	4.0
(b)	ss fixed fixed ss	Compression	6.97
(c)	ss ss free ss	Compression	0.425
(d)	ss fixed free ss	Compression	1.277
(e)	ss fixed ss ss	Compression	5.42
(f)	ss ss ss ss	Shear	5.34
(g)	ss fixed free ss	Shear	8.98
(h)	ss ss ss ss	Bending	23.9
(i)	fix fixed fixed fix	Bending	41.8