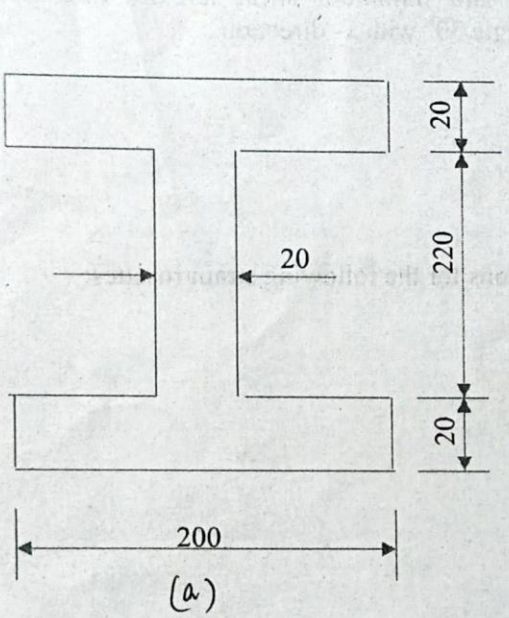
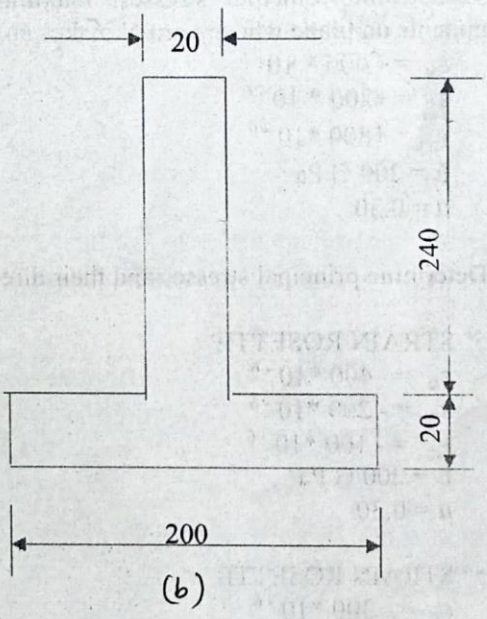
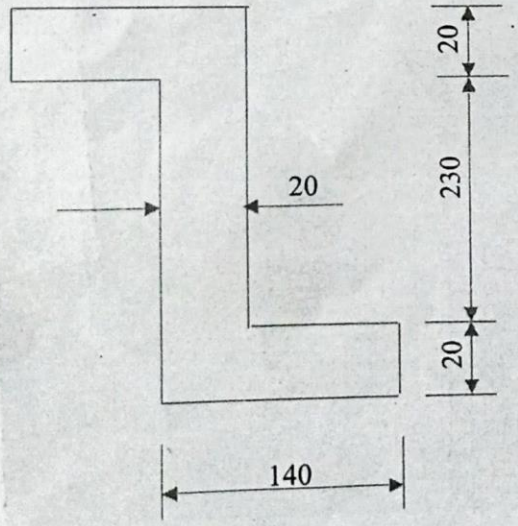
3.) Find out the principal moment of inertia about centroid and their orientation from centroidal axis for the following sections.



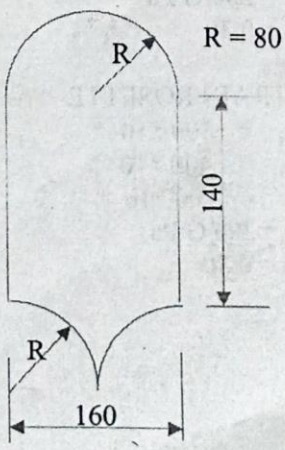
(a)



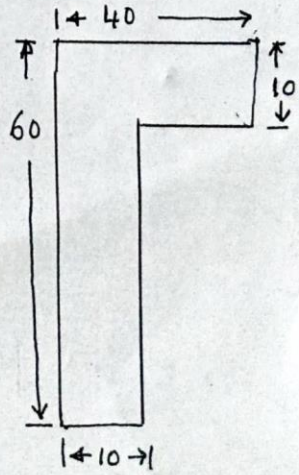
(b)



(c)



(d)



(e)

ALL DIMENSIONS ARE IN MM

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NATIONAL INSTITUTE OF TECHNOLOGY, DURGAPUR
DEPARTMENT OF MECHANICAL ENGINEERING
SOLID MECHANICS SESSIONAL (MES 451)

TRANSFORMATION OF STRAIN COMPONENTS AND
MOHR'S CIRCLE FOR MOMENT OF INERTIA

Q1. Determine principal stresses, maximum and minimum shear stresses and stress components on plane whose normal makes an angle 30° with x- direction.

$\varepsilon_x = -400 * 10^{-6}$
$\varepsilon_y = +200 * 10^{-6}$
$\gamma_{xy} = +800 * 10^{-6}$
E = 200 G Pa
$\mu = 0.30$

Q2. Determine principal stresses and their directions for the following strain rosettes:

a) 45° STRAIN ROSETTE
$\varepsilon_a = 400 * 10^{-6}$
$\varepsilon_b = -200 * 10^{-6}$
$\varepsilon_c = -100 * 10^{-6}$
E = 200 G Pa
$\mu = 0.30$

b) 45° STRAIN ROSETTE
$\varepsilon_a = 300 * 10^{-6}$
$\varepsilon_b = 600 * 10^{-6}$
$\varepsilon_c = 100 * 10^{-6}$
E = 200 G Pa
$\mu = 0.30$

c) 60° STRAIN ROSETTE
$\varepsilon_a = 300 * 10^{-6}$
$\varepsilon_b = -400 * 10^{-6}$
$\varepsilon_c = 100 * 10^{-6}$
E = 200 G Pa
m = 0.30

$\sigma_{max} = \frac{E}{1-\mu^2}(\varepsilon_{max} + \mu \varepsilon_{min})$

$= \frac{200 \times 10^9}{1-0.3^2}(590 \times 10^{-6} + 0.3 \times (-280) \times 10^{-6})$

$= \frac{200 \times 508 \times 10^3}{0.91}$

$= 111.208 \times 10^6$