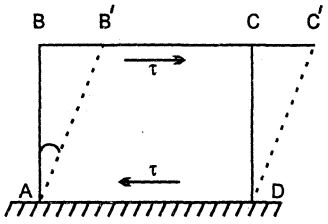

Fig.10.32

The distorted shape is AB'C'D. The diagonal strain (linear) will be

a) $\frac{\phi}{2}$

b) $\frac{\phi}{\sqrt{2}}$

c) $\phi\sqrt{2}$

d) ϕ [ES 96]

214. The lists given below refer to a bar of length l cross sectional area A, Young's modulus E. Poisson's ratio μ and subjected to axial stress p. Match List I with List II and select the correct answer using the codes given below the lists :

	List I		List II
A.	Volumetric strain	1.	$2(1+\mu)$
B.	Strain energy per unit volume	2.	$3(1-2\mu)$
C.	Ratio of Young's modulus to bulk modulus	3.	$\frac{p}{E}(1-2\mu)$
D.	Ratio of Young's modulus to modulus of rigidity	4.	$\frac{p^2}{2E}$
		5.	$2(1-\mu)$

Codes :

a)	A	B	C	D
	3	4	2	1
b)	A	B	C	D
	5	4	1	2
c)	A	B	C	D
	5	4	2	1
d)	A	B	C	D
	2	3	1	5

[ES 96]

215. If all the dimensions of a prismatic bar of square cross section suspended freely from the ceiling of a roof are doubled, then the total elongation produced by its own weight will increase
a) eight times
b) four times
c) three times
d) two times [ES 96]

216. On an element shown in Fig. 10.33, the stresses are (in MPa)
$\sigma_x = 110$
$\sigma_y = 30$
$\tau_{xy} = 30 = \tau_{yx}$

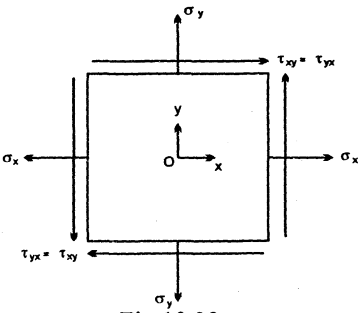

Fig.10.33

The radius of Mohr's circle and principal stresses σ_1, σ_2 are (in MPa)

	Radius = r	σ_1	σ_2
a)	50	20	120
b)	55	110	30
c)	60	20	140
d)	70	20	140

[ES 96]

217. Consider the following statements :
1. In a member subjected to uniaxial tensile force the maximum normal stress is the external load divided by the maximum cross sectional area.
2. When the structural member is subjected to uniaxial loading, the shear stress is zero on a plane where the normal stress is maximum.
3. In a member subjected to uniaxial loading, the normal stress on the planes of maximum shear stress is less than the maximum.

Of these statements
a) 1 and 2 are correct

The deflection at B is

a) $\frac{Pl^2}{2EI}(L-l)$

b) $\frac{Pl^2}{3EI}(L-l)$

c) $\frac{Pl^2}{2EI}(L+l/3)$

d) $\frac{Pl^2}{2EI}(L-l/3)$ [ES 96]

*228. A cantilever of constant depth carries a uniformly distributed load on the whole span. To make the maximum stress at all sections the same, the breadth of the section at a distance x from the free end should be proportional to

a) x

b) $\sqrt{x}$

c) x^2

d) x^3 [ES 96]

229. For a circular column having its ends hinged, the slenderness ratio is 160. The *l*/d ratio of the column is

a) 80

b) 57

c) 40

d) 20 [ES 96]

230. A hollow circular column of internal diameter d and external diameter 1.5 d is subjected to compressive load. The maximum distance of the point of application of load from the centre for no tension is

a) d/8

b) 13d/48

c) d/4

d) 13d/96 [ES 96]

231. Match List I (given sections) with List II (shape of the core) to ensure no tension condition and select the correct answer using the codes given below the lists:

	List I		List II
A.	Rectangular	1.	Circle
B.	I-section	2.	Annulus
C.	Hollow circular	3.	Rhombus
D.	Square	4.	I-section
		5.	Square
		6.	Rectangular

Codes :

	A	B	C	D	
a)	4	6	1	2	
b)	3	3	1	5	
c)	6	4	2	5	
d)	3	4	5	1	[ES 96,98]

232. A column ABCD ($2y_1$ x $2y_2$) of rectangular section carries a load P at Z having the coordinates (x, y) as shown in Fig. 10.42.

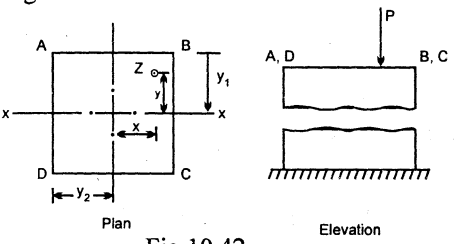

Fig.10.42

If the compressive stresses are taken as positive and area A=$2y_1$ x $2y_2$ = $4y_1y_2$ and the moment of intertia about x and y axis being I_{xx} and I_{yy} respectively, then the stress at the corner D is

a) $\frac{P}{A}+\frac{Py}{I_{xx}}y_1+\frac{Px}{I_{yy}}y_2$

b) $\frac{P}{A}-\frac{Py}{I_{xx}}y_1-\frac{Px}{I_{yy}}y_2$

c) $\frac{P}{A}+\frac{Py}{I_{yy}}y_1+\frac{Px}{I_{xx}}y_2$

d) $\frac{P}{A}-\frac{Py}{I_{yy}}y_1-\frac{Px}{I_{xx}}y_2$ [ES 96]

233. A simply supported beam of span l and flexural rigidity EI, carries a unit point load at its centre. The strain energy in the beam due to bending is

a) $\frac{l^3}{48EI}$

261. If the eccentricity of total self weight 'W' of a masonry dam at its base is equal to one fourth of the base width 'B', then the maximum pressure at the base is given by
a) 2W/3B
b) 4W/3B
c) 5W/2B
d) 8W/3B [ES 98]

262. The rectangular column shown in Fig. 10.47 carries a load 'P' having eccentricity e_x and e_y along the x-axis and y-axis respectively.

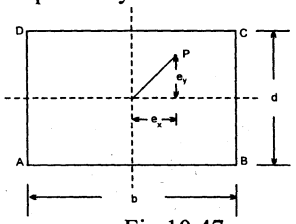

Fig.10.47

The stress at any point (x, y) is given by

a) $\frac{P}{bd}\left[1+\frac{12e_y.y}{d^2}+\frac{12e_x.x}{b^2}\right]$

b) $\frac{P}{bd}\left[1+\frac{12e_y.y}{b^2}+\frac{12e_x.x}{d^2}\right]$

c) $\frac{P}{bd}\left[1+\frac{6e_y.y}{d^2}+\frac{6e_x.x}{b^2}\right]$

d) $\frac{P}{bd}\left[1+\frac{6e_y.y}{b^2}+\frac{6e_x.x}{d^2}\right]$ [ES 98]

263. Which one of the following pairs is NOT correctly matched ?

a)	Visco-plastic material	Small plastic zone
b)	Strain hardening material	Stiffening effect felt at some stage
c)	Orthotropic material	Different properties in three perpendicular directions
d)	Isotropic material	Same physical property in all directions at a point [ES 98]

264. In a plane stress problem there are normal tensile stresses σ_x and σ_y accompanied by shear stress τ_{xy} at a point along orthogonal cartesian coordinates x and y respectively. If it is observed that the minimum principal stress on a certain plane is zero then

a) $\tau_{xy}=\sqrt{\sigma_x+\sigma_y}$

b) $\tau_{xy}=\sqrt{\sigma_x-\sigma_y}$

c) $\tau_{xy}=\sqrt{\sigma_x.\sigma_y}$

d) $\tau_{xy}=\sqrt{\sigma_x/\sigma_y}$ [ES 98]

265. In an experiment it is found that the bulk modulus of a material is equal to its shear modulus. The Poisson's ratio is
a) 0.125
b) 0.250
c) 0.375
d) 0.500 [ES 98]

266. A mild steel bar is in two parts having equal lengths. The area of cross section of Part-1 is double that of Part-2. If the bar carries an axial load 'P', then the ratio of elongation in Part-1 to that in part-2 will be
a) 2
b) 4
c) ½
d) ¼ [ES 98]

267. At a point in a steel member, the major principal stress is 200 MPa (tensile) and the minor principal stress is compressive. If the uniaxial tensile yield stress is 250 MPa , then according to the maximum shear stress theory, the magnitude of the minor principal stress (compressive) at which yielding will commence is
a) 200 MPa
b) 100 MPa
c) 50 MPa
d) 25 Mpa [ES 98]

268. The limit of proportionality of a certain sample is 300 MPa in simple tension. It is subjected to principal stresses of 150 MPa (tensile), 60 MPa (tensile) and 30

c) $10\times\sqrt[3]{\frac{9375}{10}}$ mm

d) $\sqrt[3]{9375}$ mm [ES 99]

289. A shaft of diameter 'd' is subjected to bending moment 'M' and twisting moment 'T'. The developed principal stress will be

a) $\pm\frac{16}{\pi d^3}\sqrt{M^2+T^2}$

b) $\frac{16}{\pi d^3}\left(M\pm\sqrt{M^2+T^2}\right)$

c) $\frac{16}{\pi d^3}\left(T\pm\sqrt{M^2+T^2}\right)$

d) $\frac{16}{\pi d^3}\sqrt{M^2+T^2}\pm M$ [ES 96, 99]

290.

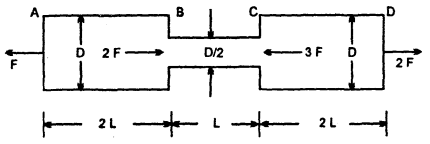

Fig.10.61

For the compound bar shown in Fig. 10.61, the ratio of stresses in the portions AB: BC: CD will be

a) 4: 1: 2
b) 1 : 2: 4
c) 1 : 4: 2
d) 4 : 2: 1 [CS 93]

291. The ratio of total elongation of a bar of uniform cross-section produced under its own weight to the elongation produced by an external load equal to the weight of the bar is

a) 2
b) 1
c) 1/2
d) 1/4 [CS 93]

292. Match List I with list II and select the correct answer using the codes given below the lists:

List I (Principal stress)		List II (Max. shearing stress)
A.	{+ 50, + 50}	1. 25
B.	{ + 150, + 50}	2. Zero
C.	{0, + 50}	3. 50
D.	{-50, - 200)	4. 75

Codes :

a)	A	B	C	D
	2	3	4	1
b)	A	B	C	D
	3	2	1	4
c)	A	B	C	D
	3	2	4	1
d)	A	B	C	D
	2	3	1	4

[CS 93]

293. Figure 10.62 shows a simply-supported beam overhanging to the left. The beam carries a uniformly distributed load of w/m throughout.

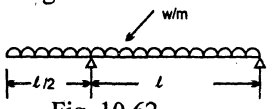

Fig. 10.62

The correct bending moment diagram for the beam is

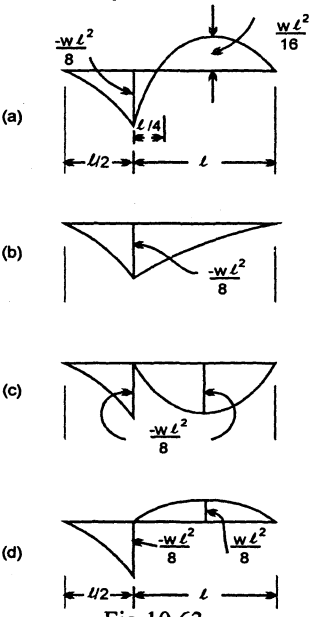

Fig.10.63 [CS 93]

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