

01. Match List-I (Theory of failures) with List-II (Scientists) and select the correct answer :

List-I	List-II
A. Maximum principal stress theory	1. St. Venant
B. Maximum shear stress theory	2. Beltrami & haigh
C. Maximum principal strain theory	3. Tresca
D. Maximum distortion energy theory	4. Von - mises
	5. Rankine

Codes :

- a. A-5, B-3, C-1, D-4
 b. A-5, B-1, C-2, D-4
 c. A-3, B-5, C-1, D-2
 d. A-3, B-1, C-2, D-5
02. A member is made of structural steel. When it is subjected to simple tension, the limit of proportionality is 280 N/mm^2 . If the principal stress p_1 and p_2 developed in the member are 100 N/mm^2 (tensile) and 40 N/mm^2 (compressive) respectively and poisson ratio is 0.30, then the factor of safety according to maximum shear stress theory would be
- a. 2.75
 b. 2.5
 c. 2.25
 d. 2.0
03. A solid shaft of 100 mm diameter in a small hydraulic tubrine is subjected to an axial Compressive load of $100 \pi \text{ kN}$ and a torque of $5 \pi \text{ kNm}$. The maximum shear stress induced in the shaft is
- a. $20\sqrt{3} \text{ N/mm}^2$
 b. $20\sqrt{8} \text{ N/mm}^2$
 c. $20\sqrt{15} \text{ N/mm}^2$
 d. $20\sqrt{17} \text{ N/mm}^2$
04. If a shaft is simultaneously subjected to a torque T and a bending moment M the ratio of maximum bending stress and maximum shearing stress is given by
- a. $2M/T$
 b. M/T
 c. $2T/M$
 d. T/M
05. If the maximum principal stress for an element under bi-axial stress situation is 100 Mpa (tensile) and the maximum shear stress is also 100 Mpa , then what is the other principal stress ?
- a. 200 Mpa (tensile)
 b. 200 Mpa (compressive)
 c. 100 Mpa (compressive)
 d. 0
06. According to maximum shear criterion, at what ratio of maximum shear stress to yielding of material take place ?
- a. 2
 b. $2/\sqrt{3}$
 c. $1/\sqrt{3}$
 d. $1/2$

07. A circular shaft is subjected to a bending moment M_b and a twisting moment M_t . What is the ratio of maximum shear stress and the maximum bending stress?

- A. $\frac{2M_t}{M_b}$
 B. $\frac{M_t}{M_b}$
 C. $\frac{M_t}{2M_b}$
 D. $\frac{1.5M_t}{2M_b}$

08. The details of the principal stresses at a certain point in a steel member are as follows:

- Major principal stress $\sigma_1 = 180 \text{ N/mm}^2$ (tensile)
 Major principal stress $\sigma_2 =$ is (compressive)
 If the uniaxial tensile yield stress is 240 N/mm^2 , according to Maximum shear stress theory, what would be the value of σ_2 in N/mm^2 at which yielding will commence ?
- a. 120 tension
 b. 90 tension
 c. 80 compression
 d. 60 compression

09. An element of a structure is subjected to two principal stresses σ_1 and σ_2 $\sigma_1 = 200 \text{ N/mm}^2$ (tensile) σ_2 is compressive

- The yield stress both in simple tension and compression for the material is 240 N/mm^2 poisson's ratio $\mu = 0.25$; what is the value of σ_2 in N/mm^2 as per maximum normal strain theory at which the yield of the material will commence ?
- a. 240
 b. 200
 c. 180
 d. 160

10. The limit of proportional in the material of a structural steel member, when subjected to simple tension, is 280 N/mm^2 . The principal stresses in the member are $\sigma_1 = 122 \text{ N/mm}^2$ (tensile) and $\sigma_2 = 60 \text{ N/mm}^2$ (compressive). $M = 0.3$ according to maximum strain theory, the factor of safety is

- a. 2.5
 b. 1.5
 c. 2
 d. 3

11. Which of the following theories of failure is most appropriate for a brittle material ?

- a. Maximum principal strain theory
 b. Maximum principal stress theory
 c. Maximum shear stress theory
 d. Maximum strain energy theory

12. Steel has proportionality limit of 300 Mpa in simple tension. It is subjected to principal stresses of 120 Mpa (tensile), 60 Mpa (tensile) and 30 Mpa (compressive) what is the factor of safety according to maximum shear stress theory ?

- a. 1.5
 b. 1.75
 c. 1.8
 d. 2.0

13. According to maximum shear stress failure theory, yielding occurs in the material when

- a. Maximum shear stress = yield stress
 b. Maximum shear stress = 2 times yield stress
 c. Maximum shear stress = $1/2$ yield stress
 d. Maximum shear stress = $\sqrt{2}$ times yield stress

14. For the design of a cast iron member, the most appropriate theory of failure is

- a. Mohr's theory
 b. Rankine's theory
 c. Maximum shear stress theory
 d. Maximum shear energy theory

15. A simply supported beam of span L carries a concentrated load W at its mid-span. If the width b of the beam is constant throughout the span, then with permissible stress as σ , the depth of the beam at mid-span will be

- A. $\frac{3WL}{2br}$
 B. $\sqrt{\frac{3WL}{2br}}$
 C. $\frac{6WL}{2br}$
 D. $\sqrt{\frac{6WL}{2br}}$

16. In a two dimensional stress system, the principal stresses are $\sigma_1 = 200 \text{ N/mm}^2$ (tensile) and σ_2 (compressive). The yield stress in both simple tension and compression is 250 N/mm^2 with $\mu = 0.25$ what will be the value of σ_2 according to maximum normal strain theory ?

- a. 160 N/mm^2
 b. 100 N/mm^2
 c. 200 N/mm^2
 d. 250 N/mm^2

17. A structural element is subjected to a two dimensional stress system, wherein

$\sigma_1 = 225 \text{ N/mm}^2$ (tensile) with σ_2 being compressive, the yield stress in both simple tension (σ_y)_t and simple compression (σ_y)_c is 250 N/mm^2 and $\mu = 0.25$. What is the value of σ_2 , according to maximum strain theory?

- a. 200 N/mm^2
 b. 150 N/mm^2
 c. 125 N/mm^2
 d. 100 N/mm^2