DEPT OF AERO
AIRCRAFT STRUCTURES-II
2 Marks Questions with Answers

UNIT 1

1. Define
   (a) Principal axis
   (b) Neutral axis and give an expression to determine them.

(a) If the two axes about which the product of inertia is found, are such, that the product of inertia becomes zero, the two axes are then called principal axes.

$I_{xy} = 0$

The product of inertia is zero.

$$I_{xy} = \int xydA = o$$

(b)In a beam subjected to bending the line of zero stress; a transverse section of the longitudinal plane, or neutral surface, which passes through the centre of area of the section.

$$\tan\alpha = -\left[\frac{I}{I_{vv}}\tan\theta\right]$$

Where α =The angle of the straight line passing through the centroid G of the section, which is inclined with UU.

2. Explain how unsymmetrical bending is developed in a beam?

(i) The section is symmetrical like I section, rectangular section, circular section, but he load-line is inclined to both the principal axes.

(ii) The section itself is unsymmetrical like angle section or a channel section and load line is along any centroidal axis.

3. Write down the expression for orientation of neutral axis of beam with unsymmetrical cross section in z-x plane and subjected to bending moments Mx and Mz.

$$\tan\alpha = \frac{M_z I_{xx} - M_x I_{xz}}{M_x I_{zz} - M_y I_{xz}}$$

4. Bending of a symmetric section subject to a skew load will be (symmetric / un-symmetric) Explain.

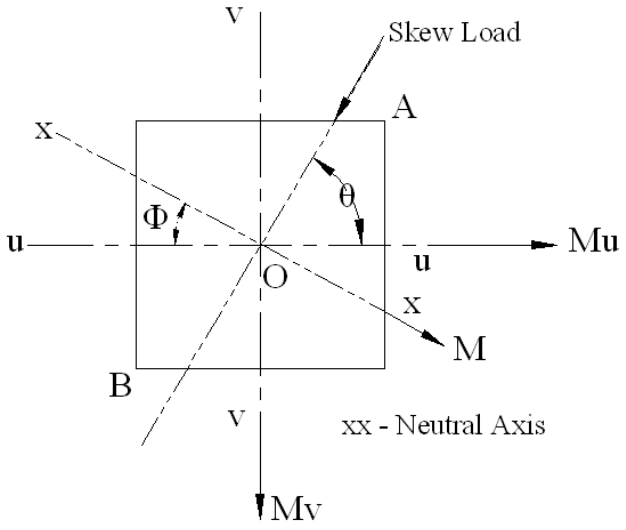
Ans. Un symmetric.

When the trace of the plane of the applied moment does not coincide with any of the principal axes of inertia then this type of bending is called un-symmetrical or non-uni-planar bending.

5. In unsymmetrical bending, the neutral axis passes through the centroid of the cross section. (True/false).

Ans.; True.

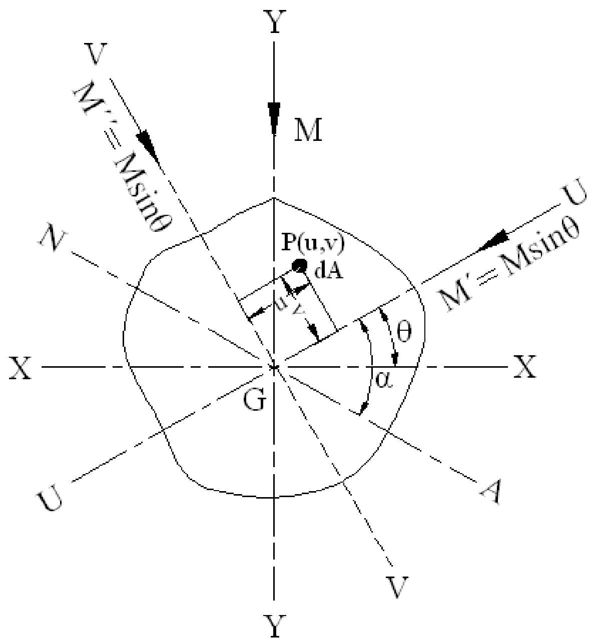
6. A rectangular cross section is subject to a skew load. Mark the neutral axis and sketch the bending stress distribution.



Bending stress at A = Tensile

Bending stress at B = Same at A, but compressive

7. Explain anyone method to obtain the bending stress due to unsymmetrical bending.
Principal axis method


Y
V
M
M'' = Msinθ
U
M' = Msinθ
N
P(u,v)
dA
u
v
θ
X
X
α
G
U
A
V
Y

$\lfloor \ I_{UU} \qquad I_{vv} \ \rfloor$

8. When does unsymmetrical bending takes place?

   a. The section is symmetrical like I section, rectangular section, circular section, but he load-line is inclined to both the principal axes.
   b. The section itself is unsymmetrical like angle section or a channel section and load line is along any centroidal axis.

9. A beam bends about its neutral axis for both symmetrical and unsymmetrical bending. (True/ False)

   Ans.: True.

UNIT 2

10. What is unsymmetrical bending?

    If the load line on a beam does not coincide with one of the principal axes of the section, the bending takes place in a plane different from the plane of principal axis. This type of bending is known as unsymmetrical bending.

11. What is symmetrical section?

    The size and shape of the object is same to the left or right or both sides of the axis, the section is known as symmetrical section.

12. What is principal planes and principal stresses.

    There are always three mutually perpendicular planes along which the stresses at a certain point (in a body) can be resolved completely into stresses normal to these planes. These planes which pass through the point in such a manner that the resultant stress across them is totally a normal stress are known as principal planes and normal stresses across these planes are termed as principal stresses.

9. What is a beam?

   (i) A bar which is loaded transversely.
   (ii) Rolled or extruded sections of certain profiles. e.g I-beam

10. What is a column?

    A vertical pillar or shaft of cast iron, forged steel, steel plate in box section, stone timber etc., used to support a compressive load.

11. What is strut?

    Any light structural member or long column which sustains an axial compressive load. Failure occurs by bending before the material reaches its ultimate compressive stress.

12. What is stress?

    When a body is acted upon by same load or external force, it undergoes deformation [(i.e) Change in shape or dimensions], which increases gradually. The internal resistance which the body offers to meet with the load is called stress.

13. Classify stress.

    (a) Simple or direct stress
        (i) Tension
        (ii) Compression
        (iii) Shear
    (b) Indirect stress
        (i) Bending
        (ii) Torsion
    (c) Combined stress

Any possible combination of above types.

14. What is symmetrical section?

The size and shape of the object is same to the left or right or both sides of the axis, the section is known as symmetrical section.

UNIT 3

15. State structure.

Structure is composed of several bars or rods jointed together in a particular fashion.

Members under tension is called tie.

Members under compression is called strut.

16. Differentiate beams and columns

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Beam	Column
1. Horizontal member 2. Transverse load	1. Vertical member 2. Axial load

17. Differentiate Truss and frame

Truss	Frame
Truss is defined as number of members riveted together to carry the horizontal, vertical and inclined loads in equilibrium.	Frame is defined as number of members welded together to carry the horizontal, vertical loads in equilibrium.

18. Differentiate the perfect and imperfect frames?

Sl.No.	Perfect frame	Imperfect frame

1. 2. 3.	Perfect frame have sufficient frame or enough members to carry the load. It satisfies the formula n= 2j-3. Eg. Triangular frame. n=3, j=3 n=2j-3 3=2x3-3, 3=3	Imperfect frame have less or more members to carry the load than the required numbers. It does not satisfy the formula n= 2j-3. Eg. Square frame n=4, j=4 n=2j-3 4=2x4-3, 4≠5

19. Differentiate the deficient frame and redundant frame?

Sl.No.	Deficient frame	Redundant frame
1.	If the number of members are less than the required of members. n < 2j-3	If the number of members are more than the required number of members. n > 2j-3

UNIT 4

20. Define plane truss and space truss. Give some examples.

A plane truss is a two dimension truss structure composed of number of bars hinged together to form a rigid frame work, all the members are lie in one plane. Eg.: Roof truss in industries.

A space truss is a three dimension truss structure composed of number of bars hinged together to form a rigid frame work, all the members are lie in different plane. Eg.: Transmission line towers, crane parts.

25. What are the methods used to analyze the plane & space frames?

- Analytical method
  1. Method of joints
  2. Method of sections (method of moments)
  3. Tension co-efficient method.
- Graphical met

26. Give relation between the number of members and joints in a truss and explain its uses.

n=2j-3, where n= number of members, j= number of joints. This relation is used to find the type of the frames. Perfect frame is only solved by method of joints.

27. What are the hints to be followed while analyzing a cantilever truss using method of joints?

- There is no need to find the support reactions.
- The analysis is to be started from the free end where there is a maximum of two unknown forces, using the condition of equilibrium $\Sigma Fx = 0$ and $\Sigma Fy = 0$.
- All the members are assumed to be tensile.
- Consider tensile forces as positive and compressive as negative.
- The force convention is, upward force assigns positive sign and downward force assigns negative sign.

28. What are assumptions made in the analysis of a truss?

1. In a frame or truss all the joints will be pin jointed.

2. All the loads will be acting at the joints only.

3. The self-weight of the members of the truss is neglected. Only the live load is considered.

4. The frame is a perfect one

UNIT 5

29. What are the types of framed structures? Explain each type?

(1)Efficient or perfect structure:

A structure is said to be perfect. It satisfies the equations

n=2j-3

n=no of member

j=no of joints

(2) Deficient or imperfect structure:

A structure is said to be deficient, when

$n<2j-3$

(3) Redundant frame:

If a structure is said to be redundant, when

$n > 2j-3$

30. What is cantilever truss? What is simply supported truss?

If anyone of the member of the truss is fixed and the other end is free, it is called a cantilever truss. There is no reaction force at the fixed end.

31. What are the conditions of equilibrium used in the method of joints? Why?

The conditions of equilibrium used in the method of joints are, $\Sigma Fx = 0$,

$\Sigma Fy = 0$. One of the assumptions is all the joints are pin jointed, there is no moment. The equilibrium condition $\Sigma Mx = 0$ is not used.

32. Explain with examples the statically determinate structures.

If the structure can be analyzed and the reactions at the support can be determined by using the equations of static equilibrium such as $\Sigma Fx = 0$, $\Sigma Fy = 0$ and $\Sigma Mx = 0$, then it is called as a statically determinate structure. Example: Simply supported beam, pin jointed truss nor frame.

33. Differentiate the statically determinate structures and statically determinate structures.

Sl.No.

	Statically determinate structures	Statically indeterminate structures

1.	Conditions of equilibrium are sufficient to analyze the structure	Conditions of equilibrium are insufficient to analyze the structure.
2.	Bending moment and shear force is independent of material and cross sectional area.	Bending moment and shear force is dependent of material and independent of cross sectional area.
3.	No stresses are caused due to temperature change and lack of fit.	Stresses are caused due to temperature change and lack of fit.

34. Where are truss type structures found in an aircraft?

Fuselage, Bi-plane, Tri-plane and wing etc.,

35. Define neutral axis?

Neutral axis is defined as the line of intersection of the neutral layer with the transverse section. Then the stress will be compressive at any point above the neutral axis and tensile below the neutral axis.