Strength of materials essay

SELVAM COLLEGE OF TECHNOLOGY, NAMAKKAL – 637 003 DEPARTMENT OF MECHANICAL ENGINEERING YEAR/SEM: II/ IV STRENGTH OF MATERIALS Two marks questions UNIT-I 1. Define tensile stress and tensile strain. The stress induced in a body, when subjected to two equal and opposite pulls, as a result of which there is an increase in length, is known as tensile stress. The ratio of increase in length to th original length is known as tensile strain. p p 2. Define compressive stress and compressive strain.

The stress induced in a body, when subjected to two equal and opposite pushes, as a result of which there is an decrease in length, is known as compressive stress. The ratio of increase in length to th original length is known as compressive strain. p p 3. Define shear stress and shear strain. p p The stress induced in a body, when subjected to two equal and opposite forces, which are acting tangentially across the resisting section as a result of which the body tends to shear off across the section is known as shear stress and corresponding strain is known as shear strain. 4.

Sketch a composite bar Material-1 Material-1 Material-2 A bar made up of two or more bars of equal length but of different materials rigidly fixed with each other behaving as one unit for extension or for compression when subjected to an axial tensile or compressive load is called as a composite bar. 5. Give example for ductile, brittle and malleable materials. Ductile materials Brittle materials Malleable materials 6. Define Poisson’s ratio The ratio of lateral strain to the linear strain is a constant for a given material, when the material is stressed within the elastic limit.

This ratio is Poisson's ratio and it is generally steel, copper wrought iron cast iron Poisson's ratio 7. Write the relationship between modulus of elasticity, modulus of rigidity and Poisson's ratio The relationship between modulus of elasticity, modulus of rigidity and Poisson's ratio is given by E= Modulus of elasticity C= Modulus of rigidity Poisson's ratio 8. If the strain in three mutually perpendicular directions are ex, ey and ez then what is the value of volumetric strain? = ex+ey+ez = (Px+Py+Pz) = volumetric strain E= young's modulus

Px+Py+Pz = stresses along x, y z and directions 1/m = poisson's ratio 9. State Hooke's law. Hooke's law is stated as when a material is loaded within elastic limit, the stress is proportional to the strain produced by stress, or Stress/strain= constant. This constant is termed as modulus of elasticity. 10. Define stress and strain. Stress: The force of resistance per unit area, offered by a body against deformation is known as stress. Mathematically stress is written as f= P/A Where f= stress P= external force or load A= cross-sectional area.

Unit of stress: stress is represented in N/m2 Strain: The ratio of change in dimension to the orginal dimension when subjected to an external load is termed as strain and is denoted by e. It has no unit. 11. Define modulus of rigidity The ratio of shear stress to the corresponding shear strain when the stress is within the elastic limit is known as modulus of rigidity or shear modulus and is denoted by C or Gor N = 12. Define modulus of elasticity. The ratio of tensile stress or compressive stress to the corresponding strain is known as modulus of elasticity or young's modulus and is denoted by E. = E 13. Define Bulk modulus.

When a body is subjected to an uniform direct stress in all the three mutually perpendicular directions, the ratio of the direct stress to the corresponding volumetric strain is found to be a constant is called as the bulk modulus of the material and is denoted by K. K= 14. Define longitudinal strain and lateral strain. = Longitudinal strain: longitudinal strain is defined as the deformation of the body per unit length in the direction of the applied load. Longitudinal strain= Where L= length of the body. P= tensile force acting on the body dL= increase in the length of the body in the direction of P 15.

Draw the stress-strain curve for a 1. Ductile material 2. Brittle material 16. Define factor of safety It is defined as the of ultimate stress to the working stress or permissible stress. Factor of safety = 17. State the two conditions employed in solving a composite bar subjected to an axial load. Two conditions employed in solving a composite bar are 1. P= f1A1 + f2 A2 2. e= f1/E1 + f2/E2 Where P = total load e= strain f1 and f2 = stress set up in the respective materials. E1 and E2 = modulus of elasticity of the respective materials. Give the relationship between modulus of elasticity, modulus of rigidity and bulk odulus. E= Where E= young’s modulus K= bulk modulus C= rigidity modulus 18. Give the relationship between modulus of elasticity, bulk modulus and poisson’s ratio. Where E = Young’s modulus K = Bulk modulus = Rigidity modulus 19. What is stability? The stability may be defined as an ability of a material to withstand high load without deformation. Strain energy 20. Give example for gradually applied load and suddenly applied load. Example for gradually applied load When we lower a body with the help of a crane, the body first touches the platform on which it is to be placed.

On further releasing the chain, the platform goes on loading till it is fully loaded by the body. This is the case of gradually applied load. Example for suddenly applied load When we lower a body with the help of a crane, the body is first of all, just above the platform on which it is to be placed. If the chain breaks at once at this moment the whole load of the body begins to act on the platform. This is the case of suddenly applied load. 21. What is resilience? The strain energy stored by the body within elastic limit, when loaded externally is called resilience. 2. Define modulus of resilience. The proof resilience per unit volume of a material is known as modulus of resilience. Modulus of resilience = Where = proof stress or maximum stress E = young's modulus 23. Write the expression for strain energy stored in an axially loaded bar. Strain energy, U = Where P = direct stress E = modulus of elasticity V = volume of bar. 24. Define strain energy. Strain energy is the energy absorbed or stored by a member when work is done on it to deform it. 25. What is the maximum stress in a uniform bar when it is suddenly loaded axially?

The maximum stress intensity due to suddenly applied load is twice the stress intensity produced by the load of the same magnitude when applied gradually. If the stress induced in a body is p, then the strain energy stored in the body is ————————U= V—volume E = young's modulus Define strain energy in the case of bending. Strain energy = M = bending moment E= young's modulus I= moment of inertia 26. Distinguish between suddenly applied and impact load. When the load is applied all of a sudden and not step wise is called is suddenly applied load.

The load which falls from a height or strike and body with certain momentum is called falling or impact load.. 27. Define proof resilience? The maximum strain energy stored in a body up to elastic limit is known as proof resilience. Proof resilience = Where = proof stress or maximum stress V = volume Write the expression for strain energy in a body due to shear stress? U= Where q= shear stress C = modulus of rigidity V = volume of a body 28. Write the equation for stress induced in a body by the application of load with impact? Stress (f) = Where p= load h= falling height l = length A= cross- sectional area 29. Define strain energy density.

Strain energy density as the maximum strain energy stored in a material within the elastic limit per unit volume. It is also known as modulus of resilience. UNIT-II 1. BENDING OF BEAMS 1. State the relationship between shear force and bending moment. The rate of change of bending is equal to the shear force at the section. = F F = shear force M = bending moments 2. What are the different types of beams? 1. Cantilever beam: A beam which is fixed at one end and at the other end is known as cantilever beam. 2. Simply supported beam: A beam supported or resting freely on the supports at its both end is known as simply supported beam 3.

Fixed beam: A beam whose both end are fixed or built-in walls is known as fixed beam. 4. Overhanging beam: if the end portion of a beam is extended beyond the support is known as overhanging beam. 5. Continuous beam: A beam which is having more than two supports is known as continuous beam 3. Draw the shear force and bending moment diagrams for a cantilever beam subjected to point load at the free end. 4. Draw the shear force and bending moment diagrams for a cantilever beam subjected to uniformly distributed load. 5. Name the various types of load. 1. concentrated load or point load 2.

Uniformly load 3. Uniformly distributed load 6. Define shear force at a section of a beam. The algebraic sum of the vertical force at any section of a beam to the right or left of the section is known as shear force. 7. Define bending moment at a section of a beam. The algebraic sum of the moments of all the force acting to the right or left of the section is known as bending of the beam. 8. What is meant by point of contraflexure? It is the point where the bending moment is zero where it change sign from positive to negative or vice –versa. 9. Mention the different types of supports? . Fixed support 2. Hinged support 3. Roller support 10. State the relationship between the load and shear force. The rate of the change of shear force is equal to the loading = -W 11. What will be the shape of bending moment and shear force diagrams for different types of load. Types of load Point load Uniformly load Uniformly distributed load S. F. D Rectangle Triangle Second degree curve BM. D Triangle Second degree curve Third degree curve 12. Define clear span and effective span. The horizontal distance between the supporting walls is called the clear span of the beam.

The horizontal distance between the lines of action of end –reaction is called effective span. 13. A simply supported beam is subjected to u. d. l of w per unit length throughout its length L. write the value maximum bending moment. Maximum bending moment= 14. A cantilever beam is subjected to u. d. l of w per unit length throughout its length L. write the value maximum bending moment. Maximum bending moment. UNIT-II BENDING AND SHEAR STRESSES 15. What is section modulus? The ratio of Moment of Inertia of a section about the neutral axis to the distance of the outer most layer from the neutral axis is known as Section Modulus.

It is denoted by Z. Z 16. What is moment of resistance? The couple produced in a flexural member due to internal forces is called as moment of resistance. 17. Sketch the bending stress distribution across a symmetrical section. d NA – Neutral Axis C – Compression T – Tension 18. State the theory of simple bending? If a length of a beam is subjected to a constant bending moment and no share force (i. e. zero shear force) then the stresses will be set up in that length of the beam due to B. M. only and that length of the beam is said to be in pure bending or simple bending.

The stresses set up in that length of beam are known as bending stress. 19. Write the bending equation? = M = bending moment Q or f = bending stress I = moment of inertia about N. A. Y = distance of the fibre from N. A. R = radius of curvature E = young's modulus of beam 20. The rectangular section is subjected to a transverse shear force. Sketch the shape of shear stress distribution. b qmax = = 1. 5X q average 21. What are the assumptions made in the theory of simple bending? 1. The material of the beam is perfectly homogeneous and isotropic. 2.

The beam material is stressed, within its elastic limit and thus obeys Hooke's law. 3. The transverse sections, which were plane before bending, remain plane after bending also. 4. Each layer of the beam is free to expand or contract, independently, of the layer, above or below it. 22. A cantilever beam of span 3 m carries a point load of 10 kN at the free end. What is the value of support moment? The value of support moment = 3 X10 = 30 kNm

23. What is the maximum value of shear stress in a circular cross – section? At neutral axis the maximum shear stress occurs. Maximum shear stress.

Qmax = where, F-shear force R- Radius of circle qmax 24. Define neutral axis of a cross section The line of intersection of the neutral surface on a cross-section is called the neutral axis of a cross-section. There is no stress at the axis. 25. What is the maximum Value of shear stress in a triangular section? qmax = Where, b = base width; h = height The shear stress is maximum at a height of h/2 26. Write the shear stress at any point (or in a fibre) in the cross-section of a beam when subjected to a shear force F? qmax = Where, A = area of the section above the fibre. distance of the C. G. of the area A from N. A. b = actual width at the fibre I = moment of inertia of the section about N. A. 27. Write the shear stress distribution across a (i) Rectangular section (ii) Circular Section. (i) Rectangular Section b q Where fs d = depth of the beam Y = distance of the fibre from N. A The shear stress distribution across a rectangular section is parabolic. (ii) Circular Section q fs Where R = radius of the circular section. Draw the shear stress distribution diagram for a I- section. 28. Write the section modulus for the following section: 1. 2. 3. 4. 1.

Rectangular section: I = Rectangular section Circular section Hollow circular section Triangular section Y max= Z= 2. Circular section: I = = , Y max= Z= 3. Hollow Circular section: I Extreme fiber distance Y max= Z= = = 4. Triangular Circular section: I = Y max = Z= h = UNIT= III 1. TORSION 1. Define torsion A shaft is said to be in torsion, when equal and opposite torques are applied at the two ends of the shaft. The torque is equal to the product of the force applied (tangentially to the ends of a shaft) and radius of the shaft. 2. What are the assumptions made in the theory of torsion? i) (ii) (iii) (iv) The material of the shaft is uniform throughout. The twist along the shaft is uniform. Normal cross sections of the shaft, which were plane and circular before twist, remain plane and circular after twist. All diameters of the normal cross section which were straight before twist, remain straight with their magnitude unchanged, after twist. 3. Write torsional equation. = Where, T—- torque = Ip— polar moment of inertia fs—- Shear stress G— Modulus of rigidity l—- Length of the shaft — Angle of twist (in radins) 4. Write the expression for power transmitted by a shaft.

Watts Where N— speed of the shaft in rpm T—Mean torque transmitted in Nm P—- Power 5. The torque transmitted by a hollow shaft is given by ___________ T Where fs fs— maximum shear stress induced at the outer surface. — External diameter —internal diameter 6. Define polar modulus. Polar modulus is defined as the ratio of the polar moment of inertia to the radius of the shaft. It is also called torsional section modulus and is denoted by Zp. Mathematically, Zp = = 7. Write the Polar Modulus (i) for a solid shaft and (ii) for a hollow shaft. For a Solid Shaft.

Zp = = = Where J= Zp = D4 D3 = = 8. Define torsional rigidity Let a twisting moment T produce a twist of radian in a length l then = = The quantity of GIp is called torsional rigidity Where G—modulus of rigidity of the material. 9. Why hollow circular shafts are preferred when compared to solid circular shafts? Comparison by strength; The torque transmitted by the hollow shaft is greater than the solid shaft, thereby hollow shaft is stronger than the solid shaft. Comparison by weight: For the same material, length and given torque, weight of a hollow shaft will be less.

So hollow shafts are economical when compared to solid shafts, when torque is acting. 10. What is the equivalent torsion and equivalent bending moment for a shaft subjected to moment M and torque T.? Me= Te= Where Me — equivalent bending moment Te – equivalent torque M—bending moment T—torque 11. Write the equation for strain energy stored in a shaft due to torsion. For solid shaft= XV For a hollow shaft= Where XV D—external diameter of shaft d—internal diameter of shaft C—modulus of rigidity q—shear stress on the surface of the shaft V—volume of shaft. 2. SPRINGS 12. Distinguish between close and open helical coil springs.

If the angle of the helix of the coil is so small that the bending effects can be neglected, then the spring is called a closed –coiled spring. Close –coiled spring is a torsion spring ( ). The pitch between two adjacent turns is small. If the slope of the helix of the coil is quite appreciable then both the bending as well as torsional shear stresses are introduced in the spring, then the spring is called open coiled spring. 13. Write the expression for vertical deflection of the closed-coiled helical spring due to axial load W. Vertical deflection Where W—load G—modulus of rigidity R—mean radius of spring coil. —diameter of spring wire N—number of coils 14. Define stiffness of a spring? In what unit it is measured? Stiffness of a spring is defined as load per unit deflection. It is denoted by K and unit is N/mm. 15. What is a spring? State various types of spring. Springs are elastic members which distort under load and regain their original shape when load is removed. Types of springs: 1. Helical springs a. Closed-coiled spring b. open-coiled helical spring 2. Leaf spring a. full-elliptic b. semi elliptic , c. cantilever 3. Torsion spring 4. Circular spring 16. State the types of stresses when a closed-coiled spring is subjected to 1. . 1. Axial load Axial twisting moment torsion (neglecting the effects of bending and direct pure bending Axial load: shear) 2. Axial twisting moment: 17. What is the value (i) maximum shear forces (ii) central deflection in a leaf spring subjected to an axial force? Maximum shear stress: Central deflection Where W= point load acting at the centre l- Length of the spring n- Number of plates b- Width of each plate t- Thickness of each plate 18. Write the expression for (i) strain energy and (ii) stiffness for a closed-coiled helical spring which carries an axial load. (i) Stiffenss of spring

Where W- axial load on the spring n- Number of coils R- Mean radius of spring coil d- Diameter of spring wire 19. What is the value of maximum shear stress in a close-coiled helical spring subjected to an axial force? Where W- Axial load on the spring R-mean radius of spring coil d- Diameter of spring wire 20. What kind of stress introduced when an axial load acts on a close and open coiled spring. Close coiled helical spring Open coiled helical spring —shear stress —bending stress shear stress 21. Write the equation for the deflection of an open coiled helical spring subjected to an axial load W.

Deflection — Helix angle 22. What is meant by spring constants or spring index? Ratio of mean diameter of the spring to the diameter of the wire. 23. The stiffness of the spring is 10N/mm and the axial deflection is 10mm. what is the axial load on the spring? Stiffness, K = load/deflection 10= W/10 W= 100N. Unit-IV BEAM DEFLECTION 1. Write the maximum value of deflection for a cantilever beam of length of length L, constant EI and carrying concentrated load W at the end. Maximum deflection at the end of a cantilever due to the load = WL3/3El 2.

Write the maximum value of deflection for a simply supported beam of a length L, constant EI and carrying a central concentrated load W. Maximum deflection at a mid span of simply supported beam due to a central load 3. Write the value of fixed end moment for a fixed beam of span L and constant EI carrying central concentrated load W. Fixed end moment due to central concentrated load W = 4. What are the different methods used for finding deflection and slope of beams? (i) (ii) (iii) (iv) (v) Double integration method Mecaulay's method Strain energy method Moment area method Unit load method . State the two theorems in moment area method. Mohr's Theorem-I: the angle between tangents at any two points A and B on the bend beam is equal to total area of the corresponding position of the bending moment diagram divided by EI. = Mohr's Theorem-II: The deviation of B from the tangent at A is equal to the statically moment of the B. M. D. area between A and B with respect to B divided by EI. 6. Write the differential equation of deflection of a bent beam. EI Where Mx = B. M. at the section x – x EI = Flexural rigidity 7. What is meant by elastic curve?

The deflected shape of a beam under load is called elastic curve of the beam, within elastic limit. 8. When Mecaulay's method is preferred? This method is preferred for determining the deflections of a beam subjected to several concentrated loads or a discontinuous load. 9. What are the boundary conditions for a simply supported end? The boundary conditions for a simply supported end beam are: (i) (ii) (iii) Deflection at the support is zero. Slop exists at all points except at the point where deflection is maximum. Bending moment is zero at the support. = Mx 10. What are the boundary conditions for a fixed end?

Both deflection and slope at the fixed support are zero. 11. What is meant by Double-Integration method? Double-integration method is a method of finding deflection and slope of a bent beam. In this method the differential equation of curvature of bent beam, EI = M is integrated once to get slope and twice to get deflection. Here the constants of integration C1 and C2 are evaluated from known boundary conditions. 12. Define the term slope. Slope at any point on the bent beam is the angle through which the tangent at that point makes with the horizontal. 13. What is meant by deflection of beams?

When a flexural member is subjected to transverse loads, the longitudinal axis of the beam deviates from its original position because of the bending of the beam. This deviation at any cross section is called as deflection. 14. What are the values of slop and deflection for a cantilever beam of length ‘ l’ subjected to load ‘ W’ at free end? Slope, = Deflection, 15. How the differential equation is written for the beams of varying cross section? If a beam is of varying cross-section and varies uniformly according to some law, the expression EI functions of x. 16. When do you prefer Moment Area Method?

Even though the moment area method can be used for problems on slopes and deflections, it is convenient to use this method for the following types of problems (with varying cross-section) (i) (ii) (iii) Cantilever beams Simply supported beams carrying symmetrical loading Beams fixed at both ends. = Mx can be arranged in the form = in which Mx and Lx are 17. What is the value of maximum deflection for a fixed beam of span ‘ l’, carrying concentrated load W at midspan? Maximum deflection under the load = 18.

What is the value of maximum deflection for a fixed beam of span ‘ l’, carrying uniformly distributed load W per meter run?

Maximum deflection at mid span = 19. What is the slope at the support for a simply supported beam of constant EI and span L carrying central concentrated load? Slope at the support due to central concentrated load, w = 20. Write the support moment for a fixed beam of constant EI and span L carrying uniformly distributed load W per unit length over the entire length. Support moment due to u. d. l = 21. A cantilever beam of constant EI and span L carries a u. d. l of W unit length throughout its length, what is the slope at the free end? Slope at the free end = 22.

Write the deflection at the free end of a cantilever beam of constant EI and span L carrying u. d. l of W/meter length. Maximum deflection at the free end of a cantilever due to u. d. l of W/m = 23. What is meant by determinate beams? The beams whose external reacts can be determined with the help of equations of static equilibrium alone are called determinate beams. 24. What is meant by indeterminate beams? The beams whose support reactions cannot be obtained with the help of static equations of equilibrium alone are called indeterminate beams. 25.

Give examples for determinate and indeterminate beams Determinate beams: cantilever and simply supported beams Indeterminate beams: fixed end beams, continuous beams and propped cantilever beams. 26. What are the values of slope and deflection for a cantilever beam of length l subjected to moment M at the free end? 27. What are the values of slope and deflection for a simply supported beam of length l subjected to moment at both the ends. Slope at AB = Defection at c= 28. There are two beams one simply supported and other fixed beam carry concentrated load W at the mid span. Their spans are equal. Compare deflections.

Simply supported beam: Y max = (under load) Fixed beam: Y max = (under load) Hence, maximum deflection for fixed beam = ? max. Deflection for supported beam. 29. A cantilever beam AB of length l is carrying a distributed load whose intensity varies uniformly from zero at the free end to W per unit area at the fixed end. The deflection at the free end is ————— and the slope at the free end is —————– W/unit l Deflection at B, Y max = = Slope B 30. Write the differential equation to the deflection curve for simply supported beam of constant EI carrying uniformly distributed load W throughout the span.

Mx = EI x- W EI = Mx EI = x- W RA = RB = 31. A cantilever of span L carries u. d. l w/m and propped at the free end. What is the prop reaction? L Cantilever carrying a uniformly distributed load of W per unit run propped at B is shown. The downward deflection of B due to the u. d. l(in the absence of the prop) YB = The upward deflection of B due to the prop reaction R(in the absence of load) YB = Equating for Y B , we get = R= 3/8 WL 32. A cantilever of span l carries a concentrated load W at the centre of the beam and propped at the free end. What is the prop reaction?

The downward deflection of B due to the u. d. l (in the absence of the prop) YB = The upward deflection of B due to the prop reaction R (in the absence of load) Y’ B = Equating for Y B , = Y’ B we get = R = UNIT-IV COLUMNS AND STRUTS 33. What is column? Column is a vertical structural member subjected to a compressive load and its length is relatively long in proportion to their cross- sectional dimensions. 34. Differentiate between short column and long column. A column is said to be short column if the ratio of the effective length to its least lateral dimension does not exceed 12.

A column is said to be long column when the ratio of the effective length to its least lateral dimension does not exceed 12. 35. A short column fails due to crushing 36. A long column fails due to buckling 37. Distinguish between a column and a strut. Column is a vertical compression member whereas strut is an inclined compression member. 38. Write the crippling load and effective length for column for different and condition. Different end condition 1 Both end of the column are pinned or hinged Crippling load Effective length(le) le = 1 P= 2 Both ends are fixed P= = le = 1/2 3 One end fixed other end is free le = 2l One end fixed other end is pinned le = 39. Define crippling load? The load at which the column just buckles is called " buckling load" this is also known as critical load or crippling load. 40. What is effective length of column? The effective length of a given with given end condition is the length of an equivalent column of the same material and section with hinged ends having the value of the crippling load to that of the given column. 41. Define slenderness ratio? The ratio between the effective length to the least radius of gyration is called slenderness ratio. Slenderness ratio: where L— effective length

K- – radius of gyration = 42. What Are the Limitations of Euler's Formula? Crippling Load = Crippling stress = = Where K- – radius of gyration = Here as L/K increases, the crippling stress decreases, and if L/K decreases, and if L/K decreases, the stress increases. Hence only for larger values of slenderness ratio (L/K), we can use Euler's formulae. Hence we can say the Euler's formulae are valid for only long columns. 43. What is the critical load for a column due to rankines formula? P= f c – crushing stress for the material L- Effective length of the column a-rankines constant A-area of the cross section. 4. Rankines formula is used for finding critical load for long and short column. 45. Write Gordon's formula for the critical load o the column? P= a1- Gordon's constant = ab2/K2 b-overall least dimension a1-rankines constant 46. Write Johnson straight line and Johnson's parabolic formula: Johnson straight line and formula: P = A Johnson's parabolic formula: P = A – Compressive yield stress r- Constant depends upon the material and upon the end conditions. 47. What are the assumptions made in Euler's theory to arrive at buckling load on column?

The material of the column is homogeneous and isotropic The linear relationship between stress and strain exists and critical load is correct only if the proportionality limit of the material is not exceeded. The column is initially straight and is axially loaded and the column section is uniform The column fails by buckling alone. The direct stress is very small compared to the bending stress at the buckling stage. 48. Find a short column crushing load is less than the crippling load. State true or false. True 49. Write radius of gyration for a solid circular cross section at diameter d K= /4 = r/8 = 50. What is a beam column? It is a member which is subjected with axial thrust and lateral loads. 51. Write the equation for Euler's critical stress. scr = = 52. Define core or kern of the section. Core: The middle portion of a section Kern: it is an area within which the line of action of the force p must cut the cross section if the stress is not to become tensile. Rectangular section kern is b/6 and circular section kern is d/4 d 53. Give the parameters influencing buckling load of a long column? 1. Moment of inertia 2. Young's modulus 3. Length of column 4. Support condition.

UNIT-V ANALYSIS OF STRESSES IN TWO DIMENSIONS Part-1: THIN CYLINDERS AND SHELLS 1. Distinguish between thin walled cylinder and thick walled cylinder? In thin walled cylinder, thickness of the wall of the cylindrical vessel is less than 1/15 to 1/20 of its internal diameter. Stress distribution is uniform over the thickness of the wall. If the ratio of thickness to its internal diameter is more than 1/20, then cylindrical shell is known as thick cylinders. The stress distribution is not uniform over the thickness of the wall. 2. What are the two type of stress developed in thin cylinder subjected to internal pressure. 1.

Hoop stress 2. Longitudinal stress 3. Define hoop and longitudinal stress Hoop stress: The stress acting along the circumference of the cylinder is called circumference or hoop stress Longitudinal stress: The stress acting along the length of the cylinder is known as longitudinal stress 4. Write the expression for hoop stress and longitudinal stress in thin cylinder due to pressure p Circumferential stress or hoop stress: fh (or) f1 = Longitudinal stress: fl (or) f2 = 5. Write the maximum value of shear stress in thin cylinder. The maximum shear stress: = Where P-internal fluid pressure d-diameter t-thickness of the cylinder. . The longitudinal stress set up in a thin walled cylinder is 20N/mm2. The hoop stress is ———Longitudinal stress= half of Hoop stress Hoop stress = 40N/mm2 7. For what purpose are the cylindrical and spherical shells used? The cylindrical and spherical shells are used generally as containers for storage of liquids and gases under pressure.

8. When is the longitudinal stress in a thin cylinder is zero? In case of cylinders with open ends, e. g. in a pipe with water flowing through it under pressure, longitudinal stress is zero. 9. What are assumptions made in the analysis of thin cylinders? Radial stress is negligible.

Hoop stress is constant along the thickness of the shell. Material obeys Hooke's law. Material is homogeneous and isotropic. 10. What is the operating pressure in a thin cylinder and thick cylinder? For thin cylinder the operating pressure is up to 30MN/m2 For thick cylinder the operating pressure is up to 250MN/m2 or more. 11. write the change in diameter and change in length of a thin cylindrical shell due to internal pressure, P. Change in diameter jd = Change in length jL = Where P= internal pressure of fluid D= diameter of the cylindrical shell t = thickness of the cylindrical shell L= length of cylindrical /m = Poisson ratio 12. Write the volumetric strain 1. Thin cylindrical shell 2. Thin spherical shell 1. Thin cylindrical shell Volumetric strain: jV/V == 2. Thin spherical shell Volumetric strain: jV/V == UNIT-V ANALYSIS OF STRESSES IN TWO DIMENSIONS PART-2: PRINCIPAL STRESSES AND STRAINS 13. Define principal planes. The planes on which no tangential or shear stresses are acting are called as principal planes. 14. Define principal stress. The normal stress acting on principal planes is called principal stress. 15. What is the value of value maximum shear stress when the principal stresses are P1 and P2?

Maximum shear stress, tmax = Where p1 and p2 are tensile or compressive principal stresses If p1 is compression and p2 is tension then Maximum shear stress, tmax = 16. What is the radius of Mohr's? Radius of Mohr's circle is the maximum shear stress. 17. The principal stress is normal to the plane and the shear stress is tangential to the plane. 18. The angle between principal planes and the planes of maximum shear stress is 450 19. The angle between the principal planes is 900 20. Give two methods to compute principal stresses? 1. Analytical method 2. Graphical method 21. The shear stress on a principal plane is zero. 2. In case of a unidirectionaliy loaded member on which plane will be the maximum normal stress? Maximum normal stress occurs at = zero. 23. on which plane in a bar located axially, the shear stress would be maximum. s 1= s/2 = 450 and 1350 and is equal to s/2 Maximum shear stress occurs at 24. What is the maximum shear stress at a point if the two principal stresses at that point are known? s s max = s1- s2/2 max = maximum shear stress s1 &s2= principal stresses 25. An element is subjected to shear stress q only. Write the value of principal stress. Shear stress q = Where s/2 s = principal stresses