Total Printed Pages : 4

Roll No. .....

E-3014

B. E. IV Semester (Main & Re-Exam) July, 2013

ADVANCE SOLID MECHANICS

Branch : ME

(New Course)

Time : Three Hours]

[Maximum Marks : 75/50
[Minimum Marks : 30/20

Note : Attempt ***all*** the questions of **Section – A**, ***four*** from **Section – B** and ***three*** questions from **Section – C**.

SECTION – A

[1.5 × 10 = 15

[1 × 10 = 10

(Objective Type Question)

Note : Attempt ***all*** questions from this Section.

1. Polar modulus of the shaft section is the ratio of ..... .

2. Poisson ratio is defined as ..... .

3. When both ends of column are fixed, then crippling load, P will be ..... .

4. Volumetric strain of a sphere of diameter *d* is equal to ..... .

5. Hoop stress is defined as ..... .

6. Effective length and actual length of a column will be equal under the condition ..... .

P. T. O.

7. Torsional moment of resistance of a shaft is defined as ..... .

8. Principal strain is the ratio of ..... .

9. Relation between the modulus of elasticity and modulus of rigidity ..... .

10. For a given maximum shear stress the minimum diameter required for a solid circular to transmit P KW at N rpm is equal to ..... .

SECTION – B

[6 × 4 = 24

[4 × 4 = 16

(Short Answer Type)

Note : Answer any *four* questions.

1. Calculate the size of a square shaft to transmit 75 KW at 120 rpm if shear stress is not to exceed 50 N/mm^2.

2. A pipe of 200 mm internal diameter and 100 mm thickness contains a fluid at a pressure of 6 N/mm^2. Calculate the maximum and minimum hoop stress across the section.

3. A column of timber section 150 mm × 200 mm is 6 m long both ends being fixed. Calculate the safe load for the column. Use Euler's formula and allow a factor of safety of ? Take E = 17500 N/mm^2.

4. A rod tapers uniformely from 40 mm diameter to 20 mm diameter in a length of 400 mm. If the rod is subjected to an axial load of 10000 N. Calculate the extension of the rod.

   Take E = 2 × 10^5 N/mm^2.

5. Derive the expression for polar modulus of a non-circular shaft.

6. Define Lame's Equation for thick cylinders.

SECTION – C

[12 × 3 = 36

[8 × 3 = 24

(Long Answer Type)

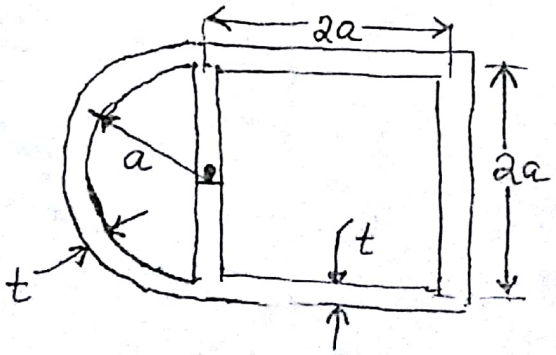
Note : Attempt any *three* questions.

1. The displacement field for a body is given by

$$u = [(x^2 + y^2 + 2)i + (3x + 4y^2)j + (2x^3 + 4z)k]\,10^{-4}$$

what is the deformed position of a point originally at (1, 2, 3) ?

2. A thin-walled box is shown in figure below is subjected to a torque T. Determine the shear stresses in the walls and the angle of twist per unit length of the box.



3. A thick-walled tube with an internal radius of 10 cm is subjected to an internal pressure of 2000 Kgf/cm^2. E= 2 × 10^6 Kgf/cm^2 and ν = 0.3. Determine the value of the external radius if the maximum shear stress developed is limited to 3000 Kgf/cm^2. Calculate the change in the internal radius due to the pressure.

4. The deflection curve for a pin-ended column is represented by a polynomial as

$$y = ax^4 + bx^3 + cx^2 + dx + e$$

Determine the critical load by the energy method.

5. For the state of stress at a point characterized by the components (in 1000 KPa)

$\sigma_x = 12, \quad \sigma_y = 4, \quad \sigma_z = 10$

$Z_{xy} = 3, \quad Z_{yz} = Z_{zx} = 0$

Determine the principal stresses and their directions.

[Total Printed Pages : 3

Roll No. 1900055300626

E - 3425

B. E. IVth Semester (Main & Re-Exam) Examination, 2014

ADVANCED SOLID MECHANICS

Branch : ME – IV Sem

[Maximum Marks : 75
[Minimum Marks : 30

Time : Three Hours]

Note : Attempt *all* the questions of *Section A, four* from *Section B* and *three* questions from *Section C.*

SECTION – A

(Objective Type Questions) $10 \times 1.5 = 15$

1. Temperature stress developed in a bar depends upon .....
2. A localized compressive stress at the area of contact between two members is known as .....
3. The angle of twist is dir..... Proportional to the twisting moment.
4. Unsymmetrical bending is the bending caused by load that only .....$\frac{wl^3}{2}$..... in the beam.
5. For a crane hook the most suitable section is ....C-Section
6. In thick cylinder the circumferential stress .....$\sigma_c = \frac{b}{g^2} + a$.
7. Maximum shear stress theory was postulated by ....Tresca.....
8. Maximum shear stress theory is suitable for ductile..... material.
9. Poisson ratio is defined as .....$\frac{\text{lateral}}{\text{longitudinal}}$
10. Principal strain is the ratio of .....

P.T.O.

SECTION – B

(Short Answer Type Questions) $6 \times 4 = 24$

1. A concrete cylinder of diameter 150 mm and length 300 mm when subjected to the axial compressive load of 240 kn resulted in an increase of diameter by 0.127 mm and a decrease in length of 0.28 mm compute the value of Poisson ratio μ $(\frac{1}{m})$ and modulus of Elasticity E.

2. A thick spherical shell of 180 mm internal diameter is subjected to an internal fluid pressure of 24 mn/m^2. If the permissible tensile stress is 120 mn/m^2 find the thickness of the shell.

3. A hollow shaft is to transmit 300 kw at 80 r.p.m. If the shear stress is not to exceed 60 mn/m^2 and internal diameter is 0.6 of the external diameter find the external and internal diameter assuming that the maximum torque is 1.4 times the mean.

4. Define Lame's Equation for thick cylinders.

5. Define strain energy theory.

6. Find the maximum principal stress developed in a cylindrical shaft 8 cm in diameter and subjected to a bending moment of 2.5 KNm and twisting moment of 4.2 KNm. If the yield stress of the Shaft Material is 300 Mpa, determine the factor of safety of the shaft according to the maximum shearing stress theory of failure.

SECTION – C

(Long Answer Type Questions) $12 \times 3 = 36$

1. Derive the Torsion equation and gives their assumptions.

2. A thin walled circular tube of wall thickness t and mean radius r is subjected to an axial load p and torque T in a combined tension torsion experiment.

   (i) Determine the state of stress existing in the tube in terms of P and T.

   (ii) Using Von-Mises-Hanky failure criteria show that failure takes place when $\sqrt{\sigma^2 + 3\tau^2} = \sigma_0$ where σ_0 is the yield stress in Uniaxial tension.

3. A thick walled tube with an internal radius of 10 mm is subjected to an internal pressure of 2000 kg f/ cm^2. E = 2×10^6 kg f/ cm^2 and v = 0.3. Determine the value of the external radius, if the maximum shear stress developed is limited to 3000 kg f/cm^2. Calculate the change in the internal radius due to the pressure.

4. A hollow circular, shaft 20 mm thick transmits 294 Kw at 200 r.p.m. Determine the diameters of the shaft. If shear strain due to torsion is not to exceed 8.6×10^{-4}.

   Take modulus of rigidity as 80 G N/m^2

5. In an steel member at a point the Major Principal Stress is 180 mn/m^2, and the minor principal stress is compressive if the tensile, yield point of steel is 225 mn/m^2, find the value of the minor principal stress at which yielding will commence according to each of the following criteria of failure.

   (i) Maximum shearing stress,

   (ii) Maximum total strain energy and

   (iii) Maximum shear strain energy.

   Take poisson's ratio = 0.26.

(Printed Pages 4) Roll No. .....

E-67

B.E. IV Semester (Main & Re-Exam.) May 2015

Advanced Solid Mechanism

Mech. Engg.

Time : Three Hours] *[Maximum Marks : 75*

[Minimum Marks : 30

Note : Attempt all the questions of **section-A**, **Four** from **section-B** and **three** questions from **section-C**.

Section-A

(Objective Type Questions)

Note : This section will contain **ten** objective type questions. They may be fill in the blanks, True/False or Multiple Choice Type. 1.5x10=15

1. --------Theory is suitable for brittle materials.

   (a) Maximum strain energy

   (b) Maximum shear stress theory

   (c) Maximum principal stress theory

   (d) Distortion energy theory

2. Strain energy theory was postulated by :

   (a) Rankine

   (b) Mohr

   (c) Tresca

   (d) Haigh

P.T.O.

3. Cylindrical Vessels, containing fluid under pressure and whose wall thickness is not small ($t^3d/20$) are classified as :

(a) Thin cylinders

(b) Either of the above

(c) Thick cylinders

(d) None of the above

4. In a thick cylinder the radial stress at the outer surface is :

(a) Always more than zero

(b) Always less than zero

(c) Usually equal to zero

(d) None of the above

5. Under unsymmetrical bending the resultant deflection of a beam is :

(a) Parallel to the axis of symmetry

(b) Perpendicular to the axis of symmetry

(c) Parallel to the Neutral axis.

(d) Perpendicular to the Neutral axis.

6. In an I-section, symmetrical about X-X and YY axes, shear centre lies at at :

(a) Centroid of the top flange

(b) Centroid of the web

(c) At the centroid of the bottom flange

(d) None of the above

7. Poisson ratio is defined as---------.

8. Principal strain is radio of -------.

9. The unit of stress in S.I. Unit is -------.

10. The deformation per unit length is called ------.

Section-B

(Short Answer Type Questions)

Note : This section will contain **six** questions. Students will ask to attempt any **four** questions out of **six** questions. 6x4=24

1. Define Lame's Equation for thick cylinder.
2. Define maximum principal stress theory.
3. A solid plug gauge made of steel has a diameter of 30.006 mm and is forced into a ring gauge of same material. The inside diameter, outside diameter and axial length of the gauge are 30 mm, 48mm and 24mm respectively. If E=200GN/m², Poisson's ratio=0.286 and Co-Efficient of friction=0.3 find :
   (i) The maximum stress in the ring.
   (ii) The force required to slide the plug
   (iii) Torgue required to rotate the plug

   With respect to ring.
4. A shaft is subjected to a maximum torque of 10 KNM and a maximum bending moment of 7.5 KNM at a particular section. If the allowable equivalent stress in simple tension is 160 MN/M², find the diameter of the shaft according to maximum shear stress theory.
5. Explain principle of virtual work energyx.
6. A Hollow shaft is to transmit 400 KW at 100 r.p.m. If the shear stress is not to exceed to MN/m² and Internal diameter is 0.8 of the external diameter find the external and internal diameter assuming that maximum torque is 1.4 times of mean.

Section-C

(Long Type Questions)

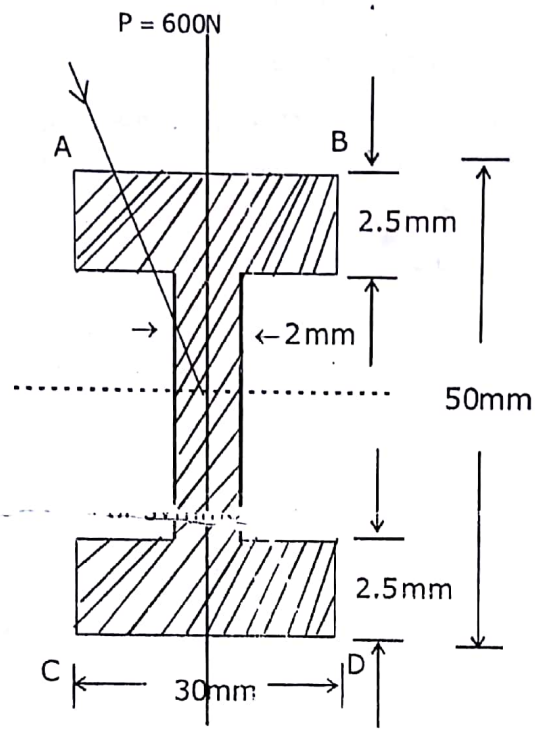
Note : This section will contain **five** questions. Students will ask to attempt any **three** questions out of five questions. 12x3=36

1. Write the short note on the following.
   (a) Equations of Elasticity
   (b) Uniqueness and super position
   (c) Airy stress function approach.

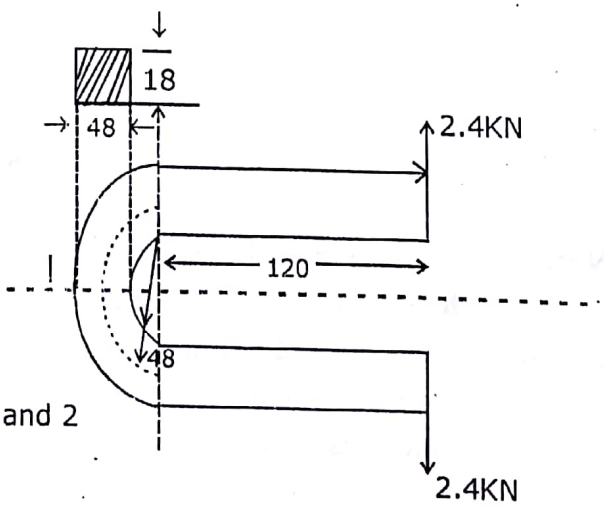
2. Derive the Torsion equation and gives their assumptions.

3. A Hollow circular, shaft 20 mm thich transmits 300 kw at 200 rpm. Determine the diameter of shaft. If shear strain due to torsion is not to exceed 8.6×10^{-4}. Take G= 90 GN,m^2.

4. A cantilever, of I-section, 2.4 meters long is subjected to a load of 200 N at the free end. Determine the resulting bending stresses at corners A and B, on the fixed section of the cantilever.



5. Fig. shows a frame subjected to a load of 2.4 KN.



Find :

(i) The resultant stressed at 1 and 2

(ii) Position of Neutral axis.

Total Printed Pages : 4

Roll No. .....

E-228

B. E. - IV Semester (Main & Re) Examination – May, 2016

ADVANCE SOLID MECHANICS

(Mech. Engg.)

Time : Three Hours]

[Maximum Marks : 75

[Min. Marks : 30

Note : Attempt *all* the questions of Section A, *four* from Section – B and *three* questions from Section – C.

SECTION – A

[Marks : 1.5 × 10 = 15

(Objective Type Questions)

1. Which of the following theory is suitable for brittle materials ?

(a) Maximum Strain Energy

(b) Maximum shear stress theory

(c) Maximum principal stress theory

(d) Distortion energy theory

2. Which of the following is not assumptions of torsion formula ?

(a) Circular section remain's circular

(b) Plane Section remain plane and do not warp

(c) Stress exceeds the proportional limit

(d) The material of bar is homogeneous and perfectly elastic

3. If 'P' is concentration load acting at free end of cantilever beam of length 'L', then deflection equation will be :

(a) $EIy = \frac{Px^2}{6}(3L - x)$

(b) $\frac{EI}{y} = \frac{Px^2}{6}(2L - x)$

(c) $EI^2 y = \frac{Px}{6}(3L - x)$

(d) $EIy = \frac{Px}{6}(2L - x)$

P. T. O.

4. In case of thin walled pressure vessels, the hoop stress is equal to :

(a) $\frac{Pr}{2t}$ (b) $\frac{Pr}{t}$

(c) $\frac{Pr}{3t}$ (d) $\frac{Pr}{4t}$

5. In an I-section, symmetrical about X-X and Y-Y axis, shear centre lies at :

(a) Centroid of top flange (b) Centroid of web

(c) At the centroid of bottom flange (d) None of these

6. Uniqueness is defined as ..... .

7. Plain strain is the ratio of ..... .

8. Relationship between E (Modulus of elasticity), C (Modulus of rigidity) and K (Bulk Modulus) is given as ..... .

9. The unit of stress in S. I. Units is ..... .

10. Membrane analysis is used to ..... .

SECTION – B

[Marks : 6 × 4 = 24

(Short Answer Type Questions)

1. Explain Von-Mises and Tresca's theories in brief.

2. Derive torsion equation for non-circular bars.

3. Explain principle of virtual work energy.

4. A shaft is subjected to a maximum torque of 10 KNM and a maximum bending moment of 9.5 KNM at a particular section. If the allowable equivalent stress in tension is 180 MN/M^2, find the diameter of shaft according to maximum shear stress theory.

5. An I-section 120 mm × 80 mm has flanges 5 mm thick and web 4 mm thick and is subjected to a Torque T. Find the maximum value of T if the shear stress is limited to 35 N/MM^2 and the twist per meter length to 6° G = 82,000 N/MM^2.

6. A tie bar on a vertical pressing machine is 2 M long and 4 cm diameter. What is the stress and extension under a load of 100 KN ? E = 205000 N/MM^2

SECTION – C

[Marks : 12 × 3 = 36

(Long Answer Type Questions)

1. Write short notes on the following :

   (a) Plain stress and Plain strain condition

   (b) Photoelasticity

   (c) Equations of elasticity

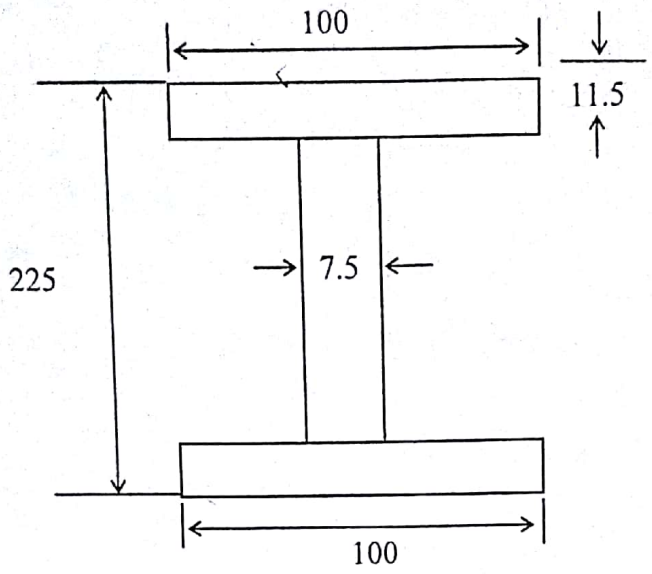
2. A turbine rotor disc is 0.6 m diameter and is fitted to a 50 MM diameter shaft. If the minimum thickness is 9.5 mm, what should be the thickness of shaft for a uniform stress of 200 N/MM^2 at 10,000 rpm ? Density = 7700 kg/m^3.

3. Derive the torsion equation and give their assumptions.

4. A hollow circular shaft 40 mm which transmits 300 kw at 200 rpm, determine the diameter of shaft. If shear strain due to torsion is not to exceed 8.6×10^{-9}. Take G = 90 GNM^2.

Elastic stability
Failure Theories
Introduction to strain gauges
photo elasticity

5. The beam of symmetrical I-section shown in figure is simply supported over a span of 9 m. If the maximum permissible stress is 75 N/MM^2. What concentrated loadl can be carried at a distance of 3 M from one support ?



6. Derive the radial stress and hoop stress in case of thick cylinders.

(Printed Pages 3)

Roll No. .....

E-439

B.E. IV Semester Examination, May 2017

(Main & Re-Exam)

Advanced Solid Mechanics

(ME)

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note : Attempt **all** the questions of Section-A, **four** from Section-B and **three** questions from Section-C.

Section-A

(Objective Type Questions)

Note : This section will contain **ten** objective type questions. They may be fill in the blanks. True/False or Multiple Choice Type. 1.5×10=15

1. Plain stress is the ratio of ..... .
2. Strain energy is the
   (a) Energy stored in a body when strain within elastic limit.
   (b) Energy stored in a body when strain up to the breaking of a specimen.
   (c) Max. strain energy which can be stored in a body.
   (d) Proof resiliance per unit Volume of a material.
3. The neutral axis of the cross-section of a beam is that axis at which the Bending Stresses:
   (i) Zero (ii) Maximum
   (iii) Minimum (iv) Infinity
4. Euler's formula holds good only for :
   (i) Short Columns (ii) Long Columns
   (iii) Both short & long Columns (iv) Weak Columns

P.T.O.

5. The unit of stress in S.I. unit is .....

6. The deformation per unit length is called :

(i) Tensile stress (ii) Compressive Stress

(iii) Shear stress (iv) Strain

7. In the torsion equation :

$\frac{\tau}{J}=\frac{T}{R}=\frac{G\theta}{L}$ the term $\frac{J}{R}$ is called :

(i) Shear modulus (ii) Section modulus

(iii) Polar Modulus (iv) None of these

8. The point of Contraflexure is a point where :

(i) Shear force changes sign (ii) Bending moment charges sign

(iii) Shear force is max^m (iv) Bending moment is max^m

9. The energy stored in abody when strained within elastic limit is known as :

(i) Resilience (ii) Proof Resilience

(iii) Strain energy (iv) Impact energy

10. Which of the following theory is suitable for brittle materials:

(a) Max^m. strain energy (b) Max^m. Shear Stress theory

(c) Max^m. principle stress theory (d) Distortion energy theory

Section-B

(Short Answer Type Questions)

Note : This section will contain **six** questions. Attempt any **four** questions out of **six** questions.

$6\times4=24$

1. Define the equation of elasticity?

2. Derive the torsion equation and give their assumptions for non-circular bar?

3. Determine the stress field that arrised from the following stress function :

(i) $\phi = Cy^2$

(ii) $\phi = Ax^2+Bxy+Cy^2$

(iii) $\phi = Ax^3+Bx^2y + Cxy^2 + Dy^3$

4. Define the following terms :

   (i) Airy stress function approach

   (ii) Uniqueness & Super position

5. A tie bar on a vertical pressing machine is 2m long and 4 cm diameter. What is the stress and extension under a load of 100 KiV? E= 205000 N/mm^2.

6. Define any **one** theory of failure :

   (i) Maxm. shear stress theory

   (ii) Maxm· principle stress theory

Section-C

(Long Answer Type)

Note : This section will contain **five** questions. Attempt any **three** questions out of **five** questions. $12 \times 3 = 36$

1. Derive the expression for general prismatic bar for a non-circular shaft?
2. Explain the three components of a rectangular Co-ordinates with suitable diagram?
3. The state of stress with respect to, Cartisian Co-ordinates system is given by :

$$\begin{bmatrix} 12 & 6 & 9 \\ 6 & 10 & 3 \\ 9 & 3 & 14 \end{bmatrix}$$

   is MPa. Calcualte the magnitude and direction of the Max.^{m} principle stresses?

4. Derive the differential equation of equilibrium condition for a Cartisian Co-ordinates.
5. A hollow circular shaft 40mm which transmits 300kw at 200 rpm, determine the diameter of shaft. If shear strain due to torsion is not to exceed 8.6×10^{-9}. Take G=90 GNM^2.

Total Printed Pages : 4

Roll No. .....

E-713

B. E. IV Semester (Main & Re-Exam) Examination, May 2018

ASM

Branch : ME

Time : Three Hours] *[Maximum Marks : 75*

Minimum Marks : 30

Note : Attempt ***all*** questions from ***Section – A***, ***four*** questions from ***Section – B*** and ***three*** questions from ***Section – C***.

SECTION – A [Marks : 1.5 × 10 = 15

1. Young's modulus is defined as ratio of :

(a) Volumetric stress and volumetric strain

(b) Lateral stress and lateral strain

(c) Longitudinal stress and longitudinal strain

(d) Shear strss and shear strain

2. Tensile strength of a material is obtained by dividing the maximum load during the test by the :

(a) Area at the time of fracture

(b) Original cress-sectional area

(c) Average of (a) and (b)

(d) Minimum area after fracture

3. If a part is constrained to more and heated if will develop :

(a) Principal stress

(b) Tensile stress

(c) Compressive stress

(d) Shear stress

P. T. O.

4. The energy absorbed in a body, when it is strained within the elastic limits, is known as :

(a) Strain Energy
(b) Resilience
(c) Proof Resilience
(d) Modulus of Resilience

5. The assumption made in Euler's column theory is that :

(a) The failure of column occurs due to buckling alone
(b) The length of column is very large as compared to its cross-sectional.
(c) The column material obeys Hook's law
(d) All of the above

6. Euler's formula bolds good only for :

(a) Short columns
(b) Long columns
(c) Both short and long columns
(d) Weak columns

7. Within elastic limit, stress is :

(a) Inversely proportional to strain
(b) Directly proportional to strain
(c) Square root of strain
(d) Equal to strain

8. The shape of cantilever for uniformly distributed load will be :

(a) Straight line
(b) Parabalic
(c) Flliptical
(d) Cubic

9. A coils is cut into two halves, the stiffness of cut coil will be :

(a) Double
(b) Half
(c) Same
(d) None of these

10. The bending stress in a beam is ..... section modules :

(a) Inversely proportional to two times
(b) Directly proportion to
(c) Inversely proportional to
(d) None of these

SECTION – B

[Marks : 6 × 4 = 24

1. What do you understand by principle of virtual work ?

2. Derive the expression of torque for a non-circular shaft under torque

3. The state of straight at a point for rectangular roselte gauge recards the following value for linear strain at a point in two dimensional stress system : $\varepsilon_{xx} = 750 \times 10^{-6}, \varepsilon_{yy} = -250 \times 10^{-6}$ and $\varepsilon_{45^\circ} = 250 \times 10^{-6}$, the latter being at 45° to the X and Y axis. Determine the principle strain and stress. Take $E = 2.1 \times 10^5 N/mm^2$ and $\mu = 0.3$.

4. Derive the equilibrium equation for 3D state of stress in cartesion coordinate system.

5. Write short notes on the following :

   (a) Airy's stress function approach

   (b) Membrane Analogy

6. What is the plane stress and plane strain ? Explain in detail.

SECTION – C

[Marks : 12 × 3 = 36

1. For the state of stress at a point characterized by $\sigma_x = 5, \sigma_y = 7, \sigma_z = 4$ and $\tau_{xy} = 3$ $\tau_{xz} = 1$, $\tau_{yz} = -2$ in mpa calculate : 12

   (i) The three invariants and also explain why these quantities are called invariant

   (ii) Principal stresses

   (iii) Draw the Mohr's circles

2. What is a strain rosette ? Draw the configuration of two such rosettes with their name. 12

3. Write the expression of the following theories : 12

(a) Maximum principle stress theory

(b) Maximum shear stress theory

4. Give the following system of strains : 12

$$\epsilon_{xx} = 5 + x^2 + y^2 + x^4 + y^4$$

$$\epsilon_{yy} = 6 + 3x^2 + 3y^2 + x^4 + y^4$$

$$\epsilon_{zz} = \gamma_{yz} = \gamma_{zx} = 0$$

$$\gamma_{xy} = 10 + 4xy(x^2 + y^2 + 2)$$

Determine the whether the above strain field is possible.

5. What do you mean by stress function ? Give an example of stress function for 3D rectangular coordinate system ? 12
