INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

May/ June 2017 End Semester Examinations

B.Tech. (Marine Engineering) Third Semester

(AY 2009-2014 batches)

Strength of Materials - II (UG11T1304/ UG11T2304)

Date : 04.07.2017 Maximum Marks: 100

Time: 3 Hrs Pass Marks : 50

Instructions: 1. Use of non-programmable calculators allowed.

2. Assume suitable data if necessary.

PART – A Marks: 10X3=30

(All questions are compulsory)

1. (a) What are principal stresses and principal planes?

(b) State whether true or false

(i) The maximum shear stress theory is conservative (safer) than the distortion energy theory.

(ii) The shear stress on the principal planes is zero.

(iii) The normal stress on the planes of maximum shear stress is zero.

(c) Define built-in and continuous beams.

(d) State the maximum principal stress theory. For stress analysis of which type of materials is the theory used?

(e) Describe the steps involved in the double integration method to find slope and deflection of a beam.

(f) State the equations for strain energy in bending and torsion.

(g) State Castigliano's first theorem and its application.

(h) Write Lame's equations for stresses in thick cylinders. How can we calculate the value of longitudinal stress from these equations?

(i) State the formula for Euler's crippling load. State the limitation of application of Euler's formula.

(j) What is slenderness ratio? State the difference between long and short columns.

PART – B Marks: 5X14=70

(Answer any 5 of the following)

2. (a) In a two dimensional stress system, a point is subjected to pure shear stress of 50 MPa. There are no direct stresses. Calculate the principal stresses induced and principal plane angles. Also verify by Mohr's circle method.

(8)

(b) In a two dimensional stress system, a point is subjected to a tensile stress of 100 MPa in the X direction and a compressive stress of 20 MPa in the Y direction. Draw the Mohr's circle and find the maximum shear stress induced at the point in the component.

(6)

3. A cantilever beam of length 3 m carries a point load of 30 kN at a section 2 m from the fixed end. The area moment of inertia of the section is 11924 cm^4. By Double-Integration method, find the deflection and slope of the beam at the point where the load is applied. Also find the deflection at the free end. Take Young's Modulus as 200 GPa.

(14)

4. A simply supported beam of span 14 meters carries two point loads of 90 KN and 60 KN at a distance of 3m and 9.5m respectively from the left support. By Macaulay's Method find (a) Deflection under each load (b) The position and amount of maximum deflection. Take Modulus for the material of beam as 210 GPa and Area moment of Inertia as 64 x 10^{-4} m^4.

(14)

5. (a) State Clapeyron's theorem of three moments. (6)

(b) A simply supported beam AB of length L, carries a point load W at its mid-span. Find expression for the maximum slope and deflection by moment area method.

(8)

6. (a) What is the advantage of a compound cylinder in comparison to a single cylinder having same thickness.

(4)

(b) A pipe of 400 mm internal diameter and 100 mm thickness contains a fluid at a pressure of 80 MPa. Find the minimum and maximum hoop stress across the section of the tube. Also sketch the radial stress distribution and hoop stress distribution along the cross-section.

(10)

7. A steel tube having outside diameter 5 cm, bore 3 cm is bent into a quadrant of 2 m radius. One end is rigidly attached to a horizontal base plate to which a tangent to that end is perpendicular. The free end supports a load of 100 kg. Determine the vertical and horizontal deflections of the free end under this load. E = 208000 MPa.

(14)

8. A 4.2 m long hollow cylindrical cast iron column 120 mm external diameter and 20 mm thick is hinged at both ends. Determine the ratio of the Euler buckling load to the critical load given by Rankine's formula. Use E = 80 kN/mm^2, Yield stress in compression = 550 N/mm^2, Rankine constant = 1/1600. For what length of the column does the Euler formula cease to apply?

(14)

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INDIAN MARTIME UNIVERSITY
(CENTRAL UNIVERSITY, GOVT. OF INDIA)
DEC 2017 – END SEMESTER EXAMINATIONS
B.TECH (Marine Engineering)
Third Semester
STRENGTH OF MATERIALS II
UG11T2304/1304

Date: 12.12.2017 MAX MARKS: 100

Time: 3 Hrs PASS MARKS: 50

Note: 1. Question 1st Compulsory from Part"A" carried 30 Marks.
2. Part "B" contains 7 questions and any "Five" questions can be solved from it. Each question carries 14 Marks.

Part A

Q.1 :

i. Define Thick – Cylinder.

ii. Define Principal Stresses and Planes.

iii. State Assumption made in Euler's Theory.

iv. Define Continuous Beam and over hangs.

v. Define Stiffness of Beam with respect to Loading 'W'

vi. State advantages Macaulay's Method.

vii. Prove $M = EI \frac{d^2y}{dx^2}$ w.r.t. bending moment M.

viii. Sate Assumptions made in Lame's Theory.

ix. Explain with diagram the strain energy stored in material for the application of gradual force.

x. Relation between the suddenly applied load & gradual load w.r.t. stress in the material.

Part B

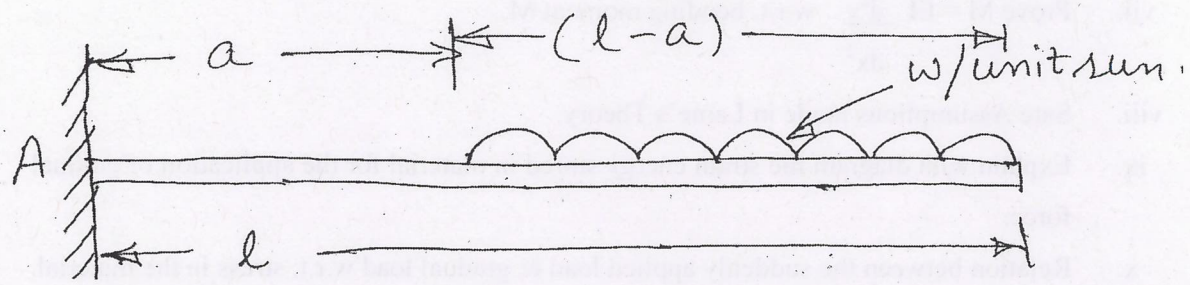
Q.2 : A Continuous beam ABCD carrying a uniformly distributed load w/unit length rests an three supports B, C, D; all at same level. It has two equal overhangs of length '1o' on either side.

Assume EI constant; find the ratio of $\frac{l_o}{l}$ for the three support reactions to be equal.

Q.3: Prove Lame's Theorem for thick cylinder form 1st Principal.
State assumption made and conventions used for the proof.

Q.4: A Compound Cylinder formed by shrinking one tube to another is subjected to an internal pressure of 90 MN/m^2. Before the Fluid is admitted, the internal and external diameters of the compound cylinder are 180 mm and 300 mm respectively and the diameter at the junctions is 240 mm. If after Shrinking on, the radial pressure at the common surface is 12 MN/m^2 Determine the final stresses developed in the compound cylinder.

Q.5: A cantilever of length '1" carrying a uniformly distributed load of 'W' per Unit run on a part of span from the free end as shown in the figure. Prove the down ward deflection at B is $Y_B = \frac{W}{24\,EI}(3l^4 - 4la^3 + a^4)$ First Principal.



Q.6: At a point in a Strained material, the state of stress is a shown in figure.

Determine:

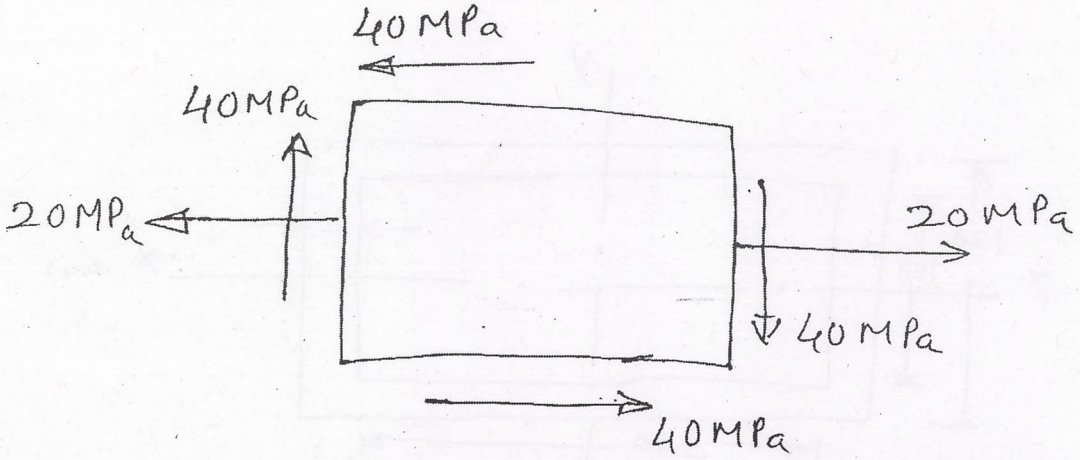
i. Principal stresses.

ii. Principal Planes.

iii. Maximum shear stress and plane on which it acts.

iv. The tensile stress which acting alone will produce same maximum shear stress and

v. The Shear stress acting alone will produce same maximum tensile Principal stress.



Q.7: When one end of the column is fixed and the other end is pinned or hinged And P is the buckling load.

Prove $P = \frac{2\pi^2 EI}{L^2}$

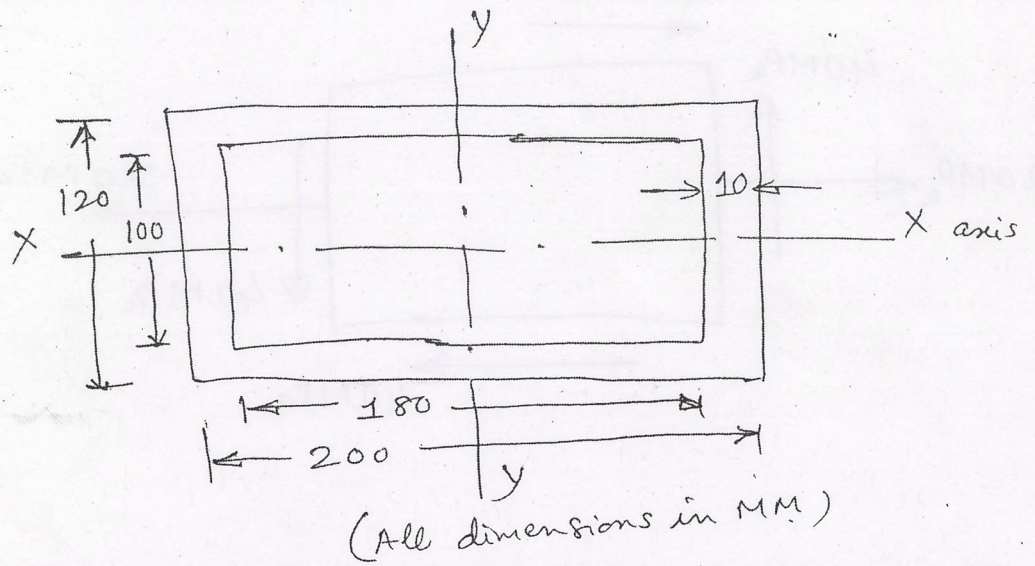
When E = Modulus of Elasticity and I = Moment of inertia.

Q.8: The Cross section of column is hollow rectangular section having outside Dimensions 200 m x 120 mm and inside dimensions 180 mm x 100 mm With uniform thickness of 10 mm. It is fixed at one end and hinged at the other end. If the buckling load given by Rankine's formula is 800 KN.

Find actual length of column.

Assume crushing stress = 300 MPa

E = 200 GPa and $a = \frac{1}{7500}$



INDIAN MARITIME UNIVERSITY

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May/ June 2017 End Semester Examinations

B.Tech. (Marine Engineering) Third Semester

(AY 2009-2014 batches)

Strength of Materials - II (UG11T1304/ UG11T2304)

Date : 04.07.2017 Maximum Marks: 100

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2. Assume suitable data if necessary.

PART – A Marks: 10X3=30

(All questions are compulsory)

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(b) State whether true or false

(i) The maximum shear stress theory is conservative (safer) than the distortion energy theory.

(ii) The shear stress on the principal planes is zero.

(iii) The normal stress on the planes of maximum shear stress is zero.

(c) Define built-in and continuous beams.

(d) State the maximum principal stress theory. For stress analysis of which type of materials is the theory used?

(e) Describe the steps involved in the double integration method to find slope and deflection of a beam.

(f) State the equations for strain energy in bending and torsion.

(g) State Castigliano's first theorem and its application.

(h) Write Lame's equations for stresses in thick cylinders. How can we calculate the value of longitudinal stress from these equations?

(i) State the formula for Euler's crippling load. State the limitation of application of Euler's formula.

(j) What is slenderness ratio? State the difference between long and short columns.

PART – B

Marks: 5X14=70

(Answer any 5 of the following)

2. (a) In a two dimensional stress system, a point is subjected to pure shear stress of 50 MPa. There are no direct stresses. Calculate the principal stresses induced and principal plane angles. Also verify by Mohr's circle method.

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(b) In a two dimensional stress system, a point is subjected to a tensile stress of 100 MPa in the X direction and a compressive stress of 20 MPa in the Y direction. Draw the Mohr's circle and find the maximum shear stress induced at the point in the component.

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4. A simply supported beam of span 14 meters carries two point loads of 90 KN and 60 KN at a distance of 3m and 9.5m respectively from the left support. By Macaulay's Method find (a) Deflection under each load (b) The position and amount of maximum deflection. Take Modulus for the material of beam as 210 GPa and Area moment of Inertia as 64 x 10^{-4} m^4.

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(b) A simply supported beam AB of length L, carries a point load W at its mid-span. Find expression for the maximum slope and deflection by moment area method.

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(b) A pipe of 400 mm internal diameter and 100 mm thickness contains a fluid at a pressure of 80 MPa. Find the minimum and maximum hoop stress across the section of the tube. Also sketch the radial stress distribution and hoop stress distribution along the cross-section.

(10)

7. A steel tube having outside diameter 5 cm, bore 3 cm is bent into a quadrant of 2 m radius. One end is rigidly attached to a horizontal base plate to which a tangent to that end is perpendicular. The free end supports a load of 100 kg. Determine the vertical and horizontal deflections of the free end under this load. E = 208000 MPa.

(14)

8. A 4.2 m long hollow cylindrical cast iron column 120 mm external diameter and 20 mm thick is hinged at both ends. Determine the ratio of the Euler buckling load to the critical load given by Rankine's formula. Use E = 80 kN/mm^2, Yield stress in compression = 550 N/mm^2, Rankine constant = 1/1600. For what length of the column does the Euler formula cease to apply?

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INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

December 2016 End Semester Examinations
B.Tech. (Marine Engineering) Third Semester

Strength of Materials - II (UG11T1304/ UG11T2304)

Date : 21.12.2016 **Maximum Marks: 100**
Time: 3 Hrs **Pass Marks : 50**

Part-A **(3x10=30 Marks)**

(Compulsory Question)

1. a) Define principle planes and principle stress.
   b) What is a Mohr's circle; explain the method of Drawing Mohr's Stress Circle.
   c) State Mohr's Theorem.
   d) Define the term 'obliquity' and how it is determined.
   e) How built-in and continuous beams can be differentiated?
   f) Define Claperyon's three moment theorem.
   g) What do you mean by thick compound cylinder?
   h) How the strain energy due to twisting can be measured?
   i) Write the assumptions made in Euler's theory.
   j) Define slenderness ratio.

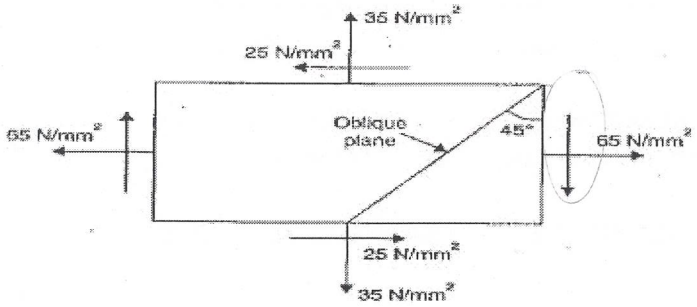
Part-B **(5x 14= 70 Marks)**

(Answer any five of the followings)

2. A rectangular block of material is subjected to tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find:

   (i) The direction and magnitude of each of the principle stress.
   (ii) Magnitude of the greatest shear stress. (7 + 7)

3. A point in a strained material is subjected to stresses shown in the figure below. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. (14)

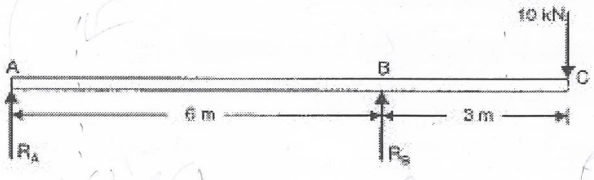


4. A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9kN/m run over the entire span of 5m. If the value of E for the beam material is 1 X 10^4 N/mm^4, Find (7+7)

   (i) Slope at the supports
   (ii) Maximum Deflection

5. An overhanging beam ABC is loaded as shown in the figure below. Find the slopes over each support and at the right end. Find also the maximum upward deflection between the supports and the deflection at the right end. (14)

   Take E= 2 X 10^5 N/mm^2 and I = 5 X 10^8 mm^4



6. A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its centre. If E = 10^5 N/ mm^2 and I = 10^8 mm^4 for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. (14)

7. A thick spherical shell of 200 mm internal diameter is subjected to an internal fluid pressure of 7 N/mm^2. If the permissible tensile stress in the shell material is 8 N/mm^2,

   (a) Find the thickness of the shell.
   (b) Also find the minimum value of the hoop stress. (7+7)

8. (a) Explain Rankine-Gordan Formula.

   (b) Determine Euler's Crippling load for an I-section joist 40 cm X 20 cm X 1 cm and 5 m long which is used as a strut with both ends fixed. Take Young's modulus for the joist as 2.1 X 10^5 N/mm^2. (4 + 10=14)

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INDIAN MARITIME UNIVERSITY

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December 2016 End Semester Examinations
B.Tech. (Marine Engineering) Third Semester

Strength of Materials - II (UG11T1304/ UG11T2304)

Date : 21.12.2016 **Maximum Marks: 100**
Time: 3 Hrs **Pass Marks : 50**

Part-A **(3x10=30 Marks)**

(Compulsory Question)

1. a) Define principle planes and principle stress.
   b) What is a Mohr's circle; explain the method of Drawing Mohr's Stress Circle.
   c) State Mohr's Theorem.
   d) Define the term 'obliquity' and how it is determined.
   e) How built-in and continuous beams can be differentiated?
   f) Define Claperyon's three moment theorem.
   g) What do you mean by thick compound cylinder?
   h) How the strain energy due to twisting can be measured?
   i) Write the assumptions made in Euler's theory.
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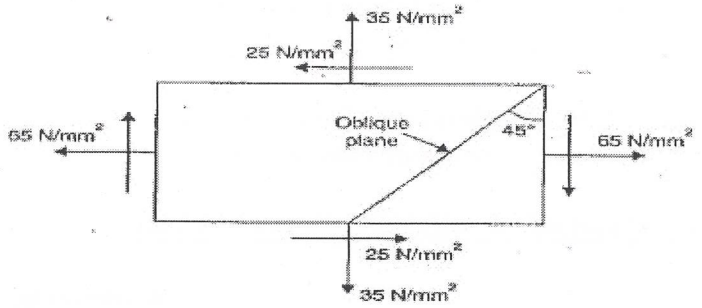
Part-B **(5x 14= 70 Marks)**

(Answer any five of the followings)

2. A rectangular block of material is subjected to tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find:

   (i) The direction and magnitude of each of the principle stress.
   (ii) Magnitude of the greatest shear stress. (7 + 7)

3. A point in a strained material is subjected to stresses shown in the figure below. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. (14)

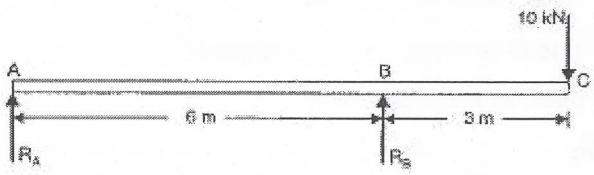


4. A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9kN/m run over the entire span of 5m. If the value of E for the beam material is 1 X 10^4 N/mm^4, Find (7+7)

   (i) Slope at the supports
   (ii) Maximum Deflection

5. An overhanging beam ABC is loaded as shown in the figure below. Find the slopes over each support and at the right end. Find also the maximum upward deflection between the supports and the deflection at the right end. (14)

   Take E= 2 X 10^5 N/mm^2 and I = 5 X 10^8 mm^4



6. A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its centre. If E = 10^5 N/ mm^2 and I = 10^8 mm^4 for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. (14)

7. A thick spherical shell of 200 mm internal diameter is subjected to an internal fluid pressure of 7 N/mm^2. If the permissible tensile stress in the shell material is 8 N/mm^2,

   (a) Find the thickness of the shell.
   (b) Also find the minimum value of the hoop stress. (7+7)

8. (a) Explain Rankine-Gordan Formula.

   (b) Determine Euler's Crippling load for an I-section joist 40 cm X 20 cm X 1 cm and 5 m long which is used as a strut with both ends fixed. Take Young's modulus for the joist as 2.1 X 10^5 N/mm^2. (4 + 10=14)

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INDIAN MARITIME UNIVERSITY
(Central University, Government of India)

May/June 2016 End Semester Examinations
B.Tech. (Marine Engineering)

Third Semester – Strength of Materials - II (UG11 2304/T1304)

Date : 27.06.2016 **Max. Marks: 100**
Time: 3 Hrs

Part – A **(3 X 10 = 30 Marks)**
Compulsory Question

1) a) Explain double integration method for finding slope and deflection.
   b) In case of deflection of a curved bar , state the relation between length of the curved beam and bending moment.
   c) State the advantages of a compound cylinder with respect to the single cylinder having same thickness.
   d) What is short column and long column?
   e) Define Poisson's ratio and Hooke's law?
   f) Define principal stress and principal plane?
   g) State the two theorems in moment area method.
   h) Define Castigliano's theorem.
   i) Write the equation for strain energy stored in a shaft due to torsion
   j) Write Gordons formula for the critical load of the column?

Part-B **(5 x 14 = 70 Marks)**
Answer Any Five of the following

2) A steel tube having outside diameter 5cm, bore 3cm is bent into a quadrant of 2m radius. One end is rigidly attached to a horizontal base plate to which a tangent to that end is perpendicular , and the free end supports a load of 100kg. Determine the vertical and horizontal deflections of the free end under this load. $E = 208{,}000\ N/mm^2$. (14 Marks)

3) a) Explain the procedure of finding slope and deflection of a beam by Moment –Area Method.
   b) A beam AB of length L, simply supported at ends A and B carries a udl of intensity w throughout its length. Determine slope at A by moment area method. (6+8 Marks)

4) An axial pull of 40kN is acting on a bar consisting of three sections of lengths 300mm, 250mm and 200mm and of diameters 20mm, 40mm and 50mm respectively. Find (i) the stress in each section and (ii) total extension of the bar. $E = 2 \times 10^5\ N/mm^2$. (14 Marks)

5) A beam with a span of 4.5 meters carries a point load of 30kN at 3 meters from the left support. If for the section, $I_{XX} = 54.97 \times 10^{-6}\ m^4$ and $E=200\ GN/m^2$, find: (i) The deflection under the load, (ii) The position and amount of maximum deflection. (14 Marks)

6) A simply supported beam of I – section, 4m long, carries a total uniform load of 40kN and a concentrated load of 70kN at mid span. (i) Find the maximum deflection of the beam. (ii) If permissible deflection is limited to 1/360 of the span, is the beam acceptable based on deflection? (iii) Find slope at the ends. Take $E = 2.1 \times 10^8$ kN/m^2; $I = 8.98 \times 10^{-5}$ m^4. (14 marks)

7) A fixed beam of 6m span is subjected to a concentrated couple of 150 kNm applied at a section of 4m from the left end. Find the end moments from the first principles. Draw B.M and S.F diagrams also. (14 Marks)

8) A steel cylinder of 1000 mm inside diameter is to be designed for an internal pressure of 4.8 MN/m^2. Calculate: (i) The thickness if the maximum shearing stress is not to exceed 21MN/m^2. (ii) The increase in volume, due to working pressure, if the cylinder is 7m long with closed ends. Neglect any constraints due to ends. Take E=200 GN/m^2, Poisson's ratio = 1/3. (14 Marks)

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INDIAN MARITIME UNIVERSITY
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B.Tech (Marine Engineering) - Semester -III
December 2015 End Semester Examinations

Strength of Materials - II
Subject Code: UG11T2304/ UG11T1304

Time: 3 hrs | Max Marks: 100
Date: 18.12.2015 | Pass Marks: 50

Part-A (3 x 10 = 30 Marks)
Compulsory Questions

1. a) What do you mean by principal plane?
   b) What do you understand by the term 'Point of contraflexure'?
   c) A rod of diameter 30 mm and length 400 mm was found to elongate 0.35 mm when it was subjected to a load of 65 kN. Compute the modulus of elasticity of the material of this rod.
   d) List any four methods of determining slope and deflection of loaded beam.
   e) What is Claperyon's three moment theorem?
   f) State Castigliano's theorem.
   g) What are assumptions involved in the analysis of thin cylindrical shells.
   h) The actual length of a column is 10 m. Determine its effective length if both the ends of the column are rigidity fixed.
   i) Write the difference between built-in and continuous beams
   j) Define bulk modulus.

Part-B (5 x 14 = 70 Marks)
Answer any five of the followings.

2. At a point in a strained material, the principle stress are $100N/mm^2$ tensile and $40N/mm^2$ compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principle stress. What is the maximum intensity of shear force in the material at the point? (11+3=14)

3. The tensile stresses at a point across two mutually perpendicular planes are $120N/mm^2$ and $60N/mm^2$. Determine the normal, tangential and resultant stress on a plane inclined at 30° to the axis of the major stress. Use Graphical Method (Mohr's circle method) (14)

4. a) A beam AB of length, simply supported at ends A and B carries a point load at the centre. Determine maximum slope and maximum deflection by moment area method.
   b) A beam 4 meter long, simply supported at its ends, and carries a point load W at its centre. If the slope at the ends of the beam is not to exceed 1°, find the deflection at the centre of the beam. (7+7)

5. Obtain expression for the maximum bending moment and deflection of a beam of length L and flexural rigidity EI, fixed horizontally at both end (built in) carrying a point load at centre. (14)

6. a) A cantilever beam AB of length L and carrying a uniformly distributed load. Find the expression for maximum slope and maximum deflection for the beam (any method).

   b) A cantilever of length 3 m is carrying a point load of 50 kN at a distance of 2 m from the fixed end. If $I=10^8 mm^4$ and $E=2\times10^5\ N/mm^2$, find (i) slope at the free end and (ii) deflection at the free end. (7+7 = 14)

7. Find the thickness of metal necessary for a cylinder shell of internal diameter 160 mm to withstand an internal pressure of $8\ N/mm^2$. The maximum hoop stress in the section is not to exceed $35\ N/mm^2$. (14)

8. a) Explain the limitation of Euler's formula.
   b) A solid round bar 3 m long and 5 cm in diameter is used as a strut with both ends hinged. Determine the crippling (or collapsing) load. Take $E = 2.0 \times 10^5\ N/mm^2$. (5+9=14)

3

INDIAN MARITIME UNIVERSITY
(A Central University, Govt. of India)

B.Tech (Marine Engineering) - Semester -III
December 2015 End Semester Examinations

Strength of Materials - II
Subject Code: UG11T2304/ UG11T1304

Time: 3 hrs | Max Marks: 100
Date: 18.12.2015 | Pass Marks: 50

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Part-B (5 x 14 = 70 Marks)
Answer any five of the followings.

2. At a point in a strained material, the principle stress are $100N/mm^2$ tensile and $40N/mm^2$ compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principle stress. What is the maximum intensity of shear force in the material at the point? (11+3=14)

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4. a) A beam AB of length, simply supported at ends A and B carries a point load at the centre. Determine maximum slope and maximum deflection by moment area method.
   b) A beam 4 meter long, simply supported at its ends, and carries a point load W at its centre. If the slope at the ends of the beam is not to exceed 1°, find the deflection at the centre of the beam. (7+7)

5. Obtain expression for the maximum bending moment and deflection of a beam of length L and flexural rigidity EI, fixed horizontally at both end (built in) carrying a point load at centre. (14)

6. a) A cantilever beam AB of length L and carrying a uniformly distributed load. Find the expression for maximum slope and maximum deflection for the beam (any method).

   b) A cantilever of length 3 m is carrying a point load of 50 kN at a distance of 2 m from the fixed end. If $I=10^8 mm^4$ and $E=2\times10^5\ N/mm^2$, find (i) slope at the free end and (ii) deflection at the free end. (7+7 = 14)

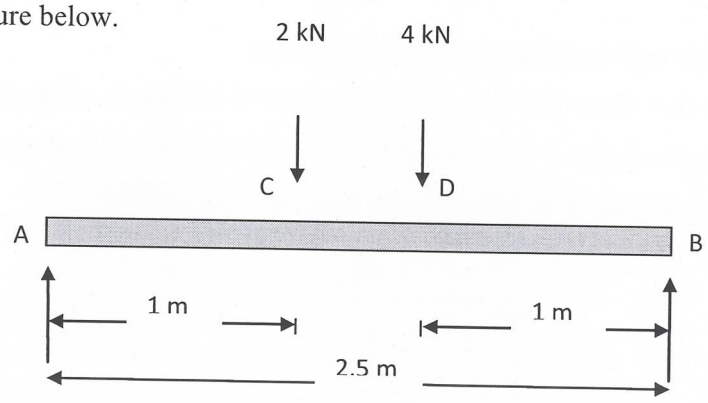
7. Find the thickness of metal necessary for a cylinder shell of internal diameter 160 mm to withstand an internal pressure of $8\ N/mm^2$. The maximum hoop stress in the section is not to exceed $35\ N/mm^2$. (14)

8. a) Explain the limitation of Euler's formula.
   b) A solid round bar 3 m long and 5 cm in diameter is used as a strut with both ends hinged. Determine the crippling (or collapsing) load. Take $E = 2.0 \times 10^5\ N/mm^2$. (5+9=14)

b) A solid steel shaft has to transmit 100 kW at 600 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. (7+7=14)

6. a)Draw the S.D.F (shear force diagram) and B.M.D (bending moment diagram) for a cantiliver beam with uniformly distributed load.

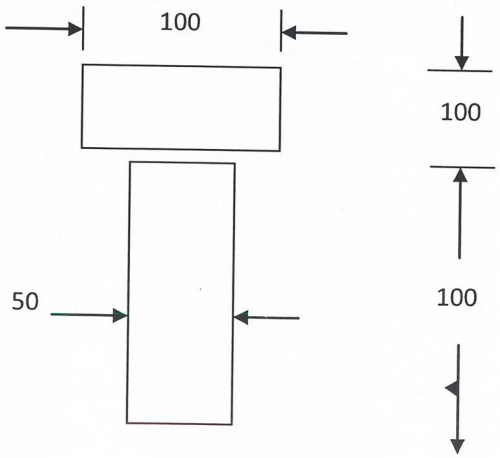
b) A simply supported beam AB of span 2.5 m is carrying two point loads as shown in the figure below.



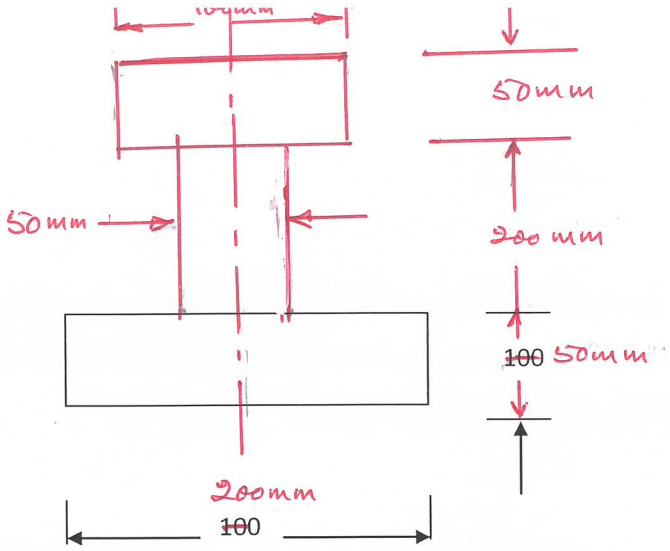
Draw the shear force and bending moment diagram for the beam. (7+7=14)

7. a) Prove that $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ (all the expressions are as per convention)

b) Figure shows a rolled steel beam of an unsymmetrical I-section.



P.T.O. for correction.



If the maximum bending stress in the beam section is not to exceed 40 MPa, find the moment, which the beam can resist. (7+7=14)

8. a) Write advantage and disadvantages of welded joints.

   b) A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plate. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25. (7+7=14)

B.TECH ... JEPARTMENT

BT.099

INDIAN MARITIME UNIVERSITY, CHENNAI

(A Central University, Govt. of India)

B.TECH (MARINE ENGINEERING)

DEC 2014 / JAN 2015- END SEMESTER EXAMINATION

III SEMESTER

STRENGTH OF MATERIALS II (T 2304 / T 1304)

Time: 03 Hrs. Max Marks: 100

Date:30-12-2014 Pass Marks: 50

Part - A (3 x 10 = 30 Marks)

Compulsory Questions

1. a) Derive normal stress and shear stress on two complementary planes and their interrelation.
   b) Deduce the expression for the strain energy due to bending
   c) Explain double integration method for finding slope and deflection
   d) In case of deflection of a curved bar, state the relation between length of the curved beam and bending moment.
   e) State the advantages of a compound cylinder with respect to the single cylinder having same thickness.
   f) What is claperyon's three moment theorem ?
   g) State Castigliano's Theorem.
   h) State the difference between short column and long column .
   i) Define built-in and continuous beams
   j) State and explain Rankine-Gordan formula for struts..

Part - B (5 x 14=70 Marks)

Answer any five of the followings.

2. The stresses at point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55^0 with the axis of major tensile stress. Also find the magnitude of the maximum stress in the component. **(14)**

3. The stresses at point of a machine component are 100 MPa (tensile) and 50 MPa (compressive). Determine the magnitudes of normal , shear and resultant stresses on a plane inclined at an angle of 25^0 with the tensile stress. Also find the magnitude of the maximum intensity of shear stress in the component. Use Mohr's circle method. **(14)**

4. A cantilever AB of length L and carrying a point load W at the free end A. Find the expressions for maximum slope and maximum deflection for the beam. **(14)**

5. Obtain expressions for the maximum bending moment and deflection of a beam of length l and flexural rigidity EI , fixed horizontally at both ends (built-in) carrying a load W (a) concentrated at mid-span (b) uniformly distributed over the whole beam. Solve by Moment-area method. (07+07)

6. A cast iron pipe of 400 mm internal diameter and 100 mm thickness carries water under a pressure of 8 N/ mm^2 . Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section. (14)

7. A steel tube having outside diameter 5 cm, bore 3cm is bent into a quadrant of 2m radius. One end is rigidly attached to a horizontal base plate to which a tangent to that end is perpendicular and free end supports a load of 100kg. Determine the vertical and horizontal deflections of the free end under this load. E= 208,000 N/ mm^2. (14)

8. A straight bar of steel 2.4 m long , of rectangular section , 3cmX1.5cm is used as a strut with both ends higed. Assuming that Euler's formula is applicable and the material attains the yield strength at the time of buckling, determine the central deflection in bar. E=210 GPa, yield strength = 270 MPa. (14)

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INDIAN MARITIME UNIVERSITY, CHENNAI

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B.TECH (MARINE ENGINEERING)
DEC 2014 / JAN 2015- END SEMESTER EXAMINATION
III SEMESTER
STRENGTH OF MATERIALS II (T 2304 / T 1304)

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   g) State Castigliano's Theorem.
   h) State the difference between short column and long column .
   i) Define built-in and continuous beams
   j) State and explain Rankine-Gordan formula for struts..

Part - B (5 x 14=70 Marks)
Answer any five of the followings.

2. The stresses at point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55^0 with the axis of major tensile stress. Also find the magnitude of the maximum stress in the component. **(14)**

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(7)

INDIAN MARITME UNIVERSITY

DEPARTMENT OF MARINE ENGINEERING

SEMESTER III – JULY 2012 EXAMINATION

T/214 STRENGTH OF MATERIALS II

TIME 3 HRS MAX MARKS: 100

Note: (i) Non- programmable scientific calculator is allowed.
(ii) Attempt six questions
(iii) Question no. 1 is compulsory

PART A

(1×30=30MARKS)

ANSWER THE COMPULSARY QUESTION

1.
a) Define Principal Stresses. (3)
b) What is a Mohr's Circle? (3)
c) What are the methods of determining slope and deflection at a section in a loaded beam? (3)
d) State Mohr's theorem. (3)
e) What are encaster beams? (3)
f) State Claperyrons theorem. (3)
g) Define maximum shearing stress. (3)
h) Briefly explain strain energy due to bending. (3)
i) Explain hoop stresses in a compound thick cylinders. (3)
j) What are the assumptions made in Euler's theory? (3)

PART B

(5×14=70 MARKS)

ANSWER ANY FIVE QUESTIONS

2. Direct stresses of 120 N/mm^2 tensile and 90 N/mm^2 compression exist on two perpendicular planes at a certain point in a body. They are also accompanied by shear stress on the planes. The greatest principal stress at the point due to thes is N/mm^2
a) What must be the magnitude of the shearing stresses on the two planes? (7)
b) What will be the magnitude shearing stress at the point? (7)
3. A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9 KN/m run over the entire span of 5m. If the value of E for the beam material is 1×10^4 N/mm^2, find:
a) Slope at the supports and (7)
b) Maximum deflection. (7)

4. A beam of length 6m is simply supported at its end and carries two point loads of 48 KN and 40 KN at a distance of 1m and 3m respectively from the left support. Using Macaulay's Method, find
   a) Deflection under each load (4)
   b) Maximum deflection, and (6)
   c) The point at which maximum deflection occurs. (4)

   Given $E = 2\times10^5$ N/mm^2 and $I = 85\times10^6$ mm^2

5. A continuous beam ABC covers two consecutive span AB and BC of lengths 4m and 6m, carrying uniformly distributed loads of 6 KN/m and 10 KN/m respectively. If the ends A and C are simply supported, using Clapeyrons equation of three moments, find the support moments at A, B and C. Draw the bending moment and shear force diagrams. (14)

6. Apply Castigliano's theorem for a body or a structure which is deformed by a set of n independent generalized forces, Pi. (14)

7. Derive Lame's equations involved for stresses in a thick cylindrical shell. (14)

8. a) What is the limitation of Euler's formula? (7)
   b) The external and internal diameter of a hollow cast iron column are 5cm and 4cm respectively. If the length of this column is 3m and both of its ends are fixed, determine the crippling load using Rankine's formula. Take the values of $\sigma c = 550$ N/mm^2 and $\alpha = 1/1600 =$ in Rankine's formula. (7)

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(9)

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