SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

Department of Mechanical Engineering

MinorI Exam, B.Tech Ist Sem(Mechanics of Materials)

Attempt all Questions *Code:MEL2016*

All Questions carry equal marks *Max.Marks=20*

1. Briefly explain Principle stresses and Hooks Law. For the given beam (Fig.1), neglecting shear due to bending, derive an expression for the strain energy of the beam for the given loading.

2. The three-bar truss is subjected to a horizontal force of 20 kN as shown in Fig.2. If cross-sectional area of each member is 100 mm^2, determine the horizontal displacement at pt B. E= 200 GPa.
3. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt according to Maximum principal stress and Distortion Energy theory. Take permissible tensile stress at elastic limit equals 100 MPa and poisson's ratio equals 0.3.
4. A pressure cylinder, 0.8 m long is made out of 5 mm thick steel plate which has an elastic modulus of 210 x 10^3 N/mm^2 and a Poisson's ratio of 0.28. The cylinder has a mean diameter of 0.3 m and is closed at its ends by flat plates. If it is subjected to an internal pressure of 3 N/mm^2, calculate its increase in volume.

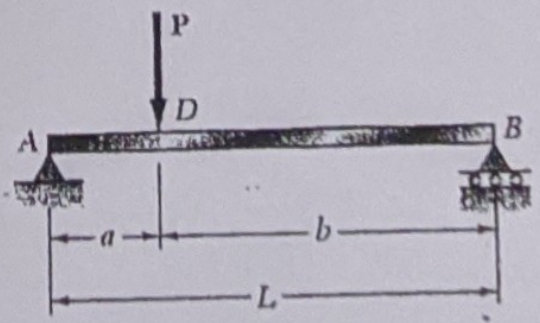


Fig 1

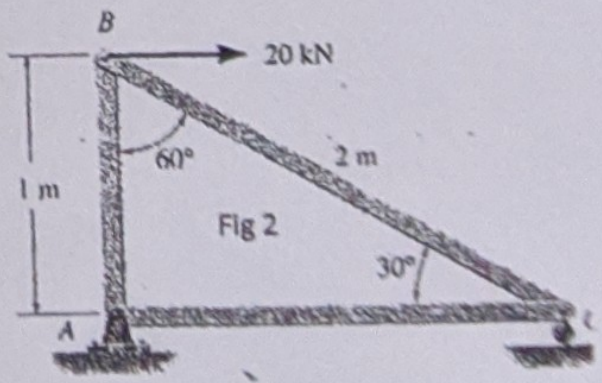


Fig 2

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

Department of Mechanical Engineering

MinorII Exam, B.Tech Ist Sem(Mechanics of Materials)

Attempt all Questions *Code:MEL2016*

All Questions carry equal marks *Max.Marks=20*

1 In what ways the strength of a thick cylinder can be increased. A pipe with internal diameter 300 mm is to carry fluid at a pressure of 12 MPa. If the maximum stress in the material of the pipe is restricted to 100 MPa, calculate the minimum thickness of the pipe required.

2 A compound tube is composed of a tube 25 mm internal diameter and 2.5 cm thick shrunk on a tube of 25 mm external diameter and 2.5 cm thick. The radial pressure at the junction is 80 N/mm^2 . The compound tube is subjected to an internal fluid pressure of 845 N/mm^2 . Find the variation of the hoop stress over the wall of the compound tube.

3 A beam of T-section (flange: 60 mm x 10 mm , web 100 mm x 5 mm) is 3 m length and is simply supported at the ends. It carries a load of 4 kN inclined at 20 degrees to the vertical (downwards) and passing through centroid of section.
If E= 200 GN/m^2, calculate (i) Maximum tensile stress,
(ii) Maximum compressive stress (iii) Position of neutral axis.

4. What is shear flow? Determine the shear center of the given section as in Fig.1.

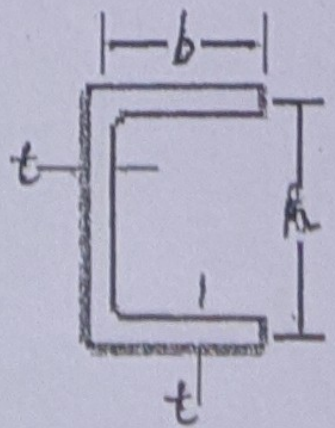


Fig 1

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mechanical Engineering

B. Tech.(SOME) Major Examination (Even Summer) 2017-18

Entry No: | | | | | | | 0 | 0 | 7 | **Total Number of Pages:[02]**

Date: 07/05/18 **Total Number of Questions: [05]**

CourseTitle: Mechanics of Materials

Course Code: MEL 2016

Time Allowed: 3.0Hours **Max Marks: [50]**

(Instructions / NOTE)

i. Attempt All Questions.

ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

iii. Assume any missing data to suit the case / derivation / answer.

Q1. (a) What is Strain energy? How does the concept of Strain energy helps a designer? [04]

(b) For the given system as shown in Fig.1, determine the magnitude of the force P necessary to produce a vertical movement of P of 25 mm. The member has a uniform width of 50mm throughout. Take E = 200GN/m^2 [06]

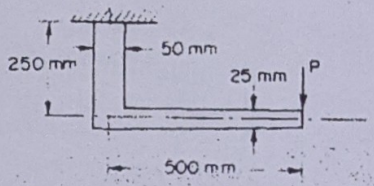


Fig.1..

Q2. (a) Why a designer needs failure theories? Why we have so many theories? [04]

(b)A steel shaft of yield strength 309MPa and of 80 mm diameter is subjected to a bending moment of 3kNm and torque T. taking Factor of safety as 2.5, determine the maximum value of torque T that can be safely carried by the shaft according to: [06]

i. Maximum normal stress theory ii. Maximum shear stress theory

iii. Von-Mises Theory

Q3. (a) Discuss the causes leading to unsymmetrical bending. Why shear centre is required? [04]

(b) A beam is constructed from four boards glued together as shown in Fig.2. If the beam is subjected to a shear of V=850N, determine the shear flow at B and C that must be resisted by the glue. [06]

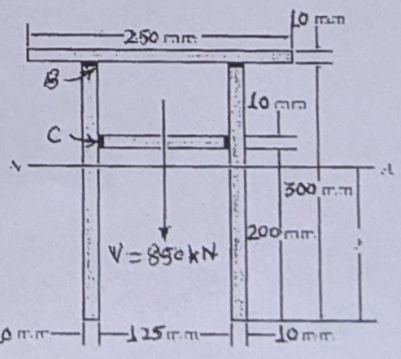


Fig.2..

Q4. (a) Distinguish between a static and a rotating cylinders? What are the various stresses encountered in these cylinders? [04]

(b) A compound cylinder is to be formed with inner diameter 300 mm, junction diameter 400 mm and outer diameter 500mm. If the initial difference in the diameter is 0.2 mm, find the radial pressure developed at the junction. [06]

Take E=,2 x 105 N/mm^2

Q5. (a) Derive bending equation for a curved bar as per Winkler bach theory [04]

(b) A composite spring has two closed coil helical springs. The outer spring is 15mm larger than the inner spring. The outer spring has 10 coils of mean diameter 40 mm and wire diameter 5 mm. The inner spring has 8 coils of mean diameter 30 mm and wire diameter 4mm. When the spring is subjected to an axial load of 400 N, find: [06]

i. Compression of each spring.
ii. Load shared by each spring.

The modulus of rigidity may be taken as $80kN/mm^2$

Course Outcomes

After successful completion of this course, students shall develop:

1. Understanding strain energy principles under different loadings, and usefulness of strain energy through different theorms such as Maxwell, Castiglianos etc.
2. Understanding and applying theories of failures in predicting failure of solid materials subjected to external loading systems.
3. Brief revision of pure bending followed by understanding the significance of unsymmetrical bending. The concept of shear centre in order to prevent twisting of the section is studied and practiced.
4. Understanding and calculating various stresses in thin and thick pressure vessels. The compounding of the cylinders is also focused upon and problems concerning compounding are practiced.
5. Understanding of the difference between static cylinders and rotating cylinders. Practicing problems involving rotating discs and cylinders
6. Understanding the difference between bending of straight and curved bars. Relating the concept with physical world and solving similar problems involving bending of curved bars, rings etc.
7. The students can determine stresses in various springs subjected to single and combined loading.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mechanical Engineering

B. Tech. (Branch) Minor Examination (Even) 2018-19

Entry No: 1 7 B M E 0 2 0 | Total Number of Pages: [02]

Date: | Total Number of Questions: [04]

Course Title: Mechanics of Materials

Course Code: MEL2016

Time Allowed: 1.5 Hours **Max Marks: [20]**

Instructions / NOTE

Attempt All Questions.

i. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
ii. Assume an appropriate data / information, wherever necessary / missing.
iii. Use of IS Code (Mention Number) is permissible in examination.

	Section - A		
Q1.	Explain the following:		
	(a) Castiglianos theorm	[2]	CO1
	(b) Shear flow	[2]	CO1
	(c) Impact factor	[1]	CO1
Q2.	(a) What do you understand by theories of failure?	[02]	CO2
	(b) Using Castiglianos theorm, find horizontal displacement at D of the frame shown in Fig. 1. Assume the flexural rigidity of the beam EI to be constant through out the member. Neglect strain energy due to axial deformations	[03]	CO1
	Section - B		
Q3.	(a)Determine the Strain energy of the beam as shown in Fig 2. Take EI as 200KNm^2	[2.5]	CO1
	(b) The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to Maximum shear stress theory (MSS). Take permissible tensile stress at elastic limit = 100 MPa.	[2.5]	CO2
Q4.	The rectangular cross section shown in Fig. 3 is subjected to a bending moment of 12 KNm. Determine the normal stress developed at each corner of the section, and specify the orientation of the neutral axis.	[05]	CO3

Fig.1

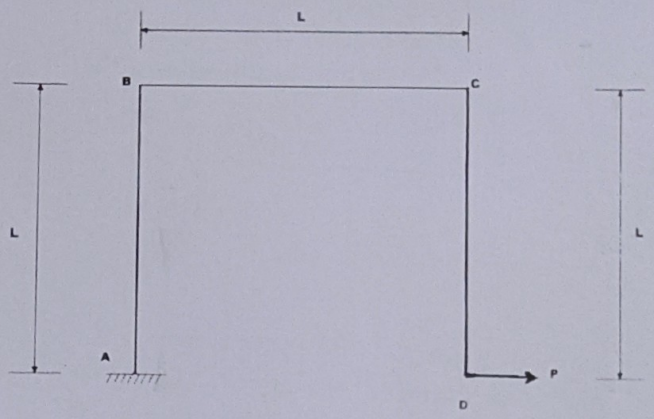


Fig.2

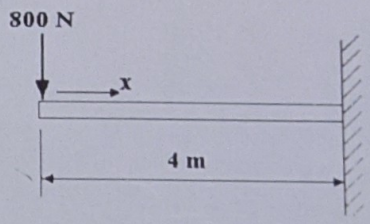
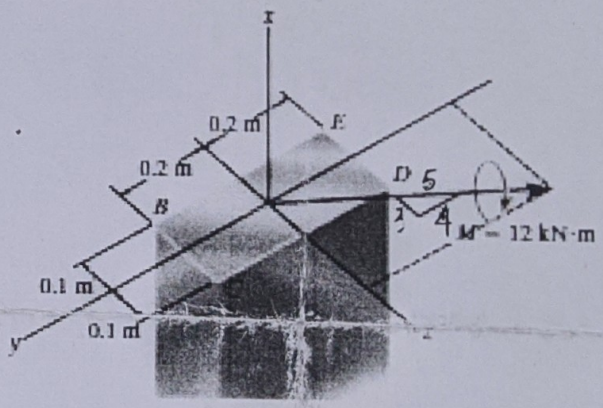


Fig.3



Course Outcomes

CO1. To recognize the concept of strain energy under axial, bending and torsional loads.
CO2. To understand and apply theories of failures in predicting failure of solid materials subjected to external loading systems.
CO3. To understand and apply principles related to unsymmetrical bending and shear center.
CO4. To apply and analyze concept of tension, bending and combined stresses in designing various machine components

1.

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mechanical Engineering

B. Tech. (Branch) Minor-2 Examination (Even) 2019-

Entry No: | | | | | | | | | |

Date:

Total Number of Pages: [02]

Total Number of Questions: [04]

Course Title: Mechanics of Materials

Course Code: MEL2016

Time Allowed: 1.5 Hours **Max Marks: [20]**

Instructions / NOTE

Attempt All Questions.

i. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
ii. Assume an appropriate data / information, wherever necessary / missing.
iii. Use of IS Code (Mention Number) is permissible in examination.

	Section - A		
Q1.	Explain the following: (a) Compound Cylinders (b) Auto Frettage	[2.5] [2.5]	CO2 CO2
Q2.	A thin cylinder 75 mm internal diameter, 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MN/m^2. Determine the change in internal diameter and the change in length. If, in addition to the internal pressure, the cylinder is subjected to a torque of 200 N m, find the magnitude and direction of the principal stresses. Take E = 200 GN/m^2, ν = 0.3.	[05]	CO2
	Section - B		
Q3.	A cylinder with external diameter 300mm and internal diameter 200mm is subjected to an internal pressure of 25 MPa. Compare the relative merits of a single thick cylinder and compound cylinder with the inner cylinder whose internal and external diameters are 200mm and 250 mm respectively. A tube of 250 mm internal diameter and 300mm external diameter is shrunk on the main cylinder. The safe tensile yield stress of the material is 110 MPa and the stress set up at the junction due to shrinkage should not exceed 10 MPa.	[5]	CO4
Q4.	A thin uniform disc of inner radius 50 mm and outer radius 200 mm is rotating at 6000 rpm about its axis. What are the maximum hoop and radial stresses? Draw the distribution of hoop and radial stresses along the radius of the disc. The density and poissons ratio as given are 7800kg/m^3 and 0.3.	[5]	CO4

40

Course Outcomes

CO1. To recognize the concept of strain energy under axial, bending and torsional loads.
CO2. To understand and apply theories of failures in predicting failure of solid materials subjected to external loading systems.
CO3. To understand and apply principles related to unsymmetrical bending and shear center.
CO4. To apply and analyze concept of tension, bending and combined stresses in designing various machine components

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mechanical Engineering

B. Tech. (Mechanical) Major Examination (Even/Summer) 2018-19

Entry No: | | | | | | | | | |

Date:

Total Number of Pages: [02]

Total Number of Questions: [05]

Course Title: Mechanics of Materials

Course Code: MEL 2016

Time Allowed: 3.0 Hours

Max Marks: [50]

Instructions / NOTE:

i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume an appropriate data / information, wherever necessary / missing.
iv. Use of IS Code (Mention Number) is not allowed in Examination.

Section – A

Q1.	Explain the following: a) Strain Energy b) Castigliianos theorem c) Theories of failure d) Unsymmetrical Bending	[2.5] [2.5] [2.5] [2.5]	CO1 CO1 CO2 CO3
Q2.	a) A simply supported beam is loaded as shown in Figure. Determine the strain energy stored due to bending. Take E = 210 GN/m² (Fig.1)	[4]	CO1
	b) A machine element is subjected to the following stresses, σ_x=60MPa, σ_y=45MPa, τ_{xy}=30MPa. Find factor of safety if it is made of C45 steel having yield stress as 353 MPa, using the following theories of failure: i. Maximum principal stress theory ii. Maximum Shear stress theory iii. Maximum Strain theory. Take poisons ratio as 0.3	[06]	CO2

Section – B

Q3.	A cantilever of length 1.2 m and of the cross section shown in Fig. 2 carries a vertical load of 10 kN at its outer end, the line of action being parallel with the longer leg and arranged to pass through the shear center of the section (i.e. there is no twisting of the section). Determine the stress set up in the section at points A, B and C, given that the centroid is located as shown. I_{xx} = 1 x 10^{-6} m^4, I_{yy} = 1.08 x 10^{-5} m^4	[10]	CO3
Q4.	a) A curved bar of rectangular section of 30mm width, 40mm depth and mean radius of curvature of 60mmis initially unstressed. If a bending moment of 400Nm is applied to the bar which tends to straighten it, determine the stresses at the inner and outer surfaces and sketch a diagram to show the variation of stress across the section. Also find the position of neutral axis. b) A spring loaded safety valve for a boiler is required to blow off at a	[05]	CO4

	pressure of 0.8 MPa. The diameter of valve seat is 90 mm and maximum lift of valve is 10 mm. Design a suitable spring for the valve assuming the spring index as 7. Provide an initial compression of 30 mm. Take allowable shear stress as 420 MPa	[05]	CO4
Q5.	a) A steel tube, which has an outside diameter of 10cm and inside diameter of 5cm, is subjected to an internal pressure of 14 MPa and an external pressure of 5.5 MPa. Calculate the maximum hoop stress in the tube.	[05]	CO2
	b) A thin disc is to be used as a rotating cutter. It is of uniform thickness except at the periphery where it is sharpened. The outer diameter of the disc may be taken as 250mm. The disc is mounted on a 50mm diameter shaft. Calculate the safe speed for the disc if the maximum stress is not to exceed 200 MN/m^2	[05]	CO4

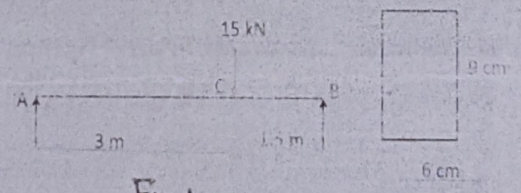


Fig.1

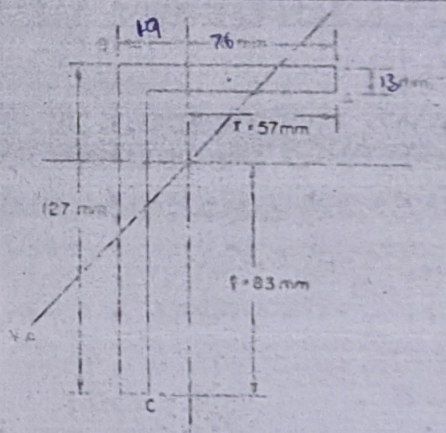


Fig.2

Course Outcomes

CO1. To recognize the concept of strain energy under axial, bending and torsional loads.
CO2. To understand and apply theories of failures in predicting failure of solid materials subjected to external loading systems.
CO3. To understand and apply principles related to unsymmetrical bending and shear center.
CO4. To apply and analyze concept of tension, bending and combined stresses in designing various machine components.

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam) (32)
CO1	Q1a-b, Q2a	9	32
CO2	Q1c, Q2b, Q5a	13.5	
CO3	Q3, Q1d	12.5	
CO4	Q4, Q5b	15	

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mechanical Engineering

B. Tech. (Mechanical Engineering) **Minor-I (4th Sem.) Feb. 2020**

Entry No: | | | | | | | 0 | 0 | 9 |

Total Number of Pages: [01]

Total Number of Questions: [04]

Course Title: Mechanics of Materials

Course Code: MEL 2016

Time Allowed: 1.5 Hours

Max Marks: [20]

Instructions / NOTE : Attempt All Questions

Q.1 Write short notes on the following **2*3=6 Marks**

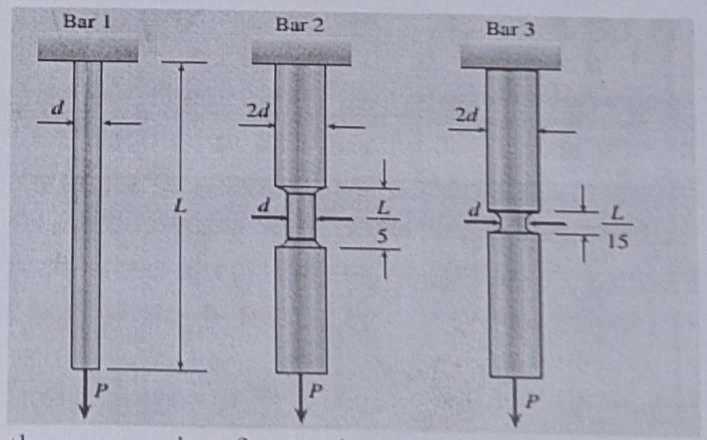
a) Modulus of resilence

b) Elastic and inelastic Strain Energy

c) Castigliano's Theorm

Q.2 A bar 100 cm in length is subjected to an axial pull, such that the maximum stress is equal to 150MN/m^2. Its area of cross-section is 2cm^2 over a length of 95cm and for the middle 5cm length it is only 1cm^2.if E=200GN/m^2, calculate the strain energy stored in bar. **04 Marks**

Q.3 Three round bars having the same length L but different shapes are shown in the figure below.All the bars are subjected to same axial load "P". Compare the amount of strain energy stored in the bars assuming linearly elastic behaviour. **05 Marks**



Q.4 Derive the expression for strain energy stored in a beam due to bending. **05 Marks**