Module (Course Syllabus) Catalogue

2021-2022

College/ Institute	Erbil Technical Engineering College	
Department	Mechanical and Energy Engineering Techniques	
Module Name	Strengths Of Materials	
Module Code	STM403	
Degree	Technical Diploma ☐ Bachler ■ High Diploma ☐ Master ☐ PhD ☐	
Semester	forth	
Qualification	MSc in applied Mechanics	
Scientific Title	Lecturer	
ECTS (Credits)	5	
Module type	Prerequisite ☐ Core ■ Assist. ☐	
Weekly hours	4	
Weekly hours (Theory)	(2)hr Class	( )Total hrs Workload
Weekly hours (Practical)	(2)hr Class	( )Total hrs Workload
Number of Weeks	12	
Lecturer (Theory)	Mrs. Ava Ali Kamal Mohammed	
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Lecturer (Practical)	Mrs. Ava Ali Kamal Mohammed	
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Websites		

Course Book

Course Description	Strength of Materials is a branch of mechanics that studies the relationships between the external loads applied to a deformable body and the intensity of internal forces acting within the body. Strength of Materials also involves computing the deformations of the body, and it provides a study of the body's stability when the body is subjected to external forces. The main concern of the strength of materials deals with understanding the (axial, direct shear, torsional shear, bending, transverse shear, combined load) stresses and their effects on a machine or structure. This course is designed to give student's skill to find a type of stresses prone mechanism or structure and conclude their effects in both elastic and plastic limits. This course is essential to understand the basics of Machine Design, where the student capable to design a machine according to the type of stresses applied to it.
Course objectives	**Studying all types of stresses (tension, compression, direct shear, torsional shear, bending) or combined of them on a mechanism or structure and if the strain is in the elastic or in plastic limit.**
Student's obligation	• **Attendance in the all lectures.** • **Several quizzes and assignment.** • **Exam in end of the course**.
Required Learning Materials	• **Lecture halls Using data show, white board and PowerPoint.** • **Testing in Mechanical Eng. Dep./Salahaddin University Laboratory.** • **Publish all lecture notes in college website**

			Task	Weight (Marks)	Due Week	Relevant Learning Outcome
Evaluation		Paper Review				
	Assignments	Homework		5%	6-7	
		Class Activity		2%	1-9	
		Report		5%	5-6	
		Seminar		5%	8	
		Essay				
		Poster				
	Quiz			8%	5-6	
	Lab.			10%	1-9	
	Midterm Exam			25%	10-11	
	Final Exam			40%	11-12	
	Total			100%		

Specific learning outcome:	**1- Stress and strain in general.** **2-Stress- strain behavior of Ductile and Brittle Materials subjected to axial and torsional load.** **3-All-important types of stresses and strains axial, direct shear, torsion, bending, transverse shear** **4-Deflection of beam and shafts.**
Course References:	**• R. C. Hibbeler, "Mechanics of Materials ", 9th edition, 2008.** **• Beer, Johnston & DE Wolf, "Mechanics of Materials ", 4th edition 2006.** **• R.S. Khurmi, "Applied Mechanics and Strength of Materials" SI units, 2005.**

Course topics (Theory)	Week	Learning Outcome
Meaning of stress, Axial stress.	1-2	1
Direct shear stress (single & Double).	3	1
Stress- strain behavior of ductile and brittle Materials subjected to axial and torsional load. Deformation, linear Normal strain& shear strain	4	2

Torsion	5	3
Resultant internal loading	6	3
Shear force and bending moment diagrams	7	3
bending	8	3
deflection	10	4
Transverse shear	11	3

Practical Topics	**Week**	**Learning Outcome**
Tensile Test	1	Stress and strain in elastic & plastic
Compression test	2	Stress and strain in elastic & plastic
Torsion test	3	Torsional stress &strain
Impact test	4	Impact toughness
Bending test	5	Finding deflection
Creep test	6	Creep strain

Questions Example Design

1. Compositional:

Q/ The assembly shown in Fig. 4–7a consists of an aluminium tube AB having a cross-sectional area of 400 mm2. A steel rod having a diameter of 10 mm is attached to a rigid collar and passes through the tube. If a tensile load of 80 kN is applied to the rod, determine the displacement of the end C of the rod. Take Est. = 200 GPa, EAl. = 70 GPa.

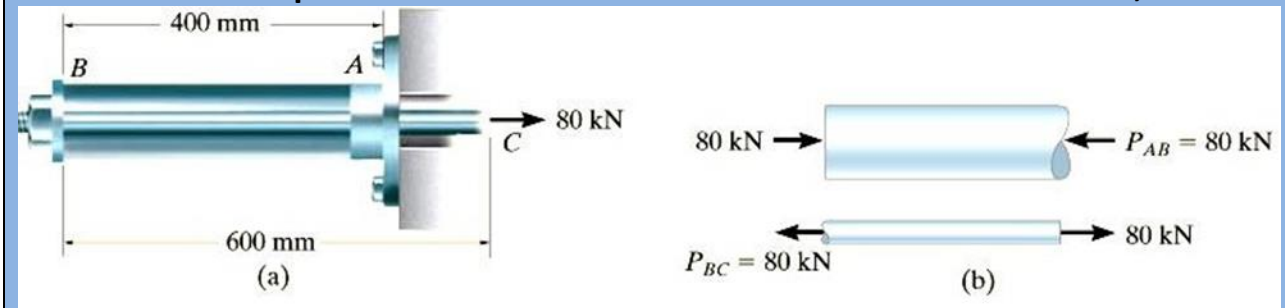


Fig. 4–7

SOLUTION

Internal Force. The free-body diagram of the tube and rod segments in Fig. 4–7*b*, shows that the rod is subjected to a tension of 80 kN and the tube is subjected to a compression of 80 kN.

Displacement. We will first determine the displacement of end C with respect to end B. Working in units of newtons and meters, we have

$$\delta_{C/B} = \frac{PL}{AE} = \frac{[+80(10^3)\ \text{N}](0.6\ \text{m})}{\pi(0.005\ \text{m})^2[200(10^9)\ \text{N/m}^2]} = +0.003056\ \text{m} \rightarrow$$

The positive sign indicates that end C moves *to the right* relative to end B, since the bar elongates.

The displacement of end B with respect to the *fixed* end A is

$$\delta_B = \frac{PL}{AE} = \frac{[-80(10^3)\ \text{N}](0.4\ \text{m})}{[400\ \text{mm}^2(10^{-6})\ \text{m}^2/\text{mm}^2][70(10^9)\ \text{N/m}^2]}$$
$$= -0.001143\ \text{m} = 0.001143\ \text{m} \rightarrow$$

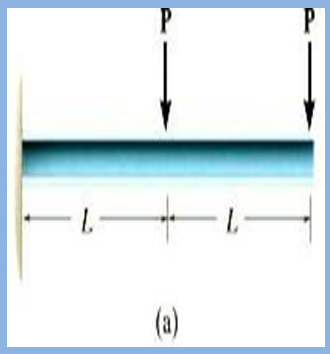
Here the negative sign indicates that the tube shortens, and so B moves to the *right* relative to A.

Since both displacements are to the right, the displacement of C relative to the fixed end A is therefore

$$(\pm\rightarrow) \qquad \delta_C = \delta_B + \delta_{C/B} = 0.001143\ \text{m} + 0.003056\ \text{m}$$
$$= 0.00420\ \text{m} = 4.20\ \text{mm} \rightarrow \qquad \textit{Ans.}$$

2. Sketching or Drawing type of exams:

Draw the shear and moment diagrams for the beam shown in Fig. 6–11*a*.



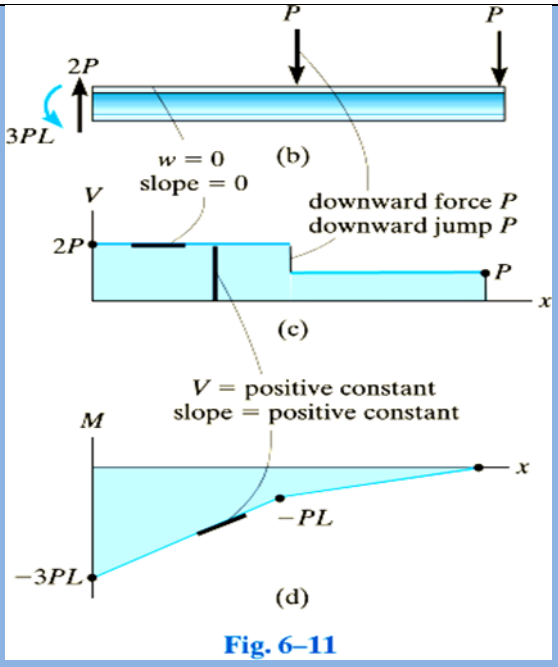


Fig. 6–11

Extra notes:

External Evaluator

The contents of this course book outlines the importance of Strength of Materials and its usage for future Machine Design course. The lectures are well organised, timely mannered and the references are up to date which they are sufficient for achievement the objectives of this course.
I recommend this course book and it satisfies the requirement of lecturing Strength of Materials.

Dr. Zhwan Dilshad Ibrahim
7/9/2022