Course Syllabus

1. **Course Title:** Strength of Materials
2. **Course Code:** STMA240121
3. **Credit Units:** 3 (3/0/6) (3 units of theory/ 0 unit of practice/ 6 units of self-study)
   Duration: 15 weeks (3 hours of theory+0 hours of practice, and 6 hours of self-study per week)
4. **Course Instructors**
   1/ Dr. Phạm Tấn Hùng
   2/ Dr. Phan Đức Huynh
   3/ MSc. Lê Thanh Phong
   4/ MSc. Trang Tấn Triển
5. **Course Requirements**
   Prerequisite courses: Fundamental of Mechanics (FUME130221)
   Previous courses: Advanced Mathematics A1 (MATH130101), Advanced Mathematics A2 (MATH130201); Fundamental Physics 1 (PHYS130102)
   Parallel courses: None
6. **Course Description**
   The course studies the internal effects of stress and strain in a solid body that is subjected to an external loading. Essential topics presented include elastic behavior of structural components under tension/compression, torsion, bending, and buckling. The course also introduces statically indeterminate and simply redundant structures; work and strain energy concepts.
7. **Course Goals**

Goals	Goal Description	Programme ELOs
G1	Understand the basic concepts of stress, strain, deformation, and material behavior under different types of loading	1.2
G2	Analyze and solve the problems of mechanic of materials of construction engineering.	2.1
G3	Engage in reading and communicating in English	3.3

8. **Course Learning Outcomes (CLOs)**

CLOs		CLO Description	Programme ELOs
G1	**G1.1**	Calculate the support reactions. Determine the internal forces acting on cross sections.	1.2
	G1.2	Draw the internal force diagrams and include all significant values by the sectional method and the graphical method.	1.2
G2	**G2.1**	Determine the normal and shear stress at a point on the cross section of bars, columns, shafts and beams. Draw distribution of stresses on the cross sections. Apply the principle of superposition for total effect of different loading cases.	2.1

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	G2.2	Indicate the methods for calculating the deflections. Compute the deflection of bars, shafts and beams. Analyze statically indeterminate members. Analyze the elastic stability of columns.	2.1
	G2.3	Calculate the modulus of elasticity for the materials from the σ-ε diagrams.	2.1
	G2.4	Analyze and draw free body diagram of structure of construction.	2.1
G3	**G3.1**	Read and understand English references of the strength of materials.	3.3

9. Learning Resources

- Textbooks:

1. R. C. Hibbeler. Mechanics of materials. 9th Edition. McFraw-Hill, 2013.
2. Đỗ Kiến Quốc, Nguyễn Thị Hiền Lương, Bùi Công Thành, Lê Hoàng Tuấn, Trần Tấn Quốc, Sức bền vật liệu. NXB ĐHQG TP.HCM, 2004.

- References:

1. Ferdinand P. Beer, E. Russell Johnston, John T. Dewolf. Mechanics of materials. McFraw-Hill, 2012.
2. Lê Thanh Phong. Sức bền vật liệu. Đh Spkt.Tp.HCM

10. Student Assessment

- Grading scale: **10**
- Assessment plan:

Type	**Content**	**Timeline**	**Assessment method**	**CLOs**	**Rate (%)**
Assigments					**70**
BT#1	Compute internal forces on the cross sections and draw internal force's diagrams	Week 1	Quiz	G1.1, G1.2	10
BT#2	Compute normal stress at a point on the cross sections of bars and columns	Week 4	Quiz	G1.2 G2.1 G2.2 G2.3 G2.4 G3.1	10
BT#3	Compute shear stress at a point on the cross sections of the shafts	Week 6	Quiz	G1.2 G2.1 G2.2 G2.4 G3.1	10
BT#4	Compute normal stress shear stress at a point on the cross sections of the beams	Week 10	Quiz	G1.2 G2.1 G2.2 G2.4 G3.1	10

BT#5	Find real structures under axial loading, torsion and bending, draw free body diagrams and solve these problems	Week 14	Homework	G1.2 G2.1 G2.4	10
Final exam					**50**
	- Calculating axial loading bars, shafts under torsion, beams, compound loading and buckling of column - Time: 90 min.	Week 17	Writing contest	G1.1 G1.2 G2.1 G2.2 G2.3 G2.4 G3.1	50
Total					**100**

11. Course Content

Week	Content	CLOs
1	***Chapter 1:*** **Fundamental concepts** *(4h,0,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** • Introduce and explain the course learning outcomes. • Give the tasks of students and. • Indicade scientific ethics. • Show afew examples of applications of the course in the construction 1.1. Research mission, research subjects of the course. 1.2. External loads, internal forces. 1.3. Stress. 1.4. Strain. 1.5. Superposition principle. **Pedagogical methods**: + Presentation of lecture + Discussion + Assessment 1	G1.1, G1.2, G2.2, G2.4, G3.1
	B/ Self-study content: *(8h)* + Find real structure on constructions, draw free body diagrams (FBD) + Determine internal force on the cross sections and draw internal force diagrams.	G1.1, G1.2, G2.4, G3.1
2	***Chapter 2:*** **Axial load** *(4h,0,8h)*	

	A/ Content and pedagogical methods in class*: (4h)* **Content:** 2.1. Difination 2.2. Internal force 2.3. Stress at a point on the cross section 2.4. Strain 2.4.1. Normal strain 2.4.2. Transverse strain and Poisson's ratio 2.5. Material properties 2.5.1. Tension test of materials 2.5.2. Compression test of materials 2.6. Condition of reliability – allowable stress 2.6.1. Condition of reliability 2.6.2. Allowable stress – Safety factor 2.7. Exercises for design for axial loading structure. **Pedagogical methods**: + Presentation of lecture + Solve problems	G1.2, G2.1, G2.2, G2.3, G2.4, G3.1
	B/ Self-study content: *(8h)* + Find real structure, which have axial loading members, building FBD and solve these problems. + Do homework	G2.1, G2.3, G2.4, G3.1
3	***Chapter 2:*** **Axial load (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 2.8. Compute displacement by graphical method 2.9. Strain energy 2.10. Formula Castigliano 2.11. Formula Mohr **Pedagogical methods**: + Presentation of lecture + Solve problems	G2.1, G2.2, G2.4, G3.1
	B/ Self-study content: *(8h)* + Find real structure, which have axial loading members, building FBD and solve these problems. + Do homework	G2.1, G2.2, G2.4, G3.1
4	***Chapter 2:*** **Axial load (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 2.12. Axial loading statically indeterminate problem. 2.13. Exercises for axial loading statically indetermine problem. **Pedagogical methods**: + Presentation of lecture	G2.1, G2.2, G2.4, G3.1

	+ Solve problems + Assessment 2	
	B/ Self-study content: *(8h)* + Find real structures, which have axial loading statically indetermine problem, building FBD and solve these problems. + Do homework	G2.1, G2.2, G2.4, G3.1
5	***Chapter 3:*** **Torsion** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 3.1. Defination 3.2. Internal force 3.3. Shear stress at a point on the cross section of the circular shaft 3.4. Stresses on pure shear 3.5. Strain – angle of twist 3.6. Condition of reliability – Condition of regibility 3.7. Strain energy **Pedagogical methods**: + Presentation of lecture + Solve problems	G1.2, G2.1, G2.4, G3.1
	B/ Self-study content: *(8h)* + Calculate stress in the joints (bolts, rivets, solders) + Do homework	G1.1, G2.1, G2.2, G2.4, G3.1
6	***Chapter 4:*** **Torsion (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **In-class practice:** 3.8. Torsion of rectangular shaft 3.9. Torsion thin-wall tubes 3.10. Calculate stress in the joints (bolts, rivets, solders) 3.11. Statically indeterminate torque-loaded members **Pedagogical methods**: + Presentation of lecture + Solve problems + Assessment 3	G2.1, G2.2, G2.4, G3.1
	B/ Self-study content: *(8h)* + Compute reliability of the joints. + Calculate the stress in rectangular shaft and thin wall tubes. + Compute and design bolts, rivets, solders. + Do homework	G2.1, G2.2, G2.4, G3.1
7	***Chapter 4:*** **Plane bending** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:**	G1.2, G2.1,

	4.1. Defination 4.2. Normal forces 4.3. Pure bending 4.3.1. Normal stress at a point on the cross section 4.3.2. Distribution of the stress on the cross seciton 4.3.3. Geometric properties of an area **Pedagogical methods**: + Presentation of lecture + Solve problems	G2.2, G2.4, G3.1
	B/ Self-study content: *(8h)* + Calculate the moment inertia for an area + Calculate the normal stress at a point on the section of beam + Find real structure, which have beam under pure bending, building FBD and solve these problems + Do home work	G2.1, G2.2, G2.4, G3.1
8	***Chapter 4:*** **Plane bending (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 4.3.4. Condition of reliability of beam under pure bending 4.4. Non-uniform bending 4.4.1. Normal stress at a point on the cross section 4.4.2. Shear stress at a point on the cross section 4.4.3. States of the tress at a point. 4.4.4. Condition of reliability of beam under non-uniform bending **Pedagogical methods**: + Presentation of lecture + Solve problems	G1.2, G2.1, G2.2, G3.1
	B/ Self-study content: *(8h)* + Calculate stresses at a point on the cross section of beam under non-uniform bending + Find real structure, which have beam under non-uniform bending, building FBD and solve these problems + Do homework	G2.1, G2.2, G2.4, G3.1
9	***Chapter 4:*** **Plane bending (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Contents:** 4.5. Strain energy of beam under bending 4.6. Deflection of beam 4.6.1. Defination 4.6.2. Elastic curve – Equation of the elastic curve 4.6.3. Compute displacement by integration 4.6.4. Formula Castigliano 4.6.5. Formula Mohr	G1.2, G2.2

	Pedagogical methods: + Presentation of lecture + Solve problems	
	B/ Self-study content: *(8h)* + Calculate deflection an slope of beam under non-uniform bending + Learn about statically indeterminate beams + Do homework	G2.2, G2.4, G3.1
10	***Chapter 4:*** **Plane bending (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 4.6.6. Formula Verexaghin **Pedagogical methods**: + Presentation of lecture + Solve problems + Assessment 4	G2.1, G2.2, G3.1, G2.4
	B/ Self-study content: *(6h)* + Find the reaction of statically indeterminate beams + Find real structures, which have statically indetermine beams, building FBD and solve these problems	
11	***Chapter 4:*** **Plane bending (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 4.7. Statically indeterminate beams. **Pedagogical methods**: + Presentation of lecture + Solve problems	G2.1, G2.2, G3.1, G2.4
	B/ Self-study content: *(6h)* + Learn about composite beams + Find real structures, which have statically indetermine beams, building FBD and solve these problems + Do homework	G2.1, G2.2, G3.1, G2.4
12	***Chapter 5:*** **Combine loading** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 5.1. Defination and classification. 5.2. Unsymmetrical bedning. 5.2.1. Deftination and indentificaiton 5.2.2. Stress at a point on the cross section 5.2.3. Distribution of normal stress 5.2.4. Condition of reliability 5.2.5. State of treses of beam under unsymmetric bending **Pedagogical methods**:	G1.2, G2.1, G2.2, G2.4, G3.1

	+ Presentation of lecture + Solve problems	
	B/ Self-study content: *(8h)* + Calculate stress at a point on the cross section of beam under unsymmetric bending. + Calculate the maximum bending tress. + Find real structures, which have unsymmetric bending beams, building FBD and solve these problems + Do homework	G2.1, G2.2, G2.4, G3.1
13	***Chapter 5:*** **Combine loading (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 5.3. Benđing – axial loading 5.3.1. Defination and indentification 5.3.2. Stress at a point on the cross section 5.3.3. Distribution of normal stress 5.3.4. Condition of reliability 5.3.5. State of stress. **Pedagogical methods**: + Presentation of lecture + Solve problems	G1.1, G1.2, G2.1, G2.4, G3.1
	B/ Self-study content: *(8h)* + Calculate stress at a point on the cross section of the members under bending – axial loading. + Determine the state of stress of a point. + Find real structures, which have the members under bending – axial loading, building FBD and solve these problems + Do homework	G1.1, G2.1, G2.4, G3.1
14	***Chapter 5:*** **Combine loading (cont.)** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Contents:** 5.4. Bending – torsion 5.4.1. Defination and indentification 5.4.2. Rectangular cross sectional shaft 5.4.3. Circular cross sectional shaft 5.5. State of stress of a point of a bending – torsion shaft **Pedagogical methods**: + Presentation of lecture + Solve problems	G1.1, G1.2, G2.1, G2.4, G3.1
	B/ Self-study content: *(8h)* + Calculate stress at a point on the cross section of the bending – torsional shaft. + Determine the state of stress of a point.	G1.1, G2.1, G2.4, G3.1

	+ Find real structures, which have bending – torsional shaft., building FBD and solve these problems + Do homework	
15	***Chapter 6:*** **Buckling of columns** *(4h,0h,8h)*	
	A/ Content and pedagogical methods in class*: (4h)* **Content:** 6.1. Critical load 6.2. Determine critical load of columns by Euler's formula 6.3. Critical stress 6.4. Inelastic buckling 6.5. Determine critical load of columns by the secant formula **Pedagogical methods**: + Presentation of lecture + Solve problems + Discussion	G2.1, G2.2, G3.1
	B/ Self-study content: *(4h)* + Determine the critical load of column	G2.1, G2.2, G3.1

12. Learning Ethics

Students must do homework by themselves. If plagiarism is found students will get zero point.

13. Date of first approval: August 1st, 2012

14. Approved by

Dean	Head of Department	Instructor
A/Prof. Dr. Nguyễn Trung Kiên	**Dr. Phạm Tấn Hùng**	**Dr. Phạm Tấn Hùng**

15. Date and Up-to-date content

1st time: Date: -	Instructor: Head of Department: