TECHNICAL ANALYSIS OF STRENGTH OF MATERIALS

By

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for the subject
Project Based Learning IV
In

T.E. MECHANICAL ENGINEERING

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CERTIFICATE

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On

"TECHNICAL ANALYSIS OF STRENGTH OF MATERIALS"

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CHAPTER 1

1.Understanding Bloom's Taxonomy and Gaming taxonomy

Bloom's Taxonomy

Bloom's Taxonomy was created by Benjamin Bloom in 1956, published as a kind of classification of learning outcomes and objectives that have, in the more than half-century since, been used for everything from framing digital tasks and evaluating apps to writing questions and assessments. The original sequence of cognitive skills was Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. The framework was revised in 2001 by Lorin Anderson and David Krathwohl, yielding the revised Bloom's Taxonomy. The most significant change was the removal of 'Synthesis' and the addition of 'Creation' as the highest-level of Bloom's Taxonomy. And being at the highest level, the implication is that it's the most complex or demanding cognitive skill–or at least represents a kind of pinnacle for cognitive tasks.

The 6 Levels of Bloom's Taxonomy

1. **The first level of Bloom's Taxonomy is to Remember.**

   Example activities at the Remembering level: memorize a poem, recall state capitals, remember math formulas

2. **The second level of Bloom's Taxonomy is to Understand.**

   Example activities at the Understanding level: organize the animal kingdom based on a given framework, illustrate the difference between a rectangle and square, summarize the plot of a simple story

3. **The third level of Bloom's Taxonomy is to Apply.**

   Example activities at the Application level: use a formula to solve a problem, select a design to meet a purpose, reconstruct the passage of a new law through a given government/system

4. **The fourth level of Bloom's Taxonomy is to Analyze.**

   Example activities at the Analysis level: identify the 'parts of' democracy, explain how the steps of the scientific process work together, identify why a machine isn't working

5. **The fifth level of Bloom's Taxonomy is to Evaluate.**

Example activities at the Evaluation level: make a judgment regarding an ethical dilemma, interpret the significance of a given law of physics, illustrate the relative value of a technological innovation in a specific setting—a tool that helps recover topsoil farming, for example.

6. The sixth and final level of Bloom's taxonomy is to Create.

Example activities at the Creation level: design a new solution to an 'old' problem that honors/acknowledges the previous failures, delete the least useful arguments in a persuasive essay, write a poem based on a given theme and tone.

Example of Bloom's Taxonomy for Strength Of Materials:

Applying Bloom's Taxonomy for creation of **Missile Launcher.**

Create – Finalized the requirements of the project and begin with production.

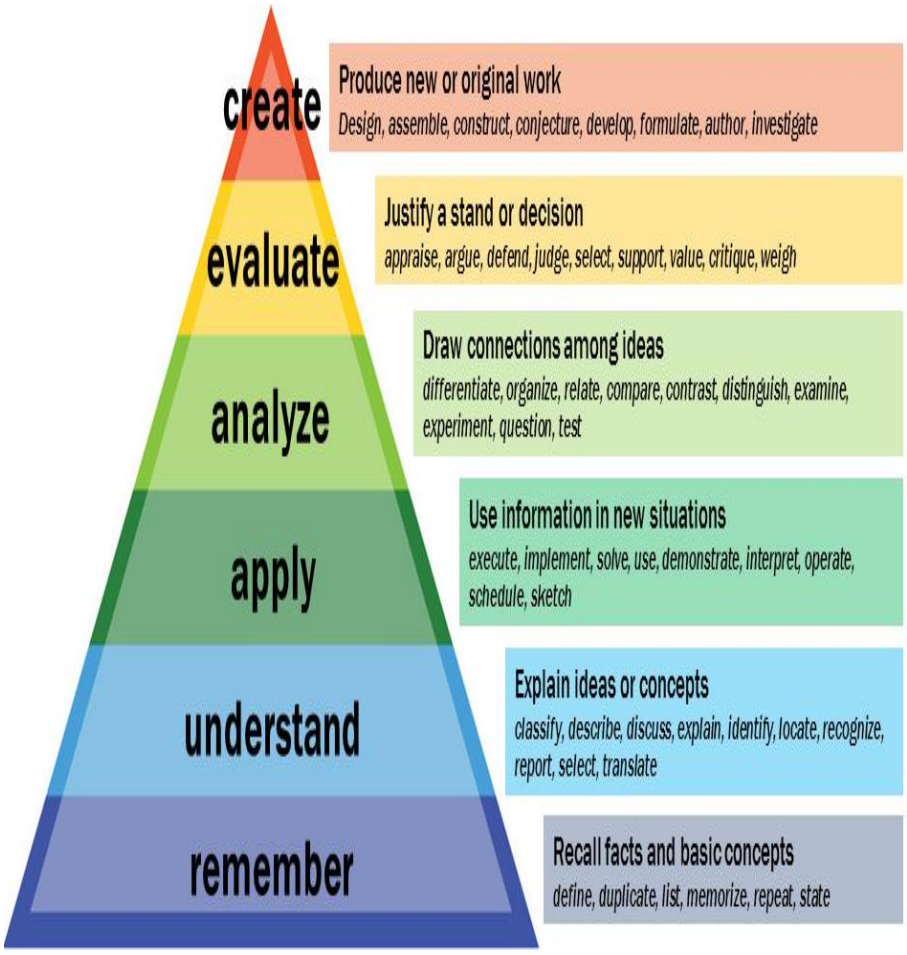
Evaluate – With the analysation, select the best materials for launcher according to the requirement and finalize the power, range and weight of the missile.

Analyse – Generate iterations for different parameters like, speed of missile, mass of missile and find the recoil effect for the same. Also develop stress strain variations for different cross sections for launcher arm and overall body.

Apply – Apply the motion laws and generate the projectile motion of the missile and draw the FBD of the launcher for the same.

Understand – The projectile motion and factors affecting the same. Understand the recoil effects on the body.

Remember – Basics of mechanics, stress, strain, modulus properties etc.



Gaming taxonomy

In 1999, Doug Church proposed the use of formal abstract design tools for game design. Part of Church's suggestion was to develop a common design vocabulary. It's ironic that while the game design community has started to develop these more rigorous design principles for games, there is much confusion even about the most basic of questions, such as what a game is, compared to a story or a simulation. This confusion only increases when we start to consider new and emerging forms like mobile games, location-based games and pervasive games. It's obvious that we need some basic distinctions and definitions at the highest level, so that more detailed methods can be sorted into their appropriate areas of application.

Developing a basic language for describing different types of games requires different dimensions of distinctions. That is, we need orthogonal taxonomies: not everything falls into a simple hierarchical system of categories and subcategories. Orthogonal taxonomies allow design concerns to be separated. So we can, for example, consider whether a game is a real-time strategy game or a warfare simulation, irrespectively of whether it is created for PCs, mobile devices, or technologically supported physical environments. The game play patterns for an RTS may apply irrespectively of the implementation strategy. Or at least, we can specify for a particular pattern what range of games it

applies to within a system of orthogonal categories. In some cases, we can even shed light on issues that still plague academic game researchers, such as the relationship between game play and narrative. How nice it would be to put this debate behind us once and for all!

In the taxonomy system proposed here, some fundamental distinctions are drawn between game forms and functions based upon narrative, repetitive game play and simulation; computer games can be seen to manifest these three functional and formal aspects to differing degrees, depending upon the particular game or game genre. Beyond the boundaries of games played only via computers and consoles we identify further classification dimensions, from virtual to physical gaming, and from fictional to non-fictional gaming.

Using game-based learning to develop Graduate Attributes. Game-based learning (GBL) is a type of game play that has Defined learning outcomes. Game-based learning is designed to balance subject matter with game play and the ability of the player to retain, and apply said subject matter to the Real world.

CHAPTER 2

Design of Objective Questionnaire

Qn. No.	Key word Used	Questions with Objectives	Blooms Taxonomy Level for the Question
1	**Memorize**	**Young's modulus is defined as the ratio of** a. Volumetric stress and volumetric strain b. Lateral stress and lateral strain c. Longitudinal stress and longitudinal strain d. Shear stress to shear strain	**Remember**
Ans.		Longitudinal stress and longitudinal strain	
2	**Derive**	**Design of thin cylinder is based on a _____.** A. Hoop stress B. Longitudinal stress C. Bending stress D. Shear stress	**Analyse**
Ans		Hoop stress	
3	**Identify**	**Hoop stress in thin cylindrical shell is _____.** A. Longitudinal stress B. Radial stress C. Compressive stress D. Circumference tensile stress	**Understand**
Ans.		Circumference tensile stress	
4	**Derive**	1. **Maximum shear stress in a thick shell is_____.** A. $(\sigma_h + \sigma_l)/2$ B. $(\sigma_h + \sigma_r)/2$ C. $(\sigma_h - \sigma_l)/2$ D. None	**Analyse**
Ans.		$(\sigma_h + \sigma_r)/2$	

5	**Implement**	**A Mohr's circle reduces to a point when the body is subjected to _____.** A. Pure shear B. Uniaxial stress only C. Equal and opposite axial stresses on two mutually perpendicular planes, the planes being free of shear D. Equal axial stresses on two mutually perpendicular planes, the planes being free of shear	**Apply**
Ans.		Equal axial stresses on two mutually perpendicular planes, the planes being free of shear	
6	**Derive**	**A thin walled cylindrical vessel of wall thickness 't' and diameter 'd' is filled with gas to a gauge pressure of 'p'. The maximum shear stress on the vessel wall will then be _____.** A. pd/t B. pd/2t C. pd/4t D. pd/8t	**Analyse**
Ans.		pd/8t	
7	**Solve**	2. **A thick cylinder is subjected to an internal pressure of 60 MPa. If the hoop stress on the outer surface is 150 MPa, then the hoop stress on the internal surface is _____.** A. 105 MPa B. 180 MPa C. 210 MPa D. 135 MPa	**Apply**
Ans.		A. 210 MPa	
8	**Solve**	**If a body is subjected to stresses in xy plane with stresses of 60N/mm² and 80N/mm² acting along x and y axes respectively. Also the shear stress acting is 20N/mm². Find the maximum normal stress.**	**Apply**

		A. 90 B. 92.4 C. 94.2 D. 96	
Ans.		92.4	
9	**Explain**	**If compressive yield stress and tensile yield stress are equivalent, then region of safety from maximum principal stress theory is of which shape?** A. Rectangle B. Square C. Circle D. Ellipse	**Understand**
Ans.		Square	
10	**Explain**	3. **Principal stress is the magnitude of _____ stress acting on the principal plane.** A. Normal stress B. Shear stress C. Both a. and b. D. None of the above	**Understand**
Ans.		Normal stress	
11	**Solve**	4. **The maximum tangential stress $\sigma_t = (\sigma_x \sin 2\theta)/2$ is maximum if, θ is equal to _____** A. 45^o B. 90^o C. 270^o D. all of the above	**Apply**
Ans.		45^o	
12	**Explain**	**The radius of gyration of a square section is not proportional to** A. square root of the moment of inertia B. square root of the inverse of the area C. square root of the moment of inertia divided by	**Understand**

		area of the section D. side of square	
Ans.		side of square	
13	**Memorize**	**The ratio of the effective length of a column and minimum radius of gyration of its cross-sectional area is known as_____.** A. buckling factor B. slenderness ratio C. crippling factor D. none of these	**Remember**
Ans.		slenderness ratio	
14	**Memorize**	5. **The equivalent length of a column fixed at one end and free at the other end, is___.** A. 0.5L B. 0.7L C. L D. 2L	**Remember**
Ans.		2L	
15	**Memorize**	6. **Struts are load currying members of a truss structure which are subjected to___.** A. Axial tensile loads B. Axial compressive loads C. Tensional loads D. Transverse loads	**Remember**
Ans.		Axial compressive loads	

CHAPTER 3

Design of Descriptive Questionnaire

3.1 Short Questions

Qn. No.	Key word Used	Questions with Objectives	Blooms Taxonomy Level for the Question
1	Derive	Derive the relation for section modulus of a circular section about an axis through its C.G., is	Analyse
2	Memorize	What is a thin sell?	Remember
3	Explain	What is the effect of joint efficiencies on the stress induced in the thin cylinder?	Understand
4	Explain	What is meant by strength of a joint?	Underdtand
5	Memorize	What are assumptions involved in the analysis of thin cylindrical shells?	Remember
6	Memorize	Define Circumferential and Hoop stress.	Remember
7	Solve	A thin walled spherical shell is subjected to an internal pressure. If the radius of the shell is increased by 1% and the thickness is reduced by 1%, with the internal pressure remaining the same, the percentage change in the circumferential (hoop) stress is?	Apply
8	Solve	A thin gas cylinder with an internal radius of 100 mm is subject to an internal pressure of 10 MPa. The maximum permissible working stress is restricted to 100 MPa. The minimum cylinder wall	Apply

		thickness (in mm) for safe design must be?	
9	**Memorize**	**Define effective length of a column.**	**Remember**
10	**Memorize**	**Define Hoop stress & longitudinal stress.**	**Remember**

3.2 Long Questions

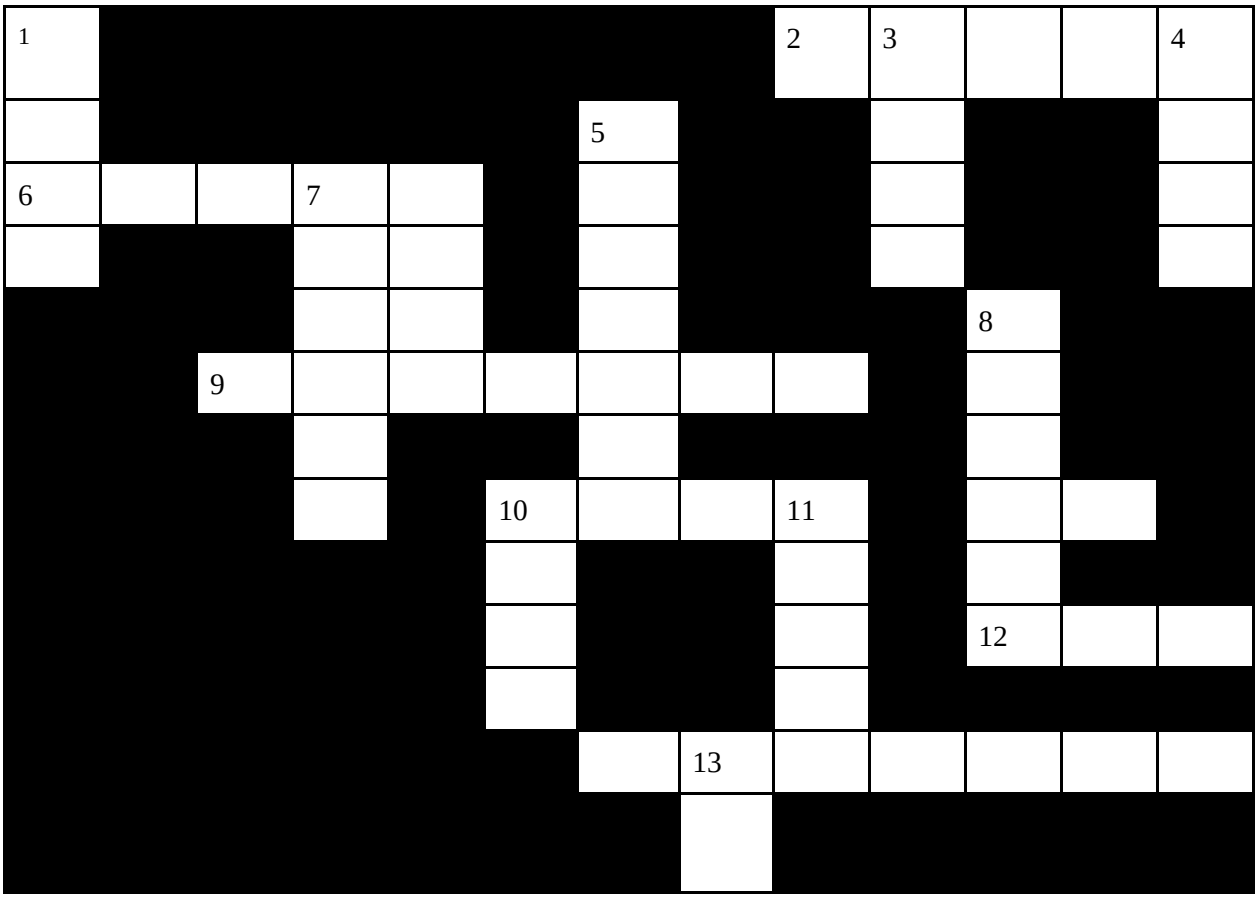
Qn. No.	Key word Used	Questions with Objectives	Blooms Taxonomy Level for the Question
1	**Distinguish**	**Distinguish between thin and thick cylinder.**	**Remember**
2	**Solve**	**A thin cylindrical shell is 3m long and 1m in internal diameter. It is subjected to internal pressure of 1.2 MPa. If the thickness of the sheet is12mm, find the circumferential stress, longitudinal stress, changes in diameter, length and. Take E=200 GPa and μ= 0.3.**	**Apply**
3	**Memorize**	**What is joint efficiency?**	**Remember**
4	**Memorize**	**Derive Lame's equations.**	**Analyse**
5	**Derive**	**Derive an expression for hoop stress in thin cylinders.**	**Analyse**
6	**Memorize**	**Explain design principals of thick walled cylinders. Instructional Objectives:**	**Remember**
7	**Solve**	**In a cylinder with inside diameter 200 mm (radius 100 mm) and outside diameter 400 mm (radius 200 mm) there is a pressure 100 MPa relative to the outside pressure.**	**Apply**

8	**Derive**	**Derive an expression for stress developed in thin spherical shell.**	**Analyse**
9	**Solve**	**A thin cylindrical shell is 3m long and 1m in internal diameter. It is subjected to internal pressure of 2.2 MPa. If the thickness of the sheet is18mm, find the circumferential stress, longitudinal stress, changes in diameter, length and. Take E=210 GPa and μ= 0.4.**	**Apply**
10	**Derive**	**Derive an expression for longitudinal stress for thin cylinders.**	**Analyse**

CHAPTER 4

4.1 Cross Words

TECHNICAL CROSSWORD



Across

2. HAZARD STUDY

6. CONSTRUCTION MATERIAL

9. JOINING METAL AT LOW TEMPERATURE

10. JOINING METAL

12. RELATED TO REFRIGERATION CAPACITY

13. TORQUE CONVERTER

Down

1. RELATED TO PUMP SUCTION

3. ONSHORE OIL COMPANY

4. FLUID MOVER

5. ENERGY TRANSFORMER

7. INCREASING CHAOS

8. CYCLE

10. UNIT OF POWER

11. ENGINE

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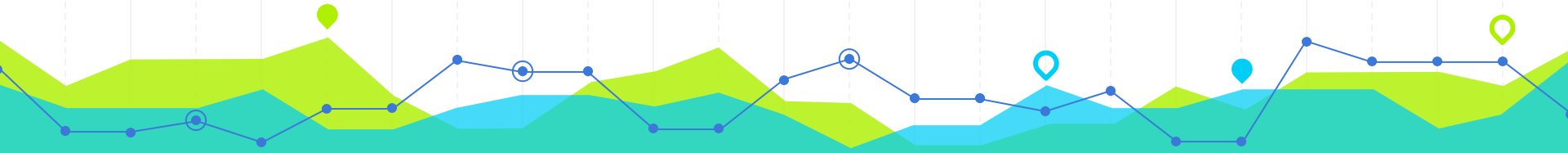

CHAPTER 1

Bloom’s Taxonomy

BLOOM'S TAXONOMY

The 6 Levels of Bloom's Taxonomy are as follows:

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Example activities at the Remembering level: memorize a poem, recall state capitals, remember math formulas

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BLOOM'S TAXONOMY

4. The fourth level of Bloom's Taxonomy is to Analyze.
Example activities at the Analysis level: identify the 'parts of' democracy, explain how the steps of the scientific process work together, identify why a machine isn't working

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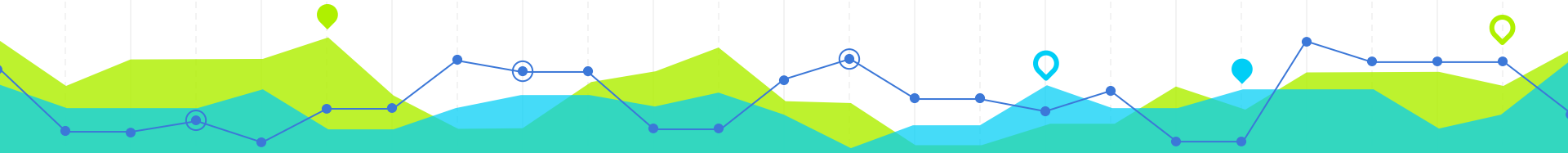


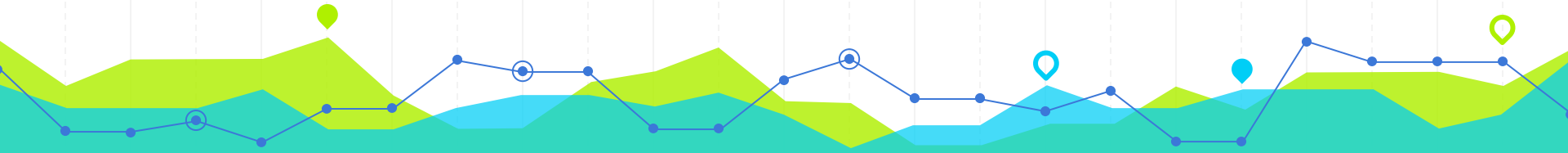
CHAPTER 2

Design of Objective Questionnaire

Design of Objective Questionnaire

KEYWORD	QUESTION	TAXONOMY LEVEL
Derive	**1. Maximum shear stress in a thick shell is_____.** A. $(\sigma_h + \sigma_l)/2$ B. $(\sigma_h + \sigma_r)/2$ C. $(\sigma_h - \sigma_l)/2$ D. None	**Analyse**
Identify	**Hoop stress in thin cylindrical shell is _____.** A. Longitudinal stress B. Radial stress C. Compressive stress D. Circumference tensile stress	**Understand**

In this way we designed different types of questions depending on the difficulty and taxonomy level.



CHAPTER 3

Design of Descriptive Question**naire**

Design of Descriptive Questionnaire

Short Answers

KEYWORD	QUESTION	TAXONOMY LEVEL
Derive	**Derive the relation for section modulus of a circular section about an axis through its C.G., is**	**Analyse**
Memorize	**What is a thin sell?**	**Remember**

In this way we designed different types of questions depending on the difficulty and taxonomy level.

Design of Descriptive Questionnaire

Long Answers

KEYWORD	QUESTION	TAXONOMY LEVEL
Derive	**Derive an expression for stress developed in thin spherical shell.**	**Analyse**
Solve	**A thin cylindrical shell is 3m long and 1m in internal diameter. It is subjected to internal pressure of 2.2 MPa. If the thickness of the sheet is18mm, find the circumferential stress, longitudinal stress, changes in diameter, length and. Take E=210 GPa and μ= 0.4.**	**Apply**

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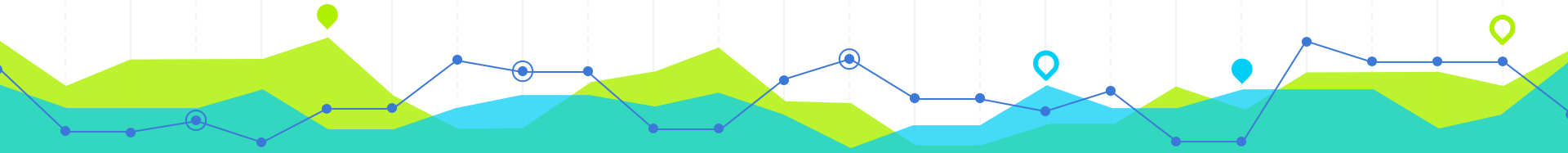
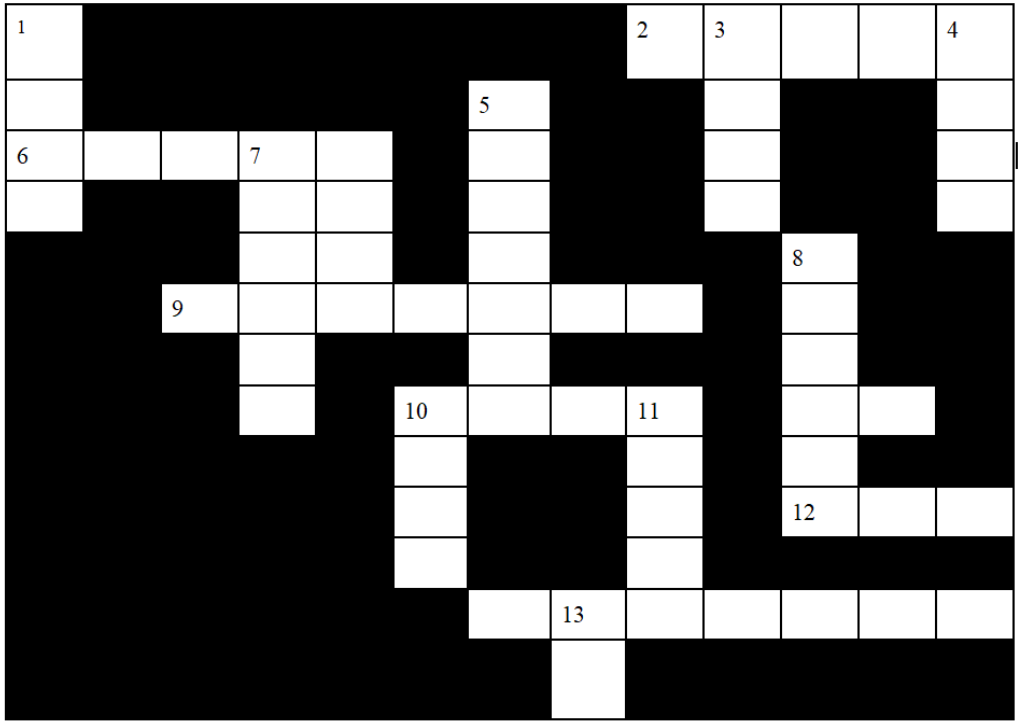


CHAPTER 4

Technical crossword

Technical Crossword



Technical Crossword

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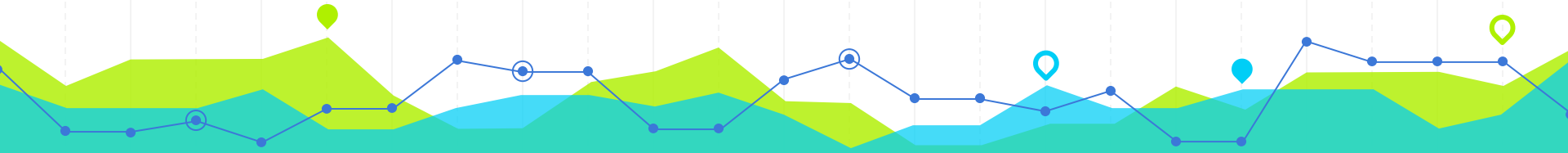

THANK YOU