FACULTY	Agriculture, Engineering and Natural Sciences		
SCHOOL	Engineering and the Built Environment		
DEPARTMENT	Civil and Mining Engineering		
SUBJECT	Building Materials		
SUBJECT CODE	TCVI3612		
DATE	November 2022		
DURATION	3 HOURS	Marks	100

REGULAR EXAMINATION

Examiners: Ms. J Simon, Mr. TTM Angula & Dr. R Ambunda

Internal Moderator: Dr. Petrina Johannes

External Moderator: Prof. Mitchell Gohnert (University of the Witwatersrand)

This question paper consists of 3 pages including this front page.

Instructions

1. **Closed** book examination.
2. Read the questions carefully.
3. The paper contains 6 questions. **Attempt all SIX (6) questions** for full marks.
4. Marks for each question are indicated.
5. Use sketches and diagrams wherever practical to illustrate your answers
6. Answer the questions in a precise and concise manner (no lengthy discussions needed!)

Question 1: Engineering Properties and Variability of Materials [10]

1.1 Differentiate between static load and dynamic load application, and state two examples of each. [6]

1.2 A tensile load of 190 kN is applied to a round metal bar with a diameter of 16 mm and a gauge length of 50 mm. Under this load, the bar elastically deforms so that the gauge length increases to 50.1349 mm and the diameter decreases to 15.99 mm. Determine the following:

a) Modulus of elasticity of the metal. [2]

b) Poisson's ratio for this metal. [2]

Question 2: Concrete (Aggregates, Cement, Admixtures and Fresh Properties) [32]

2.1 Describe the cement manufacturing process. [5]

2.2 Describe the step by step process of carrying out slump test for concrete. [10]

2.3 Define the two parameters used to describe the workability of concrete qualitatively [4]

2.4 Which hydration product in concrete is mainly responsible for protecting reinforcing steel against corrosion and state how does it protect the steel from corrosion? [2]

2.5 What is concrete durability? Describe any one deterioration process that may adversely affect the durability of concrete structures. [6]

2.6 You are a Civil Engineer in the construction of residential complex in Oshakati. You are asked to implement and consider sustainability in your project. Discuss five (5) sustainable tips you will consider in this project in order to fulfil the requirement. [5]

Question 3: Masonry [8]

3.1 Distinguish between blocks and bricks [2]

3.2 Explain why the strength of mortar is commonly required to be less than that of masonry [2]

3.3 List four main advantages of masonry [4]

Question 4: Steel and Aluminium [15]

4.1 Discuss three (3) mechanical tests that can be used to measure the properties of steel. [6]

4.2 a) Briefly define steel corrosion. [2]

b) List the four elements necessary for corrosion of steel to occur [2]

4.3 Discuss the three (3) main methods used to protect steel from corrosion. [5]

Question 5: Timber and Composite Materials [25]

5.1 a) Discuss the anisotropic nature of wood/timber. [2]

b) Explain how this anisotropic phenomenon affect the performance of wood? [4]

5.2 Figure Q4 shows the relationship between shrinkage and moisture content.

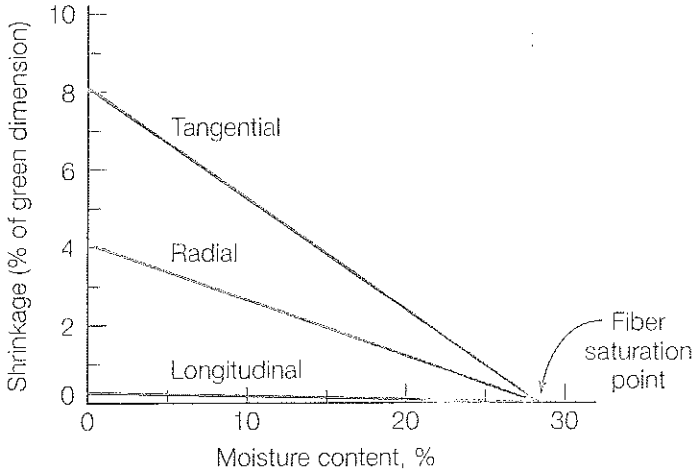

Figure Q4: Relationship between shrinkage and moisture content.

a) Define Fibre Saturation Point (FSP). [1]

b) Discuss the effect of the FSP on the shrinkage of wood in the different directions. [3]

c) Explain how this phenomenon affect the properties of lumber. [2]

5.3 a) Define microscopic composites. [1]

b) Name two phases of microscopic composites? [2]

Question 6: Asphalt and Bitumen [20]

6.1 Describe the difference between asphalt cement (bitumen) and asphalt emulsion? [5]

6.2 List and explain six common distresses /failures of Asphalt pavements. [12]

6.3 Mention three (3) types of bituminous surfacing seals used for pavement construction [3]

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