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University Examinations 2024/2025

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE MASTER OF SCIENCE IN CEMENT AND CONCRETE

SCT 7125: CONSTRUCTION MATERIALS

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Distinguish with between the following term as applied in construction materials and in each case provide two examples.

a) Primary and secondary materials. (2 marks)

b) Natural and synthetic materials. (2 marks)

b) Materials selection for construction plays a critical stage in ensuring the durability of the structures to be constructed. Discuss the importance of selecting appropriate construction materials for a building project. (2 marks)

c) A sample of wood has a dry mass of 200 g. after being exposed to a humid environment, the mass of the wood increases to 240g. Calculate the moisture content of the wood sample. (2 marks)

d) You are tasked with designing tiling a floor in a commercial building. Outline the considerations and materials you would use for both tasks. Include the types of and grout suitable for the applications. (3 Marks)

e) Explain the difference between structural and non-structural applications of metals in construction. Provide two examples of each. (2 Marks)

f) Describe the principle behind the following tests that are performed on metals to determine their mechanical properties: - (2 marks)

i) Tensile strength

ii) Hardness.

g) Explain the following defects in timber and their potential impact on structural performance: (3 marks)

i) Knots

ii) Warping

iii) Decay

h) Discuss the role of building codes in the use of glass and plastics in construction. Mention specific codes or standards relevant to their application. (4 marks)

i) Explain the concept of fiber-reinforced polymers (FRI)) and their typical advantages in construction. (3 marks)

j) Explain how nanomaterials contribute to sustainability in construction. Include at least two specific examples. (4 Marks)

k) Explain the concept of Life Cycle Assessment (LCA) and describe its stages in evaluating the environmental impact of construction materials. (3 Marks)

QUESTION TWO (15 MARKS)

a) You are working on a project to construct a sustainable office building. Outline the process you would follow to select materials for this project. Include considerations for both primary and secondary materials, and explain how you would ensure that the materials meet the criteria for sustainability and performance. (8 Marks)

b) Discuss the properties and testing methods for bitumen and asphalt. Include details on how these properties affect the performance of asphalt pavements. (7 Marks)

QUESTION THREE (15 MARKS)

a) Discuss the key mechanical properties of steel, aluminium, and copper, and how these properties influence their applications in construction. Explain the methods of protecting metals from corrosion, including galvanization, coatings, and paints. (6 marks)

b) Discuss innovative sustainable material solutions in construction. How do these materials contribute to energy efficiency and environmental sustainability? Provide specific examples and their impact on building performance. (9 Marks)

QUESTION FOUR (15 MARKS)

a) Analyze the typical performance characteristics and limitations of using Polyvinyl

b) Chloride (PVC) and High-Density Polyethylene (HDPE) in construction applications. (8 Marks)

c) A sample of insulation materials has the following characteristics:

- Conducted heat quantity (Q) = 1000J
- Thickness of material (d) = 0.05m
- Heat-transfer area (A) = $1m^2$
- Time for heat transfer (f) = 60s
- Temperature difference = 30K

Calculate the coefficient of thermal conductivity (1) of the insulation material. Based on your results, discuss whether this material would be considered a good insulator. (7 marks)