

THE OPEN UNIVERSITY OF SRI LANKA  
DIPLOMA IN TECHNOLOGY (ENGINEERING) - LEVEL 3  
FINAL EXAMINATION - 2012/13



CEX3230 - CONSTRUCTION MATERIALS

Time allowed: Three hours

Date : Tuesday, 23<sup>rd</sup> July 2013

Time: 0930 -1230 hours

Answer any five questions. All questions carry equal marks. Write down your Index Number clearly on the answer script.

*If you have answered more than five questions (either partly or in full), cross out the extra answers. Otherwise, only the first five answers appearing in the answer book will be evaluated.*

Q1. A double storey building for a hotel complex is to be built along the coastal line. The design shows that this needs to be roofed over by reinforced concrete beams and the beams, columns and the slab is to be made using 1:2:4 (20mm) of grade 20 concrete. Assume that you have been appointed as the Technical Officer to the said project and answer the following questions:

- i. State the desired properties of structural concrete both in fresh state and hardened state. (4 marks)
- ii. Would you be able to use the well water in the vicinity of site? Give reasons for your answer. State four properties of water that should be used to get good quality concrete. (4 marks)
- iii. If the cement bought is suspected to be adulterated, state the steps that you would take to ensure its quality. (4 marks)
- iv. Describe what is meant by 'bulking of sand'. Explain how you would make allowance for it. (4 marks)
- v. Assuming that mild steel is used in reinforcement list out the properties of mild steel. (4 marks)

Q2. Wood is a raw material that has been used as an engineering material from the olden times and needs to be well seasoned and preserved to be used for structural elements.

- i. Explain why timber for structural purposes should be properly seasoned and describe two methods of seasoning of timber from green state in Sri Lanka before using for structural purposes. (4 marks)

- ii. Explain why preserving is needed and describe two traditional practices of preserving bamboo timber in Sri Lanka. (4 marks)
- iii. Illustrate with neat sketches the commercial methods of sawing of timber adopted in Sri Lanka. Also discuss the suitability of each of the mentioned timber sections for structural work. (4 marks)
- iv. What considerations will you keep in mind while selecting good quality timber for structural purposes? Explain why plywood is not an alternative for this purpose. (4 marks)
- v. List out three seasoning defects of timber. (4 marks)

Q3. Use of pressed cement blocks for walling material instead of burnt clay bricks is one option to cut down on the rising cost of a building a house.

- i. Describe briefly four different methods to cut down the rising cost of building a house. (4 marks)
- ii. State four measures necessary to ensure the manufacture of quality cement blocks. (4 marks)
- iii. Enumerate briefly the harmful ingredients in clay when manufacturing bricks and effects if these are present in bricks. (4 marks)
- iv. Describe the characteristics and essential features of good quality bricks. (4 marks)
- v. Explain how you would test whether the bricks have adequate compressive strength at site. Give two methods. (4 marks)

Q4. Wall, floor and roof tiles of various types, shapes, colours are available to the consumer in the market.

- i. State the common defects present in wall tiles. Explain how you would ascribe these to the manufacturing conditions. (4 marks)
- ii. When using fired clay tiles for roofing, list out three defects that need to be inspected for and how you would ascribe these to manufacturing conditions. (4 marks)
- iii. You are requested to select a suitable tile to pave a road where there is vehicle movement from the gate to the garage of a house. What decisions involve your choice of material? (4 marks)
- iv. Draw a process flow chart for the manufacture of fired clay roofing tiles. (4 marks)

- v. Asbestos sheets are widely used in Sri Lanka as a roofing material instead of clay tile roofing. Give three reasons why asbestos are preferred over clay tiles. (4 marks)

Q5. A house is at its finishing stage. Plastering using lime mortar for internal walls and cement mortar for external walls and white washing was chosen as the internal and external finishes of walls. All metal work needs to be painted.

- i. Describe the preparation and the procedure of white washing plastered walls. (3 marks)
- ii. Discuss the quality of sand to be used in a mortar mix. (3 marks)
- iii. Explain why cement mortar is chosen for external walls instead of lime mortar. (3 marks)
- iv. List three types of wall finishes instead of plastering and whitewashing. (3 marks)
- v. Describe how lime is slaked for plasterwork. (3 marks)
- vi. Give the essential constituents of paints and the functions of each of these. (5 marks)

Q6. (a) Cast iron is widely used in engineering and allied industries. Irrigation sluice gates, penstocks, grills and ornamental work and manhole covers are a few items that are made out of cast iron.

- i. Explain how cast iron is formed. (5 marks)
- ii. State three desirable properties of cast iron, which make it suitable for the above applications. (3 marks)
- iii. Explain why cast iron is not suitable as a structural material as compared for instance with steel. (3 marks)

(b) Copper and Aluminium find applications both in pure form and as alloys in modern engineering.

- i. Copper alloys when compared to pure copper possess many advantages. State three advantages of copper alloys over pure copper. (3 marks)
- ii. Seamless copper piping is commonly used for domestic hot and cold water supplies and sanitary purposes. State three properties of copper which make it suitable for this application. (3 marks)
- iii. List three heat treatment processes that can be used to improve the performances of Aluminium alloys. (3 marks)

Q7. (a) Plastics mostly being synthetic materials are available in market in a variety of forms to suit varied requirements. These are fast replacing conventional materials like timber and steel.

- i. Discuss why plastics are fast replacing many conventional materials. (3 marks)
- ii. PVC is one of the plastics commonly used in Sri Lanka for various applications. Explain how PVC is formed and the manufacturing process of PVC products used in the construction industry. (5 marks)
- iii. Discuss the factors that affect the degradation of plastics. (3 marks)

(b) Bitumen and coal tar are the two basic materials used in road works as binding materials.

- i. Compare the characteristics of bitumen and tar. (3 marks)
- ii. Give two types of tests that you can follow to distinguish bitumen and tar. (3 marks)
- iii. What are bitumen emulsion and cutback? Under what circumstances can they be used? (3 marks)

Q8. It is required to select a geosynthetic for use under rock armour in a coastal defense scheme. The underlying beach material is coarse sand and ideally the armour should be placed directly onto the geosynthetic.

- i. State the properties that need to be investigated in order to select a suitable geosynthetic. (4 marks)
- ii. List out the functions that need to be fulfilled by the geosynthetic in the above application. (4 marks)
- iii. Sketch a diagram of rock armour with geosynthetic at the underlying beach material interface. (4 marks)
- iv. Discuss the suitability of Jute geotextiles for the above application. (4 marks)
- v. Give three examples of uses of Jute geotextiles in civil engineering applications. (4 marks)