INSTITUTE OF CONCRETE TECHNOLOGY
CONCRETE TECHNOLOGY & CONSTRUCTION

Stage 1
CONCRETE PRACTICE

Learning objectives Revision 2 (2014)

1.00.00	**Introduction to the course** 1.00.01 Outline the aims, objectives and content of the course. 1.00.02 State methods of teaching and learning to be used on the course. 1.00.03 Plan for career progression and further training following successful completion of the course.
1.01.00	**Health and safety** 1.01.01 State the potential risks to health when handling cement, concrete, mortars, admixtures and any other constituent material of concrete, and describe the measures that should be taken to minimize the risk to health. 1.01.02 Identify and state sources of danger in the operation of plant and equipment used in concrete operations and list precautions to be taken to ensure safe working.
1.02.00	**Sustainability** (with acknowledgement to BRE Global Ltd) 1.01.01 Define sustainability and its relevance to concrete. 1.01.02 List main sustainability issues associated with sourcing of constituent materials. 1.01.03 Identify environmental impact of concrete production and supply 1.01.04 Identify environmental impacts of CDE (construction, demolition and excavation).
1.03.00	**The nature of concrete** 1.03.01 Define plain concrete, reinforced concrete, in situ concrete, precast concrete, prestressed concrete, non-structural concrete, lightweight and heavy-weight concrete, and self-compacting concrete. 1.03.02 Identify types of concrete listed in 1.03.01 by inspection during manufacture or construction, or from description. 1.03.03 Identify suitable construction application of the following types of precast element: paving slabs, kerbs, blocks, pipes and cladding.
1.04.00	**Cementitious materials** 1.04.01 Name the common cements. 1.04.02 State effects on properties of concrete of using different types of cement. 1.04.03 List the types of Portland cement, name the principal raw materials and outline the normal production processes. 1.04.04 State the effect of fineness of grinding of cement on strength development of concrete. 1.04.05 State the differences between masonry cement and Portland cement CEM I. 1.04.06 State the most appropriate cement for use in a particular situation, given essential information about the conditions. 1.04.07 Name cements which it is essential to prevent from accidental mixing together and state reasons. 1.04.08 State normal methods of cement packaging and delivery and quantities in package and state reasons for using bulk or bagged cement.

	1.04.09 Describe satisfactory methods of storing cement in bags and in bulk. 1.04.10 Identify satisfactory or unsatisfactory condition of cement by visual inspection, feel or description. 1.04.11 Describe the production, properties and use of fly ash (pulverised-fuel ash) and ground granulated blastfurnace slag in concrete.
1.05.00	**Natural aggregates** 1.05.01 List the main types of natural aggregates and describe their production and processing. 1.05.02 Identify crushed stone and gravel aggregate from sample or description. 1.05.03 Define coarse and fine aggregates 1.05.04 State how coarse and fine aggregates are classified in terms of size and grading. 1.05.05 Describe important site tests for aggregates for concrete and state reasons for tests. 1.05.06 Describe the main standard tests on aggregates and state their limiting values. 1.05.07 Describe how to take a representative sample of aggregate from bulk supply in accordance with standard methods. 1.05.08 Demonstrate a knowledge of how to prepare and sieve a sample of aggregate in accordance with standard methods, including calculation of results. 1.05.09 Describe the various methods of determining the moisture content of aggregates and compare the results and their application. 1.05.10 Identify shape of aggregate particles from samples. 1.05.11 Identify dirty aggregates, major differences in aggregate grading, presence of large proportion of flaky particles, by visual inspection or description. 1.05.12 List the main impurities associated with aggregates and state their possible effects on concrete. 1.05.13 Explain how the properties of aggregates affect their handling and storage and describe what action may be taken to minimize any problem. 1.05.14 List the properties of aggregates that affect properties of concrete and state important effects.
1.06.00	**Admixtures** 1.06.01 Name types of admixture in common use 1.06.02 State the usual physical forms(s) of each admixture. 1.06.03 State the reasons for the importance of following specifications and manufacturers' instructions regarding dosage rates. 1.06.04 State the typical air contents for air-entrained concrete and list the main factors affecting the amount of air entrained. 1.06.05 Describe the effects of various types of admixture on the properties of fresh and hardened concrete.
1.07.00	**Water** 1.07.01 State requirements for water to be satisfactory for use in concrete. 1.07.02 State situations where it is necessary to carry out chemical and physical tests in order to determine whether water is suitable for use in concrete.
1.08.00	**Concrete properties** 1.08.01 Name and recognise constituents of concrete. 1.08.02 State which constituents are involved in chemical reaction with each other. 1.08.03 Describe the nature and physical composition of concrete, and basic principles of the process of hydration. 1.08.04 Identify the fresh, hardening and hardened states of concrete by visual inspection or description. 1.08.05 List important properties of concrete in its various states from the time of mixing onwards. 1.08.06 Identify the major factors that may influence properties and development of properties of concrete. 1.08.07 Define strength in terms of maximum load and area on which load acts. 1.08.08 Identify the typical range of concrete strengths used for a particular purpose. 1.08.09 Define density and state the density of water, give particle densities of cement, natural aggregates, fly ash and ground granulated blastfurnace slag. 1.08.10 Identify range of densities of normal-weight, lightweight and heavy-weight concretes.

1.09.00	**Reinforcement** 1.09.01 Give simple definitions of compression, tension, shear and bond as applied to structural concrete. 1.09.02 Distinguish between steel bar, fabric and fibre reinforcement and state applications. 1.09.03 Describe how reinforcement is secured for simple structural concrete members. 1.09.04 State reasons for providing cover to reinforcement.
1.10.00	**Plant for batching and mixing** 1.10.01 List principal types of batching and mixing equipment and recognize them from a description or illustration. 1.10.02 List typical sizes of ready-mixed concrete trucks.
1.11.00	**Proportioning, batching and mixing** 1.11.01 Differentiate between proportions by weight and by volume 1.11.02 Recognise typical range of mix proportions in use, expressed either as ratios or quantities per unit volume. Describe typical mix proportions for concrete to be used for a particular purpose. 1.11.03 Distinguish between the terms 'total water', 'added water' and 'effective (free) water' and explain the importance of water/cement ratio in mix design. 1.11.04 List and define main properties of concrete to be taken into account when selecting proportions or batch quantities. 1.11.05 Describe situations where weigh batching and volume batching would be appropriate. 1.11.06 State key characteristics of materials and their proportioning that influence mix design. 1.11.07 State major effects on properties of concrete of changes in quantities of constituents. 1.11.08 State the methods and procedures for storing constituent materials. 1.11.09 State effects on concrete due to changes in aggregate grading and moisture content. 1.11.10 Calculate effective (free) water content of concrete from effective (free) water/cement ratio and cement content. 1.11.11 Using a standard table for prescribed concretes, determine the quantities of dry materials needed to produce a cubic metre of concrete to meet a given specification. 1.11.12 Calculate adjustments to be made to batch quantities due to changes in moisture content of aggregate. 1.11.13 Define bulking of sand and state adjustments to be made to batch quantities to allow for bulking. 1.11.14 Outline procedures for batching and mixing concrete and list precautions to be taken to maintain uniformity, for both site-mixed and ready-mixed concrete. 1.11.15 Calculate volume of compacted concrete required to fill a form of given dimensions. 1.11.16 State the meaning of the terms 'designated', 'designed', 'prescribed', 'standardised prescribed' and 'proprietary' concretes and describe the differences between prescription and performance specifications.
1.12.00	**Transporting, handling and placing** 1.12.01 List properties of concrete which could be affected during transporting, handling and placing. 1.12.02 State precautions to be taken to avoid adverse effects during transporting, handling and placing. 1.12.03 Evaluate courses of action in the event of a delay in the discharge of of delivery of concrete.
1.13.00	**Compaction** 1.13.01 State reasons for compacting concrete 1.13.02 Describe the effects on concrete of vibration 1.13.03 State conditions necessary to enable concrete to be compacted satisfactorily. 1.13.04 Distinguish when compaction of concrete is complete. 1.13.05 Describe effects of incomplete compaction 1.13.06 Describe the principal types of compacting equipment and their application. 1.13.07 Explain the difference between internal and external vibration and give reasons for the use of each method. 1.13.08 Describe self-compacting concrete and give reasons for its use

1.14.00	**Curing** 1.14.01 Define curing and state effects of curing on properties of concrete 1.14.02 List factors affecting curing and state effects of each. 1.14.03 List and compare curing methods available, including special measures for extreme conditions. 1.14.04 Select suitable curing methods for given situations.
1.15.00	**Formwork and falsework** 1.15.01 Define the terms 'formwork' and 'falsework' as applied to concrete construction. 1.15.02 Identify safe and unsafe conditions of formwork and falsework from visual inspection or description. 1.15.03 State the checks of formwork and falsework necessary before concreting. 1.15.04 Identify stability and instability of formwork and falsework during concreting 1.15.05 State the factors affecting formwork striking times
1.16.00	**Surface finish** 1.16.01 Describe methods for finishing the top surface of concrete. 1.16.02 Name common types of release agent, describe their properties and outline methods of storage and application. 1.16.03 List the factors affecting the appearance of formed concrete surfaces.
1.17.00	**Joints** 1.17.01 Describe in simple terms contraction joints, expansion joints and construction joints and state the purpose of each. 1.17.02 Describe methods of forming satisfactory horizontal and vertical construction joints in plain and reinforced concrete walls. 1.17.03 Describe methods of forming satisfactory construction joints in slabs, beams and columns. 1.17.04 State requirements for construction joints to be watertight.
1.18.00	**Lightweight and heavy-weight concretes** 1.18.01 Describe the main types of lightweight and heavy-weight concrete. 1.18.02 Describe the properties of different types of lightweight and heavy-weight aggregates. 1.18.03 State the main applications of lightweight and heavy-weight concretes.
1.19.00	**Testing and inspection** 1.19.01 Explain importance of performing tests in accordance with standard procedures. 1.19.02 State procedures for sampling fresh concrete from a moving stream and from a heap, in accordance with standard procedures. 1.19.03 Describe procedure for preparing a sample for tests on fresh concrete, describe the test procedures and interpret test results from slump, degree of compatibility, flow, compacted density and air content tests. 1.19.04 Compare consistence of concrete given values of slump, degree of compatibility, flow and slump flow tests. 1.19.05 State the purpose of cube or cylinder testing for compressive strength. 1.19.06 Describe procedures for making and curing cubes or cylinders of concrete, and identify common faults and their effects. 1.19.07 Recognise no-fines concrete test specimen. 1.19.08 Outline procedures for testing the compressive strength of test cubes or cylinders in accordance with standard procedures. 1.19.09 Identify normal and abnormal failure of test cubes and cylinders. 1.19.10 State action to be taken by a testing machine operator in the event of abnormal failure of a test cube or cylinder. 1.19.11 Outline the equipment and means for accelerated curing of test cubes or cylinders and state purpose of accelerated testing.

	1.19.12 Describe and state purpose of tensile splitting strength testing. 1.19.13 Identify drilled concrete cores and state reasons for taking and testing cores. 1.19.14 State method for checking delivered quantity of ready-mixed concrete.
	END OF STAGE 1