Reference should be made throughout the syllabus to the relevant British Standards.

Reference to safety regulations, to the importance of safe working methods and to safety precautions generally should be made at every appropriate stage throughout the course.

Students are expected to be completely familiar with the contents of the syllabus for Concrete Technology and Construction (General Principles).

Each objective should be prefaced with: The candidate has demonstrated the ability to

1 TESTING CONCRETE

1.1 Describe the procedures for the drilling, examining, preparing and compression testing of cores, in accordance with BS 1881 and estimate actual and potential strengths in accordance with the relevant Concrete Society Technical Report.

1.2 Compare the various methods of determining tensile strength.

1.3 Describe the testing of a structure using a rebound hammer and interpret the results accounting for the type of structure, the number of readings and their locations, surface condition and angle of test.

1.4 Compare workability test methods and state why two concretes of the same slump can have different compacting factors.

1.5 State the key mechanical and operational factors and their effects on compressive testing machine performance.

1.6 Describe a method of comparing compressive testing machines using cubes.

1.7 Assess results of the rapid analysis of fresh concrete.

1.8 Interpret results of the chemical analysis of hardened concrete.

1.9 Compare various methods and applications of non-destructive testing.

1.10 Describe the procedure for the Initial Surface Absorption test stating typical values.
2 SPECIFICATION OF CONCRETE, MIX DESIGN AND QUALITY CONTROL

SPECIFICATION

2.1 Identify critical areas in specification clauses and estimate their effects on materials and mix selection.

2.2 Prepare simple specification clauses using BS 5328 as a basis.

MIX DESIGN

2.3 Design specified strength concrete mixes for; minimum and maximum cement contents; maximum water/cement ratio; air-entertainment; conditions of exposure; sulphates in the ground; or minimising the risk of ASR.

2.4 State the factors affecting mix design and make modifications to a design for particular conditions of construction and use.

QUALITY CONTROL

2.5 Describe, explain, compare and operate Shewhart and Cusum systems of quality control of concrete including necessary calculations.

2.6 Distinguish between ‘repeatability’ and ‘reproducibility’ as used in testing.

2.7 State the principles of quality control for the production of concrete.

2.8 Describe the operation of approved quality assurance schemes.

2.9 Describe the methods of sampling finished precast products applying appropriate British Standards and Codes of Practice.

2.10 Interpret the British Standards relevant to the quality control of precast products and components.

3 CONCRETE PRODUCTION, SUPPLY AND PLACING

3.1 Calculate quantities of materials, delivery rate and storage capacity given concreting programme, mix data and materials availability including allowances for losses.

3.2 Compare the basic advantages and economics of site and ready-mixed concrete.

3.3 State the procedures to be agreed between purchaser and supplier in the provision of ready-mixed concrete.

3.4 Describe and explain how properties of concrete can be affected during handling, transporting and placing and describe and justify suitable methods for typical and special situations.

3.5 Describe and sketch storage and plant layout for batching and mixing given details of output required, situation, ground conditions, access and facilities available for site,
3.6 Select types and sizes and describe items of plant for economic placing to suit particular requirements.

3.7 Describe the placing of concrete under water and bentonite suspension.

3.8 Outline methods of spraying concrete and mortar.

4 JOINTS

4.1 Describe and sketch details of joints in a concrete structure and state the applications of each type of joint.

4.2 Determine the location and methods of forming construction joints for a given structure.

4.3 Describe and explain the use of compressible joint fillers, water stops and joint sealing compounds.

5 FORMWORK, INCLUDING FALSEWORK

5.1 State the factors which affect the pressure of concrete on formwork and show how the pressures are distributed.

5.2 Determine the pressure and working loads on propped and vertical formwork given sufficient data, using approved graphs and formulae.

5.3 Describe and state the function of formwork ironmongery, sheathing materials and their effects on stripping and explain the economical use of all formwork materials.

5.4 Sketch arrangements of formwork to kickers, box outs and stop ends and decide when back forms should be used.

5.5 Classify types of release agents and their effects on striking and the concrete finish.

5.6 Describe and explain the use of proprietary systems in formwork.

5.7 Sketch arrangements of formwork for typical structural members and prepare detailed pre-pour checklists.

5.8 Sketch typical arrangements of travelling forms and state their applications.

5.9 Identify situations where permanent formwork is appropriate and explain the use of proprietary void formers.

5.10 Describe the procedures for the handling, storage, maintenance and repair of formwork.
6 REINFORCEMENT AND PRE-STRESSING

6.1 Describe the application of steel fabric and expanded metal reinforcement, and typical fixing details.

6.2 Read reinforcement drawings and bending schedules, describe methods of fixing and locating reinforcement and state acceptable tolerances in cutting, bending and locating reinforcement.

6.3 Describe the principles of pre-stressed concrete construction, both pre-tensioned and post-tensioned, illustrated by it’s application in common systems.

6.4 List the safety precautions to be taken when pre-stressing.

7 COMPACTING AND FINISHING

COMPACTING AND COMPACTION PLANT

7.1 Select the correct vibrating equipment in a given situation and describe its care and maintenance.

7.2 State the effect of various types of vibration on the design and construction of formwork.

7.3 State and explain problems likely to be experienced in compacting and finishing special concretes.

SURFACE FINISH

7.4 List the factors to be considered in the production of a concrete required for a given grade finish.

7.5 List the different types of concrete finishes and explain the methods of production.

7.6 Identify the factors necessary to produce direct and indirect surface finishes as described in BS 8110 or the Department of Transport “Specification for Highway Works”.

7.7 Explain the significance of striking times, curing and release agents on the appearance of concrete finishes.

7.8 Name, identify and explain the occurrence of common defects in concrete surfaces and describe how to minimise them.

7.9 Select the correct material type and repair method for faults in concrete.

8 CURING

8.1 State the main requirements for the protection of concrete during extreme hot or cold conditions.

8.2 List and explain the factors which govern the minimum striking times for formwork, and
state typical times.

8.3 Define the maturity of concrete and calculate concrete strengths using this concept.

8.4 Explain in simple terms the concepts of latent heat and thermal capacity.

8.5 State the purpose of accelerated curing and describe established methods.

8.6 Explain how a delay in curing may cause plastic cracking and state remedies.

8.7 State typical requirements to avoid cracking in massive pours of both low and high strength concrete.

9 ROADS AND FLOORS

ROADS

9.1 List materials suitable for use in sub-bases.

9.2 Distinguish between wet lean concrete, cement bound granular materials categories 1, 2, 3 and 4 and cement-stabilised soils.

9.3 Based on the Department of Transport ‘Specification for Highway Works’, name and describe acceptable tests for CBM and pavement quality concrete and their constituent materials.

9.4 Describe the main methods of construction for concrete roads, including the sequence of operation of the plant used, for both fixed form and slipform construction.

9.5 Describe the differences between the unreinforced, joint reinforced and continuously reinforced concrete pavements.

9.6 Sketch joints and joint assemblies for concrete roadwork.

9.7 Describe curing methods for pavements.

FLOOR SLABS

9.8 State the requirements for suitable materials for sub-grades and sub-bases.

9.9 Describe the main methods of construction for concrete floor slabs and their finishes.

9.10 State the main factors to be considered in determining bay layout.

9.11 Sketch and explain the standard joints used in floor slabs.

9.12 Describe methods of curing floor slabs and concrete finishes and treatment to combat dusting on a concrete floor.

9.13 State the mix proportions and use for floor screeds, the possible causes of failure of
screeds and the precautions that can be taken to reduce them.

9.14 Describe sand/cement screeds and granolithic toppings, their uses, the possible causes of failure and the precautions taken to minimise them.

9.15 Describe a method of producing a non-slip concrete floor.

9.16 Describe a method of producing a floor to a very tight level (flatness) tolerated.

10 PRECAST PRODUCTS AND COMPONENTS

10.1 Describe and state the applications of the main types of concrete products, structural components and cladding.

10.2 Describe the main operations and principal methods used in precast concrete manufacture and state the applications and advantages of each methods.

10.3 List and explain the factors affecting the choice between precast and in-situ concrete construction.

10.4 Describe the curing methods used for precast products and components.

10.5 Name and describe materials commonly used for moulds for precast products and components.

10.6 Describe the methods of mould making and list the factors affecting dimensional accuracy.

10.7 Identify the special requirements for aggregate storage, batching, mixing and handling equipment used in precast concrete production.

10.8 Describe materials and components used for fixing, fastenings and lifting units and describe the locating techniques used.

10.9 Describe methods for fixing and making connections between precast units to in-situ concrete and between precast concrete components.

10.10 Describe methods of erection for columns, beams, slabs, cladding and other units in precast concrete.

10.11 Describe the correct mould from a product specification and select the material bearing in mind the number of casts, the degree of accuracy required and the production technique.

10.12 Describe the procedure for testing the main types of precast concrete units.

11 ORGANISATION, SUPERVISION AND SAFE WORKING PRACTICES
PLANNING

Given sufficient data and the following criteria where applicable: job specification, location of site, production method, materials and equipment, provision of services, testing facilities and labour and supervision requirements.

11.1 Prepare a suitable layout of facilities for the production of precast products.

11.2 Prepare a suitable layout of facilities for the production of precast concrete.

11.3 Plan the organisation, staffing and facilities for supervising the quality of in-situ and precast concrete.

11.4 Prepare an outline scheme for working on a construction site to enable concreting to take place in abnormal conditions.

PERSONNEL

11.5 Name the key management and supervisory positions on a construction contract, in a precast concrete works and in a ready-mix concrete plant and explain the roles of these personnel.

11.6 Outline a training programme for an operative in any sector of concrete production, construction and testing.

11.7 Describe the role of the client, architect, consulting engineer, contractor, specialist subcontractor, ready-mix concrete supplier, precast manufacturer and materials suppliers in the performance of a construction contract.

HEALTH AND SAFETY

11.8 Prepare an assessment of the risk to health for a given situation in any sector of concrete construction.