UNIT I

Chapter 1 : Introduction to Concrete & Ingredients of Concrete 1-1 to 1-44

a) **Cement and Aggregate :** Manufacture, chemical composition, hydration, physical and mechanical properties, classification, types and application of cement, tests on cement, Classification of aggregate, physical and mechanical properties of aggregate, deleterious materials in aggregate, alkali-aggregate reaction, Fineness and gradation of aggregates using sieve analysis, tests on aggregates.

b) **Water and Admixtures :** Quality of water for use in concrete, role of admixture, classification and types of admixtures like accelerators, retarders, plasticizers, super plasticizers, mineral admixtures-fly ash, silica fume, ground granulated blast furnace slag.

UNIT II

Chapter 2 : Production, Properties & Testing of Fresh Concrete 2-1 to 2-18

a) Production and Properties of Fresh Concrete : Nominal mixes, Water-cement ratio, Process of manufacturing fresh concrete-batching, mixing, transportation, compaction, curing of concrete, curing methods, influence of temperature, maturity rule, workability and factors affecting workability, cohesion and segregation.

b) Tests on Fresh Concrete : Workability by slump cone, compaction factor, Vee-Bee consistometer and flow table apparatus, Effect of admixture on workability of concrete and optimum dosage of admixture by Marsh cone test.

UNIT III

Chapter 3 : Properties and Testing of Hardened Concrete 3-1 to 3-28

a) Hardened concrete : Strength of concrete, factors affecting strength, micro-cracking and stress-strain relationship, relation between tensile and compression strength, impact strength, abrasion resistance, creep and shrinkage.

b) Testing of hardened concrete : Destructive tests - compression strength, flexural strength, indirect tensile strength, core test. Nondestructive tests: rebound hammer, ultrasonic pulse velocity, pullout test and impact echo test.

UNIT IV

(a) Concrete Mix Design : Concept and objectives of concrete mix design, factors affecting the mix design, quality control, variability of laboratory test result, acceptance criteria, Grade designation and IS requirements as per IS 456 (Exposure conditions, minimum & maximum cement content and maximum W/C ratio

(b) Methods of Mix Design : IS code method and DOE method (with and without mineral admixture), Use of spreadsheet t/programming/ software for concrete mix design.

UNIT V

(a) Concreting Equipment's and Techniques : Batching plants, concrete mixers, hauling, pumps, concrete vibrators and compaction equipment's. Special concreting techniques- ready mix concrete, under water concreting, roller compacted concrete, cold and hot weather concreting.

(b) Special concretes : Lightweight concrete and its types, foam concrete, no fines concrete, self-compacting concrete, high density concrete, fiber reinforced concrete, geo-polymer concrete and Ferrocement technique.

UNIT VI

a) Deterioration – Durability, factors affecting the durability of concrete, Permeability, sulphate attack, acid attack, chloride attack, corrosion of reinforcement, carbonation of concrete

b) Repairs – Symptoms and diagnosis of distress, evaluation of cracks, selection of repair procedure, repair of defects using various types and techniques – shotcrete and grouting. Introduction to retrofitting of concrete structures by fibre reinforced polymer (FRP), polymer impregnated concrete. Corrosion monitoring and preventive measures.

❑❑❑