Scoring Indicators

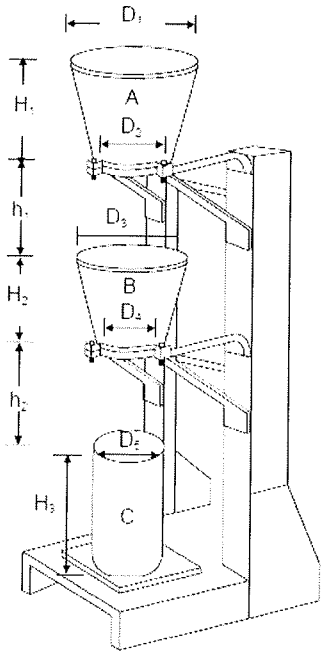
COURSE NAME: CONCRETE TECHNOLOGY

COURSE CODE: 3012 **QID: 2110220093**

Q No	Scoring Indicators	Split Score	Sub Total	Total Score
	PART A			**9**
I.1	Soundness	1	1	
I.2	6	1	1	
I.3	Rapid Hardening Cement	1	1	
I.4	Seconds	1	1	
I.5	Durability	1	1	
I.6	Characteristic compressive strength	1	1	
I.7	28	1	1	
I.8	Non Destructive Testing	1	1	
I.9	Air entraining admixtures	1	1	
	PART B			**24**
II. 1	• Rapid hardening cement • Low heat cement • Portland pozzolana cement • Sulphate resisting cement • Blast furnace slag cement • High Alumina cement • White cement (Any six)	1x6 = 6	3	
II. 2	a. Plunger b. 1 mm square needle **c.** Needle with circular/annular attachment	1 1 1	3	
II. 3	1. M 10 2. M 20 3. M 15	1 1 1	3	
II. 4	1. Slump Cone test 2. Compacting factor test 3. Vee Bee Consistometer test	1 1 1	3	
II. 5	Construction Joint Expansion Joint Contraction Joint Isolation Joints Cold Joint (Any three)	1 1 1	3	
II. 6	a)Grade designation; b) Type of cement, and grade of cement (if applicable) c) Maximum nominal size of aggregate d) Minimum cement/cementitious materials content and maximum	0.5 x 6	3	

	water-cement/ cementitious materials ratio to be adopte; or Exposure conditions as per Table 3 and Table 5 of IS 456 e) Workability required at the time of placement f) Transportation time g) Method of placing h) Degree of site control (good/fair) or value of established standard deviation, if any i) Type of coarse aggregate (angular/sub angular/ gravel with some crushed particles/rounded gravel/manufactured coarse aggregate) j) Type of fine aggregate (natural sand/ crushed stone or gravel sand/manufactured sand/ mixed sand) k) Maximum cement content l) Whether a chemical admixture shall or shall not be used and the type of chemical admixture and the extent of use m) Whether a mineral admixture shall or shall not be used and the type of mineral admixture and the extent of use n) Any other specific requirement like early age strength requirements (Any six)			
II. 7	For protection against problems such as • Corrosion of steel reinforcement in concrete • Blistering of paint • Dampness on walls, roofs & Floors • Leakage in water tanks (Any three)	3	3	
II. 8	–Gains compressive strength rapidly. –Strength after 24 hours is found to be more than 25 MPa and after 28 days is found to be 60 to 70 MPa. –It has lesser drying shrinkage and produces lower heat of hydration. –It has better fire resistance. –It has lesser chloride permeability. –It has very high acid resistance (Any three)	3	3	
II. 9	• Tremie method • Bucket placing • Placing in bags • Pre-packed concrete • Placing in dewatered caissons (Any three)	1 1 1	3	
II.10	• Additive is a material added at the cement factory during grinding of cement clinker to modify the properties of cement. • Examples: granulated blast furnace slag, natural pozzolanes, fly ash, calcined clay, Alkanolamines etc • Admixture is a material other than cement, aggregates and water, used as an ingredient of concrete to modify the properties of concrete.	1.5 1.5	3	

	• Examples: accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures, super plasticizers etc			
	PART C			**42**
III. 1	Procedure: • Weigh approximately 100 g of cement • Take it on an Indian standard sieve No. 9 (90 microns) • Break down the air set lumps in the sample with the fingers • Continuously sieve the sample giving circular and vertical motion for a period of 15 minutes. Mechanical sieving devices may also be used • Weigh the residue left on the sieve. • Express its mass as a percentage of the quantity first placed in the sieve to the nearest 0.1 percent. • This weight shall not exceed 10% for OPC.	1 2 2 1 1	7	
III. 2	Classification according to size • Fine aggregate (<4.75 mm) • Coarse aggregate (>4.75 mm) Classification according to shape • Rounded • Flaky • Irregular/Partly rounded • Angular	1.5 1.5 1 1 1 1	7	
III. 3	• The chemical reaction taking place between cement and water is known as hydration of cement • The hydration reaction is an exothermic reaction • The Bogue's compounds namely, Tricalcium silicate (C3S), Dicalcium silicate (C2S), Tricalcium Aluminate (C3A) and Tetracalcium Alumino Ferrite (C4AF) react with water to form hydration products	1 1 1	7	

	• The products of the reaction are Calcium Silicate Hydrate, Calcium Hydroxide, Calcium Aluminate Hydrate (Ettringite and Monosulphate aluminates)	2		
	• C3A causes initial setting of cement. C3S develops early strength and C2S develops ultimate strength. C4AF is usually inert	2		
III. 4	Procedure •The sample of concrete to be tested is filled gently in the upper hopper. •Trap-door of upper hopper is opened so that the concrete falls into the lower hopper. •Trap-door of the lower hopper is opened and the concrete is allowed to fall into the cylinder. •Surface is leveled and the weight of concrete in the cylinder is determined. This weight is known as "the weight of partially compacted concrete". •The cylinder is refilled with concrete from the same sample in layers approximately 5 cm deep, the layers being heavily rammed to obtain full compaction and weighed. This weight is known as "the weight of fully compacted concrete". •Compacting factor is defined as the ratio of the weight of partially compacted concrete to the weight of fully compacted concrete.  (Sketch) **Typical Dimensions** D_1 = 25 cm D_2 = 12.5 cm H_1 = 27.5 cm h_1 = 20 cm D_3 = 22.5 cm D_4 = 12.5 cm H_2 = 22.5 cm h_2 = 20 cm D_5 = 15 cm H_3 = 28.5 cm	1 1 1 2 2	7	

		2		
III. 5	Workability can be defined as "that property of freshly mixed concrete or mortar which determines the ease and homogeneity with which it can be mixed, placed, compacted and finished." **Factors affecting workability** • Water Content • Cement Content • Aggregate-Cement Ratio • Size of Aggregates • Shape of Aggregates • Grading of Aggregates • Use of admixtures • Temperature (Any six)	1 1x6	7	
III. 6	Curing is Process of maintaining a satisfactory moisture content and a favourable temperature in concrete during the period immediately following placement, so that hydration of cement may continue until the desired properties are developed to a sufficient degree to meet the requirements of service. 1.Water curing • Spraying • Immersion • Ponding • Wet covering 4. Membrane curing 5. Application of heat-Steam curing, electrical curing, curing by infrared radiation 6. Miscellaneous methods- CaCl2, sealing of formwork etc	2 2 1 1 1	7	
III. 7	Objectives –To achieve a **minimum compressive strength** at 28 days period based on the value assumed by the designer so as to comply with the specifications of structural strength. -Achieve **minimum required strength** in hardened state –**Durability**, which is associated with compressive strength, the greater the strength, the more durable the concrete. –The mix should be designed in such a way that minimum quantity of cement is used as it is the costliest material, so that the mix is **economical.** –The provision of sufficient **workability** for obtaining full compaction with the available compacting equipment. –The concrete mix should **be cohesive** for preventing the possibility	2 2 1 1	7	

	of honeycombing and segregation and capable of being mixed, transported and compacted efficiently as possible / To achieve satisfactory **appearance** / Conform to **standards established by law**	1		
III. 8	Methods of mix design • IS Method • ACI Method • Road Note-4 Method • IRC-44 method • Arbitrary method • Max density method • Fineness modulus method • Surface area method • Mix design for high strength concrete • DOE mix design method (Any seven)	1x7	7	
III. 9	Concreting done at atmospheric temperature above 40°C is termed hot weather concreting. High ambient temperature, reduced relative humidity and high wind velocity are the climatic factors affecting concrete in hot weather. •Problems in hot weather concreting: –Reduction in ultimate strength due to lower relative humidity and due to the use of more water to compensate evaporation losses. –Accelerated setting, causing reduction in handling time. –Rapid evaporation during curing, affecting hydration and strength. –Increased tendency to crack, due to rapid evaporation. -Entrains lesser air with air-entraining agents. (Any three) •Precautions to be taken: • **Proportioning of concrete**: Low heat cement is preferred. Plasticizers and retarders may be used. Accelerators must not be used.	1 3	7	

	• **Temperature control of ingredients**: Use broken ice along with mixing water, so that it melts completely when mixing is over. Temperature at placement must be less than 40°C. • **Production and delivery**: Time between mixing and delivery must be kept minimum. • **Placement and Curing**: Sub-grade, formwork and reinforcement should be sprinkled with cool water just before the placement of concrete. • Area around the work should be kept wet to cool the surrounding air and increase its humidity. • Speed of placement and finishing helps minimize problems in hot weather concreting. • After compaction the concrete should be protected to prevent the evaporation of moisture by means of wet gunny bags. • Continuous moist-curing should be done when the concrete hardens, to prevent surface cracking. • High velocity winds cause higher rate of evaporation and hence windbreakers should be provided. • Concreting can be done during night shifts. (Any three)	3		
III. 10	Precautions for concreting in marine environment: –Cement with low C3A content should be preferable to make concrete. –Prepare rich concrete with low water cement ratio which makes the concrete impervious. –Water reducing admixtures can be added to the concrete to make it workable for construction. –Adequate cover should be provided for reinforcement in concrete structure to enhance durability. –Good compaction and well-made construction joints in the structure helps the concrete structure to withstand against expansion caused by seawater. –Use of pozzolanic material in the preparation of concrete is good against salt water. –High pressure steam cured concrete elements can be used for construction of structure in marine conditions for better durability. –Suitable air entraining agents can be used to prevent the effect of	1x7	7	

	seawater on concrete. –Aggregates used for making concrete should be thoroughly washed with fresh water to reduce the chloride ion concentration in it. . **(Any seven)**			
III. 11	In the rebound hammer test, the extent of rebound of the hammer is measured on a graduated scale to measure **the surface hardness** of concrete. This measured value is designated as rebound number or rebound index Factors affecting Rebound index: • Type of Cement • Type of Aggregate • Surface Condition and Moisture Content of Concrete • Curing and Age of Concrete • Carbonation of Concrete Surface • Vertical distance from the bottom of concrete placement • Surface condition used in development of Correlation between Compressive Strength and Rebound Number (Any five)	**2** 5	7	
III. 12	Precautions to be taken • Storage of materials: All materials are to be stored on secured surfaces like wooden platforms and properly covered with tarpaulins etc. • Proportioning of concrete: Additional quantity of cement may be used to increase the heat of hydration. • Temperature control of ingredients: The temperature at the time of setting of concrete can be raised by heating the ingredients of the concrete mix. • Use of insulating formwork: Insulating formworks, made of timber, clean straw, blankets, tarpaulins, plastic sheeting, etc., can preserve the heat of hydration for maintaining the required temperature of the mix. • Placement: The surface on which the concrete is to be placed	7	7	

	should be sufficient warm. Concrete shall be delivered to the point of placing at not less than 5 ° C • Curing: Water curing is not to be used during the periods of freezing or in near freezing conditions. • Removal of Formwork: As the rate of gain of strength is slow during the cold weather, the formwork and props have to be kept in place for a longer time than the normal concreting			