SCHEME OF VALUATION

Course Title: Concrete Technology

PART A

I. Answer all questions in one word or one sentence **(9 x 1 = 9 Marks)**

Qst No.	Scoring Indicator	Split up score	Total
1	30 minutes	1	1
2	Coarse	1	1
3	Le-Chatelier's apparatus	1	1
4	IS 456	1	1
5	Compaction	1	1
6	M25	1	1
7	$F_{ck} + 1.65S$	1	1
8	Fibre Reinforced Concrete	1	1
9	Light weight concrete	1	1

PART B

II. Answer any eight questions **(8 x 3 = 24 Marks)**

Qst No.	Scoring Indicator	Split up score	Total
1	100 gms of cement is weighed accurately and to be placed on a standard IS test sieve 9 (90 micron IS Sieve). Air set lumps should be broken with fingers. The residue left on the sieve after 15 min of sieving is weighed The weight shall not exceed the limit specified <table><tr><td>The residue by weight not to exceed</td><td>Ordinary cement 10%</td><td>Rapid hardening cement 5%</td><td>Low heat cement 5%</td></tr></table>	3	3
2	Rounded: voids ranging from 32 to 33 percent. Irregular: voids ranging from 35 to 38 percent. Angular: voids ranging from 38 to 40 & Flaky Aggregates: restricted to maximum of 15 percent	3	3

3	Ordinary Portland Cement has 3 grades based on its strength namely 33, 43 and 53 grades. -33 Grade: 28 day strength of cement-sand mortar cube of $50cm^2$ area when tested in compression testing machine is not less than 33 N/mm^2 -43 Grade: 28 day strength not less than 43 N/mm^2 -53 Grade: 28 day strength not less than 53 N/mm^2	3	3
4	• Water Content: • Mix Proportions • Size of Aggregate • Shape of Aggregates: • Surface Texture: • Grading of Aggregates: • Use of Admixtures (Any 6)	0.5 x 6	3
5	Segregation: Segregation can be defined as the separation of the constituent materials of concrete specially coarse aggregates **Causes** • The badly proportioned mix • Insufficiently mixed concrete with excess water content • Dropping of concrete from heights • Conveyance of concrete by conveyor belts, wheel barrow, long distance haul by dumper etc	1 2	3
6	1. IS Method 2. ACI Method 3. Road Note-4 Method 4. IRC-44 method 5. Arbitrary method 6. Max density method 7. Fineness modulus method 8. Surface area method 9. Mix design for high strength concrete 10. DOE mix design method (Any 6 Nos.)	0.5 x 6	3
7	**Nominal Mix concrete:** When concrete is produced by taking standard arbitrary proportions of concrete ingredients, it is known		

	as Nominal mix concrete. Eg: M10, M15 etc. **Design mix concrete:** concrete mix produced under quality control keeping in view the strength, durability and workability is called design mix.	1.5 1.5	3
8	Mix design is the art and science of determining the relative proportions of the ingredients of concrete to achieve the desired properties in most economical way	1 x 3	3
9	1) Light weight concrete 2) Air entrained concrete 3) High Strength concrete 4) High performance concrete 5) Polymer concrete 6) Geo Polymer concrete 7) Steel fiber reinforced Concrete 8) Self compacting concrete (Any 6)	0.5 x 6	3
10	-Super Plasticizers are also known as High range water reducers. - Super Plasticizers constitute a relatively new category and improved version of plasticizers - Chemically different from plasticizers - classified into Sulphonated formaldegyde condensates (SMF), Sulphonated naphthalene formaldehyde condensates (SNF), Modified lingo sulphonates etc. - Used for Self compacting concrete, HSC and HPC etc.	3	3

PART C

Answer ALL questions. Each question carries 7 marks (6 x 7 = 42Marks)

Qst No.	Scoring Indicator	Split up score	Total
III	**<u>Storing of Cement: Precautions to be taken</u>** **1. Moisture:** • Cement should be stored in water tight containers • Moisture absorption do not exceed 5% **2. Period of Storage:** • Advisable to avoid storing of cement in Jute bags for a period longer than 3 months **3. Quality of Cement:** • Finely grained Cement is more active and it absorbs moisture rapidly from the atmosphere. • Extraordinary precautions to be taken **4. Removal of Cement:**		

	• When cement bags are to be removed from piles of sufficient height, the cement which is stored previously should be taken out first. **5. Piles:** • Cement bags are stacked in Piles (Economical to form a pile of 10 bags of cement) • A distance of about 30 cm should be kept between the piles of cement bags and exterior walls of the building. • The passage of width about 90 cm should be provided between piles. • For long storage the top and bottom of piles should be covered with Tarpaulins or water proof paper. **6. Storage Shed:** • The walls, roof and floor of such sheds should be water proof construction • Few small windows should be provided and they kept tightly shut • The floor should be above ground • If necessary, drainage should be provided • Size of shed : 20 bags/1 tonne of cement require about 1 m^3	7	7
IV	Procedure : • Sample of cement collected shall be sieved through IS Sieve no.9 • About 400 gms of sieved cement shall be taken • To this as a first trial 100 gms of water by weight shall be added in a non porous vessel and mixed thoroughly for about 3 mins (not more than 5 mins) – Gauging Time • The paste shall then be filled into the vicat mould, placed on a non-porous plate (glass plate) • The bottom surface of the plunger shall be brought into contact with the surface of the cement paste. • During this position reading against the indicator shall be taken • The rod is then quickly released without any jerk and the penetration shall be noted • If the plunger penetrates into the paste between 33 mm to 35 mm from the top or 5mm to 7 mm from the bottom the paste is said to be of normal consistency • If this is not achieved trial pastes is not achieved trail pastes shall be made with varying quantities of water and test shall be repeated as above till the desired penetration is obtained Percentage of water requires for normal consistency ***P*** is given by $$P = \frac{W_1}{W} \times 100$$		

	W_1= Weight of water for desired penetration W= Weight of cement sample Generally the value of ***P*** varies from 25-35%	7	7
V	Slump test is a laboratory or at site test used to measure the consistency of concrete. Slump test shows an indication of the uniformity of concrete in different batches. The shape of the concrete slumps shows the information on the workability and quality of concrete. The slump value of concrete is just a principle of **gravity flow** of surface of the concrete cone that indicates the amount of water added to it, which means how much this concrete mix is in workable condition. **Apparatus for Slump test** • Metallic mould in the shape of a frustum of cone having bottom diameter 20 cm (8 in), top diameter 10 cm (4 in) and height 30 cm (12in). • Steel tamping rod having 16 mm (5/8 in) diameter, 0.6 m (2 ft.) long with bullet end. **Procedure of Slump test** • The internal surface of the mould is cleaned and free from moisture and free from other old sets of concrete. • Then place the mould on the smooth horizontal, rigid, and non-absorbant surface. • The mould is then filled with fresh concrete in four layers with taping each layer 25 times by taping rod, and level the top surface with a trowel. • Then the mould is slowly pulled in vertical and removed from concrete, so as not to disturb the concrete cone. • This free concrete deform all the surface to subside due to the effect of gravity. • That subsidence of concrete in the periphery is a SLUMP of concrete. • The height difference between the height of subsidence concrete and mould cone in mm is 'slump value of concrete'. If the slump value is between: Below 25mm, then workability is very low 25-75, then workability is low 50-100, then workability is Medium 100-150, then workability is High	7	7
VI	**Bleeding:** Due to rise of water in the mix to the surface because of the inability of the solid particles in the mix to hold all the mixing water during the settling of the particles under the effect of compaction	2	

	It can be reduced by • Proper proportioning and uniform and complete mixing. • Use of finely divided pozzolanic materials reduces bleeding by creating a longer path for the water to traverse. • The use of air-entraining agent is very effective in reducing the bleeding. • It is also reported that the bleeding can be reduced by the use of finer cement or cement with low alkali content. • Rich mixes are less susceptible to bleeding than lean mixes	5	7
VII	The durability of cement concrete is defined as its ability to resist weathering action, chemical attack, abrasion, or any other process of deterioration. Durable concrete will retain its original form, quality, and serviceability when exposed to its environment. Factors affecting are: • Cement Content • Aggregate Quality • Water Quality • Concrete Compaction • Curing Period • Permeability • Moisture • Temperature • Abrasion • Carbonation • Wetting and Drying Cycles • Freezing and Thawing • Alkali-Aggregate Reaction • Sulphate Attack • Organic Acids (Any 10 Nos)	2 5	7
VIII	Compaction of concrete is the process adopted for expelling the entrapped air from the concrete. The following methods are adopted for compacting the concrete: • Hand Compaction - Rodding - Ramming - Tamping • Compaction by Vibration - Internal vibrator (Needle vibrator) - Formwork vibrator (External vibrator) - Table vibrator - Platform vibrator - Surface vibrator (Screed vibrator)	1	

	- Vibratory Roller. • Compaction by Pressure and Jolting • Compaction by Spinning	1.5x 4	7
IX	Step 1: Determination of target mean strength as f'ck = fck+ 1.65 s Step 2: Selection of water-cement ratio Adopt a water-cement ratio lesser than the maximum water-cement ratio given in Table 5 of IS 456 for the given exposure condition Step 3: Estimation of air content Step 4: Selection of water content and fine to total aggregate ratio Step 5: Calculation of cement content by dividing water content by w/c ratio Step 6: Calculation of aggregate content Step 7:Mix Calculations (Volume) Step 8:Mix Proportions for trial 1 (Weight calculations)	7	7
X	Basic Data for design of concrete mix •Grades of concrete •Type of cement •Type and size of aggregate •Nominal maximum size of aggregates •Maximum/Minimum cement content •Type of mixing and curing •Maximum free water-cement ratio •Degree of workability of concrete •Air content •Type of admixture •Water absorption and surface moisture conditions of aggregate	7	7
XI	• Made from fly ash and alkaline solution • Reduce CO2 emissions • High fire resistance • High compressive strength • Rapid strength gain • Greater corrosion resistance (With explanations)	7	7
XII	**Cooling of aggregates:** -The temperature of the concrete can be kept down by controlling the temperature of the aggregates. -Aggregates should be stockpiled in shade. -Water can be sprinkled on the aggregate before using them in concrete. -The precooling of aggregates can be achieved at the mixing stage by adding calculated quantities of broken ice pieces as a part of mixing water, provided the ice is completely melted by the time mixing is completed. -Heavy blowing of cold air over the aggregate just before it is		

	batched is desirable. **Mixing water:** -The temperature of the mixing water has the greatest effects on temperature of concrete, and the temperature of water is easier to control than that of other ingredients -Cooled water may be added to reduce the temperature of concrete. If the ambient temperature is very high, ice pieces are incorporated directly into the mixer. **Production of delivery:** -The temperature of the ingredients of concrete should be maintained at the lowest practical levels so that the temperature of concrete is below 40°C at the time of placement. -The concrete is mixed to the minimum required time. When ice is used it must be mixed to such an extent that all the ice gets melted -The period between mixing and delivery should be kept to an absolute minimum. -Immediately after finishing, the top of concrete must be covered by plastic sheets. tarpaulins, gunny bags etc. to prevent the loss of water by evaporation. -Continuous curing is also important because the volume changes due to alternate wetting and drying promote the development surface cracking	7	7
XIII	High strength concrete as the name signifies is concrete having compressive strength more than 40MPa. Nowadays due to high technological development it is possible to obtain concrete strengths of about 150MPa, thus only strengths above 60MPa are recognised as high strength concrete in recent days. Compressive strength is the most important characteristic which is considered to state whether the concrete is suitable for construction or not, though other properties like tensile and flexural strength are being tested for, compressive strength holds prime importance in the construction industry. Hence with higher compressive strengths the concrete becomes more desirable. High strength concrete has found its invaluable position in the construction of • High rise buildings. • Bridges with long spans. • High load carrying buildings built on weak soil (low bearing capacity)	7	7
XIV	1. Accelerating Admixtures or Accelerators: These admixtures when added to concrete, increase the rate of hydration of cement, shorten the setting time and increase the rate of strength development. Used to: a) permit earlier removal of formwork.		

	b) reduce the required period of curing. c) Partially compensate for the retarding effect of low temperature during cold weather concreting d) In emergency repair works - Examples of accelerators are calcium chloride, Sodium chloride, Sulphates of Sodium and Potassium etc. 2. Retarding Admixtures or Retarders: Delay in setting time is achieved by using retarding admixtures. Used to : a) Overcome the accelerating effect of high temperature on setting properties of concrete in hot weather concreting. b) Very useful when concrete has to be placed in very difficult conditions and delay may occur in transporting and placing. Applications: Ready Mixed concrete, For preventing formation of cold joints, For concreting in hot weather etc. Eg: Plaster of Paris and Gypsum:	3.5 3.5	7