Model Answer: Summer-2019

Subject: Concrete Technology | **Sub. Code: 17504**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills.)
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by the candidate and those in the model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and the model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	**A)**	**Attempt any THREE of the following:**		**(12)**
	a)	**Enlist the Bougue's compounds of cement with its effect on cement properties.**		
	Ans.	**Bogue's compound and their effect on cement properties:** **1. Tri-calcium Silicate:** It gives early strength to cement by producing more heat of hydration. **2. Di-calcium Silicate:** It gives ultimate strength to cement by generating comparatively lesser heat. **3. Tri-Calcium Aluminate:** It varies setting time of cement. **4. Tri-Calcium Alumino-Ferrite:** It is chemically inactive and does not contribute compressive strength and setting time of cement.	**1 each**	**4**
	b)	**Define fineness of cement. State its effect on hydration of cement.**		
	Ans.	**Fineness of Cement:** It is the degree of grinding of cement particles during its manufacturing process is called as fineness of cement. **OR** It is the measure of size of cement particles.	**1**	
		Effect of Fineness on Hydration of Cement: 1. When the fineness of cement is more i.e. the size of cement particles is very small; then the all the cement particles gets covered with water film easily. Hence the hydration of cement takes place very quickly with added water.	**1 ½**	
		2. When the fineness of cement is less i.e. the size of cement particles is very coarse; then more water is required to fill the voids of cement particles. Also there are more chances of water absorption by particles. Hence the hydration of cement remains incomplete at the same water-cement ratio.	**1 ½**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	c) Ans.	**Explain in brief the soundness test on cement.** **Soundness Test on Cement:** 1. Take 100 gm cement sample and add water 0.78 times to that of water required for its standard consistency to prepare homogenous cement paste. 2. Fill this cement paste in mould of Le-Chatelier's apparatus completely by keeping non-porous glass plates at top and bottom respectively. Keep lead weight on it. 3. Keep this assembly at room temperature for 24 hours, so that it gets sufficiently hardened. 4. Now measure the distance between two indicator arms of apparatus as d_1 mm using measuring scale. 5. Then keep this set in tempo water bath under boiling water at a temperature 100^0C for 3 hours continuously, so that cement will expand due to temperature. 6. Remove the mould from water bath and measure the increased distance between two arms as d_2 mm. 7. Calculate the amount of expansion i.e. soundness of given cement as $(d_2 - d_1)$ mm. 8. When the expansion of cement is less than 10 mm, it is said to be sound cement as per IS.	**4**	**4**
	d) **Ans.**	**State two properties and two applications of rapid hardening cement.** **Properties of Rapid Hardening Cement:** 1. **Fineness:** Maximum fineness of cement should be 5 % by IS sieving method and specific surface not less than 3250 cm^2/gm. by Blaine air permeability apparatus. 2. **Soundness:** Maximum 10 mm for un-aerated cement and 5 mm for aerated cement by Le-Chatelier's apparatus. 3. **Setting Time:** Initial setting time should be more than 20 min. and final setting time should be less than 600 minutes. 4. **Compressive Strength:** Minimum compressive strength should be 16 MPa and 27 MPa for 1 day and 3 days respectively. **Application of Rapid Hardening Cement (RHC):** 1. RHC is used in works where high strength within short period is required. 2. It is also applicable where formwork is required to remove	**1 each (any two)**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	d)	3. RHC is useful in road construction where delay in traffic is not allowed. 4. RHC is more beneficial in cold weather concreting for faster hardening of concrete. 5. It is also applicable in Tremie method of underwater concreting. 6. RHC may useful certainly in manufacturing of precast and prefabricated concrete products like poles, sleepers, frames etc.	**1 each (any two)**	**4**
	(B)			**(06)**
	a) Ans.	**Attempt any ONE of the following:** **Enlist any six properties of fine aggregate.** **Properties of fine aggregate:** 1. Size or grading 2. Shape 3. Source 4. Specific gravity 5. Bulk density 6. Water absorption 7. Cleanliness 8. Alkali aggregate reaction OR reactivity 9. Silt content 10. Bulking 11. Strength	**1 each (any six)**	**6**
	b) Ans.	**Explain the determination of fineness modulus of coarse aggregate.** **Determination of fineness modulus of coarse aggregate:** The fineness modulus of coarse aggregate is determined by conducting sieve analysis test using IS sieves set. 1. Arrange the set of IS sieves (300mm, 150mm, 80mm, 40mm, 20mm, 10mm) in descending order with coarser sieve at top and finer sieve at bottom. 2. Now put 500-1000 gm of coarse aggregate sample on top most sieve and place lid and pan at top and bottom respectively. 3. Keep this sieve set on mechanical sieve shaker and shake it for 10-15 minutes, so that aggregate will be sieved completely. 4. Take the weight of aggregate fraction retained on each sieve separately using weighing balance. 5. Calculate % cumulative weight retained on each sieve using following tabular format. 6. Calculate fineness modulus (FM) by using formula. FM = (Σ % Cumulative weight retained / 100)	**6**	**6**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2		**Attempt any FOUR of the following:**		(16)
	a)	**Define water-cement ratio. Also state Duff Abraham's w/c ratio law.**		
	Ans.	**Water-cement ratio:** It is the ratio of weight of water to weight of cement in the particular concrete mix proportion, is known as water-cement ratio.	2	
		Duff Abraham's w/c ratio law: For workable concrete, the compressive strength of concrete depends on water-cement ratio.	1	
		Expression: $S = \frac{A}{B^x}$ where, S = Strength of concrete, X = water-cement ratio, A, B = Empirical constants	1	4
	b)	**Explain the necessity of supervision for concreting operation. (min. four points)**		
	Ans.	**Necessity of supervision for concrete operation:** 1. Supervision is necessary to complete all concreting operations in standard manner. 2. It is necessary to avoid any type of delay in concrete work. 3. It is also beneficial to reduce wastage of concrete during concreting. 4. It is required to get overall quality in concrete work at site 5. Supervision becomes essential in maintaining smooth flow of concreting operations at each stage of project. 6. It found very effective in controlling bad workmanship.	1 each (any four)	4
	c)	**Explain the factors affecting workability of concrete. (any four)**		
	Ans.	**Factors Affecting Workability:** **1. Water-cement ratio:** If water-cement ratio is more or less, then concrete shows poor workability, but if w/c ratio is optimum as per IS: 456, then concrete mix gives required workability as per site requirement. **2. Size of aggregate:** If size of aggregate is coarse or large, then concrete shows poor workability due to non-homogenous mix. But if the size of aggregate is finer, then available cement slurry produces more uniform mix of enhanced workability. **3. Shape of aggregate:** If shape of aggregate is rounded, then concrete gives more workability than in case of angular, flaky or elongated aggregates. **4. Use of admixtures:** If various admixtures are used like air entraining admixtures, then concrete give good workability. **5. Grading of aggregate:** Well graded aggregate gives more	1 each (any four)	4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	c)	**6. Surface texture of aggregate:** Aggregate having smooth surface texture give more workability than aggregate having rough surface texture. **7. Porosity and absorption of aggregate:** Porous aggregate absorb water of concrete mix and water cement ratio decreases and hence workability of concrete decreases. **8. Temperature:** As temperature increases, workability decreases due to evaporation of water. **9. Method of mixing of concrete:** If concrete is mixed mechanically using mixers, then concrete shows good workability due to homogenous mixing as compared to manual mixing.		
	d) Ans.	**Explain the compaction factor test to determine workability of concrete mixture.** **Compaction Factor Test as per IS: 1199-1959:** 1. Take the freshly mixed concrete of any specific grade and fill it in upper hopper of compaction factor test apparatus with trap door 1 (TD1)in closed position. 2. After filling the upper hopper, open the TD1 and allow the concrete to free fall from upper hopper into lower hopper through dropping height 200mm with TD2 in closed position. 3. Now, immediately open TD2 and allow to free fall the concrete again from lower hopper into cylinder through same dropping height. 4. Repeat above steps till the cylinder fills with concrete completely. Take the weight of this partially compacted concrete as W_1 gm. 5. Remove the concrete from the cylinder and fill it with same grade of concrete by properly compacting with vibration. 6. Take the weight of this fully compacted concrete as W_2 gm. 7. Calculate the compaction factor of given concrete by using $CF = (W_1 / W_2)$ 8. Depending upon calculated C.F., the degree of workability can be designated as follows.	**3** **1**	**4**

Sr. No.	Compaction Factor	Degree of Workability
1	0.78	Very low
2	0.85	Low
3	0.92	Medium
4	0.95	High

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	e) Ans.	**Enlist any four objectives of concrete mix design.** **Objectives of Concrete Mix Design:** 1. To achieve specified compressive strength of concrete. 2. To reduce wastage of concrete by correct proportioning. 3. To achieve economy by selecting appropriate concrete ingredients. 4. To maintain workability of concrete mix throughout work. 5. To obtain maximum possible yield per bag of cement. 6. To ensure less defects and enhanced durability of concrete.	**1 each (any four)**	**4**
	f) Ans.	**Explain the ultrasonic pulse velocity test.** **Ultrasonic Pulse Velocity Test:** It is simple and quick test in which pulse velocity is determined passing through concrete. 1. The ultrasonic pulse or waves are generated from pulse generator. 2. These waves transmit through transmitter end into the concrete mass and receive at receiver end as shown in figure below. 3. The digital display shows the time required to pass the waves through concrete mass. 4. The pulse velocity is then calculated by dividing path or wavelength by time of travel. 5. The average pulse velocity of wave propagation is calculated by testing concrete at two more locations. 6. Depending on pulse velocity, quality of concrete is decided as follows:	**3**	

Sr. No.	Velocity (Km/s)	Quality of Concrete	Compressive Strength (N/mm^2)
1	4.0 and above	Very good	30-35
2	3.5 to 4.0	Good	25-30
3	3.0 to 3.5	Medium	20-25
4	3.0 and below	Poor	15-20

½

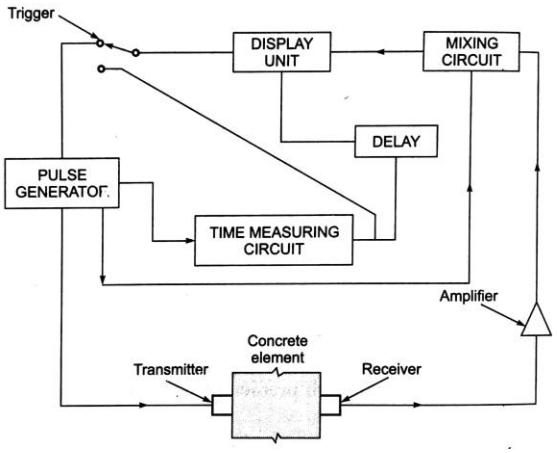
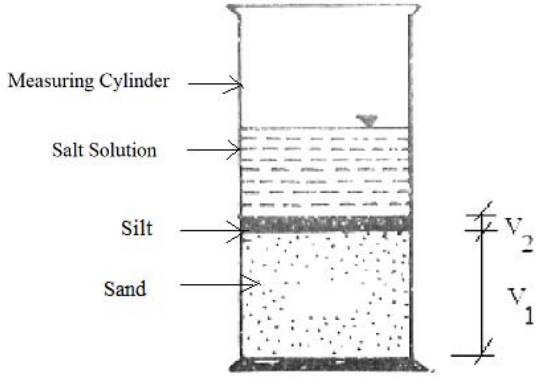


Fig. Ultrasonic Pulse Velocity Test

½ **4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3		**Attempt any FOUR of the following:**		(16)
	a) Ans.	**Enlist the requirements of good aggregate. (min. 4 points)** **Requirements of Good Aggregate:** The requirements of good aggregate are as follows. 1. A good aggregate should be strong having sufficient impact, crushing and abrasion strength. 2. A good aggregate should be durable to resist atmospheric variation. 3. It should be non-reactive type to avoid alkali- aggregate reaction. 4. It should be clean i.e. free from organic and inorganic impurities. 5. It should be well graded with minimum voids. 6. It should have rough texture for better bonding. 7. It should not absorb water more than 5%from added water to avoid variation in w/c ratio. 8. It should have angular shape for strong interlocking of particular.	**1 each (any four)**	**4**
	b) Ans.	**Explain silt content laboratory test of fine aggregate.** **Silt Content Laboratory Test:** 1. Prepare 1% salt solution by adding 10 gm common salt in 1000 ml water. 2. Fill this salt solution up to 50 ml mark in measuring cylinder. Now add sand sample in it to reach the mixture up to 100 ml mark. Add more salt solution to reach total volume up to 150 ml. 3. Shake the mixture vigoursly in both palms. Now keep it at room temperature for 3 hours to separate silt layer above sand sample as shown in figure below. 4. Measure the separated volumes of sand and silt as V_1 and V_2 respectively. 5. Calculate the silt content of given sand sample in percentage as $(V_2/V_1) \times 100$. The silt content should be less than 6% as per IS (other than road concrete).  **Fig. Silt Content Test**	**3** **1**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3	c) Ans.	**Explain aggregate impact test.** **Aggregate Impact Test:** 1. Take oven dried aggregate passing through 12.5 mm IS Sieve and retained on 10 mm IS sieve. 2. Fill this aggregate in impact mould within 3 layers. Compact each layer 25 times using tamping rod. 3. Calculate the weight of aggregate filled by subtracting empty weight of mould as W_1 gm. 4. Put the mould under aggregate impact testing machine and give 15 successive blows by lifting handle of it; so that aggregate gets crushed. 5. Take out sample from mould and sieve it through 2.36 mm IS sieve. Take weight of aggregate fraction passing through 2.36 mm IS sieve as W_2 gm. 6. Calculate % aggregate impact value of given coarse aggregate as (W_2/W_1) X 100.	4	4
	d) Ans.	**Explain aggregate abrasion test.** **Aggregate Abrasion Test:** 1. Take 1.25 to 5 kg. oven dried clean aggregate as per grading of concrete, which can be taken as initial weight W_1 gm. 2. Put it in drum of Los Angeles abrasion testing machine through opening with abrasive charge balls. 3. Now rotate the drum at a rate of 20 to 33 revolutions/minute for total 500 – 1000 revolutions as per grading of aggregates so that aggregate will break down. 4. Take out crushed aggregate from drum and sieve it through 1.7 mm IS Sieve. 5. Take the weight of aggregate fraction passing through 1.7 mm IS sieve as W_2 gm. 6. Calculate % aggregate abrasion value of given aggregate as (W_2/W_1) X 100.	4	4
	e) Ans.	**Explain compressive strength test carried out on concrete.** **Compressive Strength Test on Concrete:** 1. Take three cubes of 15 cm sides and apply oil to its inner surface. 2. Prepare the concrete mixture of required grade and fill it in each mould in 3 layers. Compact each layer 25 times with a tamping rod (steel) of 16 mm diameter and 600 mm long. 3. Keep all the moulds at room temperature for 24 hrs for initial hardening and at relative humidity 90%. 4. Remove cube moulds and keep concrete cubes under fresh water for curing for 7, 14, 21, 28 days. 5. Remove cube from water after curing period and keep it under compression testing machine (CTM) for testing.		

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3	e)	6. Apply compressive load at a rate of 4 tonnes / minute for 10 minutes or till failure of cubes. Note down the failure load in N and cross sectional area of cube in mm^2. 7. Calculate compressive strength of cubes i.e. load upon area. 8. The average of three test cubes can be calculated as average compressive strength in MPa or N/mm^2.	4	4

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>Q.4</td><td>(A)
a)

Ans.</td><td>Attempt any <u>THREE</u> of the following:
Differentiate between weigh batching and volume batching. (min. 4 points)
Difference between Weigh batching and Volume batching:
<table>
<tr><th>Sr. No.</th><th>Weight Batching</th><th>Volume Batching</th></tr>
<tr><td>1</td><td>In this, measurement of materials is done by taking weight.</td><td>In this, measurement of materials is done by taking volume.</td></tr>
<tr><td>2</td><td>Weigh machine is used.</td><td>Gauge boxes are used.</td></tr>
<tr><td>3</td><td>It is more accurate.</td><td>It is less accurate.</td></tr>
<tr><td>4</td><td>It is useful for more important works where mix-design is adopted.</td><td>It is useful for less important works where ordinary mix is used.</td></tr>
<tr><td>5</td><td>Weigh batching is done for cement.</td><td>Volume batching is done for aggregates and water.</td></tr>
<tr><td>6</td><td>It requires skilled labours.</td><td>It requires unskilled labours.</td></tr>
<tr><td>7</td><td>It requires more time.</td><td>It requires less time.</td></tr>
</table></td><td>1 each (any four)</td><td>(12)
4</td></tr>
<tr><td></td><td>b)

Ans.</td><td>Enlist any four precautions to be taken while transportation of concrete mixture.
Precautions to be taken while transportation of concrete mixture:
1. Establish mixing plant nearest possible to the construction site to reduce time of transportation.
2. Select higher w/c ratio, if distance between mixing plant and working site is more.
3. Maintain cold or humid condition around the concrete mixture during transportation.
4. Use retarding admixture, to avoid early setting and hardening of concrete.
5. Cover the concrete mixture, if it is transported in open trucks to avoid direct sunlight.
6. Due care should be taken to avoid leakage and wastage of concrete mix during transportation.</td><td>1 each (any four)</td><td>4</td></tr>
</table>

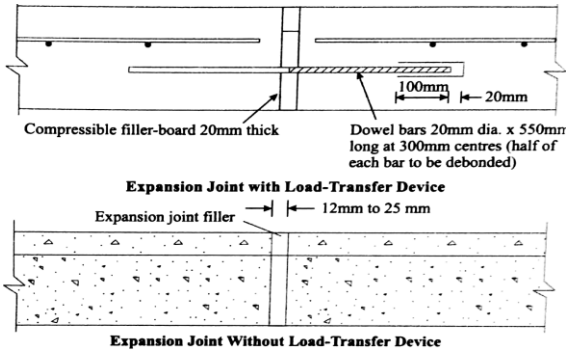
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	c)	**State any four methods of compaction of concrete with their suitability.** **Methods of compaction of concrete with their suitability:** **1. Manual compaction:** It is suitable for small scale concrete works with comparatively less important. Rodding is used for vertical columns, deep beam. Ramming is applicable for PCC of ground floors. Tamping is done for roofs, floors, pavements etc. **2 Compaction by vibration:** It is suitable when large quantity of concrete is used and manual compaction becomes difficult. It is applicable when strength requirement is more like RCC buildings, concrete dams, bridges, concrete roads etc. It is preferred when w/c ratio is less and stiffness of concrete is more. It is suitable to achieve denseness in such stiff mixes. 3. **Compaction by pressure and jolts:** It is applicable to compact the dry concrete used for hollow blocks, cavity blocks and solid concrete blocks. It is also suitable for compaction of cement bricks, pavement blocks, decorative POP elements etc. 4. **Compaction by spinning:** It is useful by applying rotations for compaction of hume pipes, spun pipes, tunnel lining etc.	**1 each**	**4**
	d) Ans.	**Explain the necessity of waterproofing of concrete. (min. 4 points)** **Necessity of water proofing:** 1. It reduces permeability of concrete which is necessary to reduce leakage of water retaining structures. 2. The waterproofing is required to prevent formation of cracks on concrete surface. 3. It avoids formation of efflorescence of concrete surface which avoids strength reduction. 4. Proper waterproofing resists defects which ensure more durability of structures. 5. It prevents growth of algae and vegetation of concrete, hence keeps good sanitation of concrete structures. 6. It prevents paint removal and damaging appearance of structures.	**1 each (any four)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	(B)	**Attempt any ONE of the following:**		(06)
	a)	**What is "stripping time of formwork"? State the values of stripping time for beam, column and slab as per IS 456-2000.**		
	Ans.	**Stripping time of formwork:** The minimum time of removal of formwork from the date of casting after sufficient hardening of concrete is called as stripping time of formwork.	1	
		Stripping time for beam, column and slab as per IS 456-2000:		
		1. Beam: i. Soffit formwork for beam – 7 days	2	
		ii. Beam and arch of span up to 6m – 14 days		
		iii. Beam and arch of span more than 6m – 21 days		
		2. Column: i Vertical formwork – 16 to 24 hours	1	
		3. Slab: i. Soffit formwork – 3 days		
		ii. Span up to 4.5m – 7 days	2	6
		iii. Span more than 4.5m – 14 days		
	b)	**Enlist the type of joints in concrete (any two). Also explain in brief the method of joining old and new concrete.**		
		Type of joints in concrete: There are following types of joints which can be provided in concrete structures.	1 each (any two)	
		1. Construction joint		
		2. Expansion joint		
		3. Contraction joint		
		4. Isolation joint		
		Method of joining old and new concrete:		
		1. Cleaning: The old concrete surface is first thoroughly cleaned with wire brush. Loose material if any, should be removed.		
		2. Chiseling: The old concrete surface is made rough by denting it with a chisel for a strong bond with new concrete.		
		3. Application of cement slurry or paste with some admixtures: The surface is then wetted with rich cement slurry. Sometimes an admixture has to be added to give additional strength to the joints. Then fresh concrete is placed over the old concrete.	1 each	6
		4. Providing overlap: To give homogeneity to the reinforcing bars, overlap is provided and the overlap portion is bound tightly with high tensile wire.		

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5		**Attempt any FOUR of the following:**		(16)
	a)	**Define chemical admixture in concrete. Also state any three purposes of adding admixtures in concrete.**		
	Ans.	**Chemical admixture:** The addictive materials which are added purposefully to modify properties and to improve overall engineering performance as per site requirement; are known as chemical admixture.	1	
		Purposes of adding admixtures in concrete: The admixtures are used in concrete to serve the following purposes. 1. To modify the properties of fresh concrete as per site requirement so that to facilitate the actual working conditions. 2. To improve workability of concrete so as to avoid any wastage during handling. 3. To avoid segregation and bleeding problems occurring in non-homogeneous mix. 4. To increase or decrease the rate of setting or hardening of concrete. 5. To decrease the rate of setting or hardening of concrete in extreme weather conditions. 6. To reduce heat of hydration and related formation of cracks. 7. To reduce excessive water in concrete mix so that optimum workability can be maintained. 8. To increase flow ability of concrete mix. 9. To increase in bonding between steel reinforcement and concrete mass. 10. To increase strength and durability of concrete in its hardened state. 11. To improve finishing of concrete by reducing voids and hence making dense concrete. 12. To join old and new concrete at construction joints.	1 each (any three)	4
	b)	**State any two properties and two applications of ready mix concrete.**		
	Ans.	**Properties of ready mix concrete:** 1. Excessively high workability in fresh state. 2. More homogeneity of concrete mix. 3. Enhanced ultimate strength. 4. More durability. 5. Highly dense nature of concrete. 6. More fire resistance.	1 each (any two)	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	b)	**Applications of ready mix concrete:** 1. Applicable to mega construction projects like multi-storied building, commercial complex and industrial sheds etc. 2. Highly recommended for more important constructions like government buildings, expressways, skyscrapers etc. 3. Suitable for mass concrete works like dams, bridges, mega foundations etc. 4 Feasible for ordinary or normal concrete road construction. 5 Useful in construction in highly congested area like crowded zone, large urban city etc.	**1 each (any two)**	**4**
	c) Ans.	**State any four ill-effects of hot weather concreting.** **Ill effects of hot weather concreting:** 1. Due to hot weather, concrete shows rapid rate of hardening, which results difficulty in transportation of concrete. 2. Extreme heat evaporates water from concrete mix fastly, which results decreases in w/c ratio and workability of concrete. 3. Water may get absorbed by formwork, aggregate or ground, which gives harshness in concrete. 4. More shrinkage cracks get developed on concrete surface due to incomplete hydration with less water in concrete. Hence, early finishing becomes more essential. 5. Continuous curing is required to keep humidity and to avoid further development of cracks. 6. Air entrained in concrete may get expelled due to temperature, hence workability may reduce additionally.	**1 each (any four)**	**4**
	d) Ans.	**State the applications of accelerating admixture and retarding admixture. (any two each)** **Applications of accelerating admixture:** 1. It is applicable where delay in construction is not allowed i.e. road construction. 2. It is useful where quick setting is required i.e. in underwater construction. 3. It is beneficial where rapid hardening of concrete is necessary i.e. in case of high rise structures. **Applications of retarding admixture:** 1. It is applicable where high heat and vibrations are required to reduce i.e. in machine foundations and nuclear power plant. 2. It is useful where slow setting of concrete is required i.e. in extreme hot weather concreting. 3. It is beneficial where slow hardening of concrete is necessary i.e. in mass concrete structures like dam, bridge etc.	**1 each (any two)** **1 each (any two)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	e)	**Define an air entraining admixture. State any two situations to use it.**		
	Ans.	**Air Entraining Admixture:** The admixture which generates tiny air bubbles in fresh concrete mix to increase its workability; is called as air entraining admixture.	**2**	
		Situations to use air entraining admixture: 1. Air entraining admixture is useful in structural concrete to provide resistance to frost. 2. It is useful for poorly graded concrete to make it more cohesive, workable mix. 3. It is essential to aid compaction and surface finish in harsh concrete. 4. It is required to increase strength of concrete. 5. It is necessary to de-mould concrete blocks without its wear	**1 each (any two)**	**4**
	f)	**State two advantages and two disadvantages of self-compacting concrete over ordinary concrete.**		
	Ans.	**Advantages of self-compacting concrete (SCC) over ordinary concrete:** 1. SCC reduces noise and Hand Arm Vibration Syndrome (HAVS), as it does not require any external vibration for its compaction; whereas ordinary concrete produce noise pollution through vibration. 2. As SCC is self compactable, it reduces labour requirement and labour cost than that of RCC. 3. SCC gives more homogeneous mixture than ordinary concrete. 4. SCC is pumpable to higher elevations without disturbing workability than ordinary concrete. 5. SCC gives easy placing even in thin and highly reinforced sections, where ordinary RCC cannot be placed. 6. SCC gives smoother finishing than ordinary concrete.	**1 each (any two)**	
		Disadvantages of self-compacting concrete over ordinary concrete: 1. There is no perfect mix design method for self compacting concrete, as RCC has specific design method. 2. SCC requires high fluidity in tight joints, which slows down the casting rate. 3. Highly skilled and experiences workers are required for the production of SCC. 4. The production of SCC requires super plasticizers, hence depends totally on availability of such admixtures. 5. SCC production is more costly than conventional ordinary concrete.	**1 each (any two)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6		**Attempt any FOUR of the following:**		(16)
	a) Ans.	**Enlist any four methods of concrete curing with their suitability.** **Methods of concrete curing with their suitability:** 1. **Water curing:** It is suitable where availability of water is abundant in nature. It can be used for ordinary construction like buildings, dams, bridges etc. 2. **Membrane curing:** It is suitable where water scarcity is predominant. It is also applicable where atmospheric temperature is quite high, hence to avoid evaporation of water from casted concrete. It can be used for beam, column of buildings in drought areas. 3. **Curing by application of heat:** It is suitable for pre-casting and pre-stressing concrete members with longer length like railway sleepers, fencing poles, door and window frames, pre-stressed concrete beams, deck slab etc. 4. **Miscellaneous methods:** The methods like curing by chemicals are suitable when other methods of curing cannot work. In these methods use of $CaCl_2$, $NaSiO_3$ are done for curing of resilient tile and flooring.	1 each	4
	b) Ans.	**Draw a neat labelled sketch of expansion joint in concrete.**  **Fig. Expansion Joint in Concrete**	3 1	4
	c) Ans.	**Define water reducing admixture. Give its effect on workability and strength of concrete.** **Water Reducing Admixture:** The admixture which is added to reduce the excessive water content to maintain desired workability is known as water reducing admixture. **Effect of water reducing admixture on workability and strength of concrete:** 1. The water reducing admixture reduces water up to 5 to 10 % and the desired workability of concrete is maintained. 2. The use of wide ranges of water reducers, strength of concrete increases up to 25 % as compared to untreated concrete.	2 1 1	4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	d) Ans.	**State two advantages and two disadvantages of fiber reinforce concrete.** **Advantages of Fiber Reinforce Concrete (FRC):** 1. FRC has more shear and torsional strength, which resists shock and dynamic loads. 2. FRC acts as crack arresters, hence gives smooth finishing to concrete. 3. FRC is light in weight, hence easy to handle. 4. FRC resists freezing and thawing and fire resistant of concrete. 5. FRC is cheaper or less costly than RCC. **Disadvantages of fiber reinforce concrete:** 1. FRC requires strict supervision for its better quality. 2. Random mixing of fibers reduces workability of concrete mix. 3. FRC requires proper placing arrangement. 4. Fibers in concrete do not contribute the tensile strength. 5. Improper mixing of fibers gives honeycombing and unfinished concrete surface.	**1 each (any two)** **1 each (any two)**	**4**
	e) Ans.	**How will you make the concrete impermeable in nature? (min. 4 points)** **Concrete can be made impermeable in nature by following ways:** 1. The selection of appropriate mix proportion of concrete ingredients and its batching helps to concrete impermeable in nature. 2. Use angular aggregates gives good interlocking and more cement content results strong bonding of aggregates, which ultimately helps non-porous concrete. 3. The mixing of concrete should be mechanical to produce homogenous concrete mixture. Then such mix results in more finished concrete surface reducing permeability of concrete. 4. The compaction should be done immediately after placing of concrete i.e. before hardening of concrete, then the voids will be removed completely to give impermeable concrete. 5. Continuous and sufficient curing is essential to avoid crack formation on concrete surface; hence it will facilitate the impermeabilty of concrete. 6. Suitable admixtures like damp proofing and water proofing agents should be used to avoid water repellence. 7. The finishing of hardened concrete using fine mortars gives impermeable concrete. 8. Honeycombing in concrete can be avoided by erecting leak proof formwork, which further results in more finished concrete. 9. The impermeabilty of concrete can be ensured by providing various construction joints at appropriate locations with perfect bonding.	**1 each (any four)**	**4**