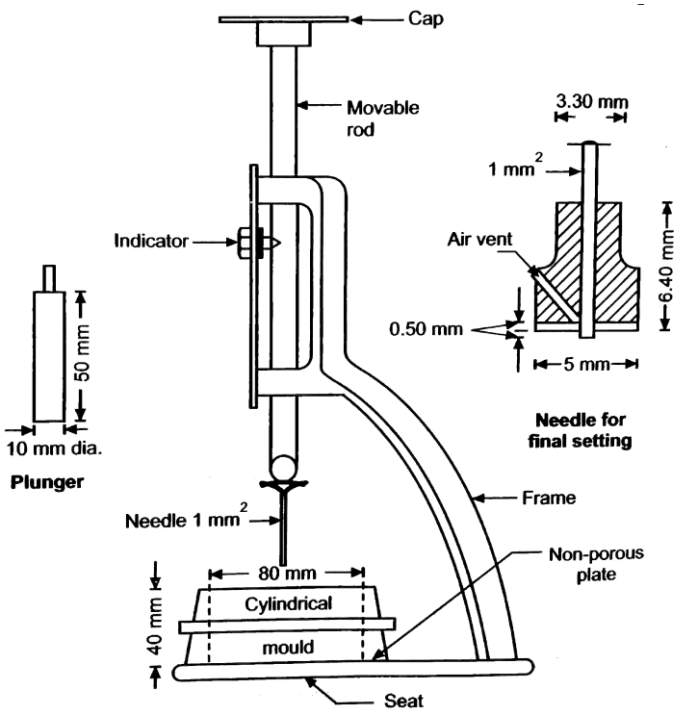
Model Answer: Winter-2018

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) (a) Ans.**	**Attempt ant THREE of the following** **Explain the process of hydration of cement.** **Hydration of cement:** i. It is exothermic chemical reaction takes place when water is added to cement, which gives rise cement paste and large heat evolved about 120 cal/gm. is called as hydration of cement. ii. For complete hydration of cement, 38% water by weight of cement is required. It is the reaction (series of chemical reactions) of cement with water to form the binding material. In other words, in the presence of water, the silicates (C_3S and C_2S) and aluminates (C_3A and C_4AF) form products of hydration which in time produce a firm and hard mass - the hydrated cement paste. iii. There are two ways in which compounds of the type present in cement can react with water. In the first, a direct addition of some molecules of water takes place, this being a true reaction of hydration. iv. The second type of reaction with water is hydrolysis, in which its nature can be illustrated using the C_3S hydration equation: $3CaO.SiO_2 + H_2O \rightarrow Ca(OH)_2 + xCaO.ySiO_2$. (calcium silicate hydrate)	**4**	**(12)** **4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	**(b)** **Ans.**	**Draw labelled diagram of vicat apparatus with plunger, initial & final setting needle.**  **Fig. Vicat's Apparatus with Plunger and Needle**	**4**	**4**
	(c) **Ans.**	**State any four types of cement with their special uses.** **Types of cement and their uses:** 1. Ordinary Portland cement(OPC) i. Ordinary PCC and RCC construction work ii.Plastering and water proofing works iii.Drainage works 2. Rapid Hardening cement (RHC) i. Road construction where delay in traffic is not required ii.Tremie method of concreting in underwater construction works. iii.Manufacturing of concrete products like fencing pole, electric pole, doors and windows frames iv.Cold weather concreting 3. Low heat cement (LHC) i. Mass concreting works like construction of abutment, retaining wall bridge, dam etc. ii. Construction of chimney of factory iii.Construction of machine foundations 4. Portland pozzalana cement (PPC) i. All construction works where OPC is used i.e. PCC and RCC ii.Construction of hydraulic structure	**1 each (any four)**	**4**

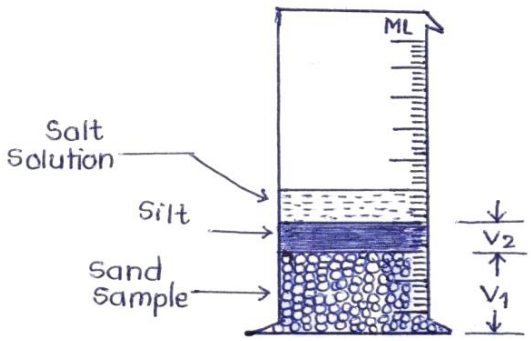
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1		iii. Mass concreting work 5. Sulphate resisting cement i. Construction of foundation on soil and water containing high % of SO_4. ii. Marine and seashore construction iii. Underground laying of RCC pipes in acidic soils. 6. Blast furnace slag cement (BFSC) i. All construction works where OPC is used. ii. Mass concreting iii. Marine works 7. White cement (WC) i. Decoration Works i.e. False ceiling ii. Finishing works i.e. internal plastering iii. Waterproofing works ***(Note: Any other type of cement should be considered.)***		
	(d) Ans.	**As a site engineer write steps you will take to store cement on site.** **Steps to take while storing cement on site:** i. Ensure the separate industrial shade to store the cement at site. ii. Building should be with 150 mm concrete floor and 230mm brick walls. iii. There should be D.P.C. (1:4:8) to avoid dampness. iv. Actual stacking should be on wooden planks 300 mm above ground floor. v. Bags should not be stacked more than 8 to 10 bags vertically. vi. Stacking should be lengthwise and widthwise alternatively. vii. Stacking should be 300 mm away from walls with 1 m gap between two rows for easy handling. viii. One should ensure that there should be exhaust fans and windows for ventilation.	**4**	**4**
	(B) (a) Ans.	**Attempt any ONE of the following:** **Define fineness modulus and write procedure to determine FM of fine aggregate in Lab.** **Fineness Modulus:** It is defined as the ratio of sum of cumulative percentage of weight retained on various IS sieves taken up to 150 µ sieve divided by empirical constant 100. **Procedure to determine FM of fine aggregate in Lab :** To determine fineness modulus, sieve analysis of fine aggregate sample is done as per following procedure. i. Arrange the set of IS. Sieves i.e. 4.75mm, 2.36mm, 1.18mm, 600µ, 300µ, 150µ, 75µ, in descending order with coarser sieve at top and finer sieve at bottom.	**1**	**(6)**

<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.1</td><td></td><td>ii. Take the oven dried fine aggregate (sand) sample about 500gm and put it on topmost sieve. Place lid and pan at top and bottom of sieve set respectively.
iii. Keep this assembly on mechanical sieve shaker and shake it for 15-20 minutes, so that the sand will be completely sieved.
iv. Take the weight of sand fraction retained on each sieve separately and calculate the % finer using following tabular format.
<table><tr><td>Sieve size (mm)</td><td>Weight retained (gm)</td><td>% Weight retained</td><td>Cumulative % weight retained</td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>∑=</td></tr></table></td><td>3
1</td><td>6</td></tr>
<tr><td></td><td></td><td>v. Calculate fineness modulus of given aggregate sample as
FM = (∑ Cumulative % weight retained up to 150μ) / 100.</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>Write any three properties of coarse aggregate and their effects on behaviour of concrete.</td><td></td><td></td></tr>
<tr><td></td><td>Ans.</td><td>i. Size: If coarse aggregate is of larger size used in concrete, it gives less workability and concrete becomes porous in nature.
ii. Shape: If the shape of coarse aggregate particles is flaky or elongated will result in difficulty in mixing. Even rounded coarse aggregate will give weak interlocking of particles but void ratio is less. Angular shape coarse aggregate gives required bonding and strength.
iii. Surface texture: Smooth texture of coarse aggregate mixed with sand will result in low workability in the form of segregation. Rough textured aggregate will give strength to concrete.
iv. Water absorption: If coarse aggregate has more water absorption capacity then concrete will become harsh indicating reduced workability and honeycombed finishing.
v. Specific gravity: The more specific gravity of coarse aggregate will increase dead load of concrete structure. The lesser specific gravity gives light weight concreting.
vi. Bulk density: If the bulk density of coarse aggregate is more, then lesser voids in concrete gives dense and compacted mass. But less bulk density of coarse aggregate requires more cement slurry and may result in porous concrete and uneconomical.
vii. Fineness Modulus: If FM of coarse aggregate is not in between 2.9 to 3.2, then such aggregate will not be well graded, hence it will not satisfy strength requirement.</td><td>2 each (any three)</td><td>6</td></tr>
</table>

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
		viii. Impact or crushing strength: The impact or crushing strength of coarse aggregate should be less than 45%; otherwise load carrying capacity of concrete will reduce. **ix. Alkali aggregate reaction:** This is undesirable reaction takes place due to chemical reactive aggregate, which gives rise to various cracks on concrete surface. ***(Note: Any other property should be considered.)***		
Q.2		**Attempt any FOUR of the following:**		**(16)**
	(a)	**State any four grades of concrete as per IS 456 – 2000 with their proportion.**		
	Ans.	There are four categories of concrete grades as follows depending upon compressive strength of cube obtained after 28 days curing in N/mm^2. i.M10 = 1:3:6 ii.M15 = 1:2:4 iii.M20 = 1:1.5:3 iv.M25 = 1:1:2	**1 each**	**4**
	(b)	**Write importance of w/c ratio in concrete technology.**		
	Ans.	i. The W/C ratio plays very vital role in concrete mixture. The improper or random selection of W/C ratio leads in various defects in both fresh and hardened concrete. ii. If W/C ratio is less (e.g. w/c= 1/4 = 0.25), then concrete will become harsh and results in honeycombing or porous nature due to poor workability. iii. If w/c ratio is more (e.g. w/c= 3/4= 0.75), then concrete undergoes segregation and bleeding. Thus finally concrete shows defects in it. iv. The w/c ratio should be optimum, which depends on grade of concrete and exposure conditions hence w/c ratio should be selected from IS: 456-2000. v. If w/c ratio is opted out properly as mentioned above, then concrete possess good workability, compressive strength and durability. vi. If w/c ratio is not proper, then the mixture is non- homogenous due to improper mixing, then concrete results in segregation. vii. If higher w/c ratio is adopted, then more chances of bleeding takes place. The excessive vibration results in bleeding in concrete. To avoid bleeding, proper w/c ratio should be adopted as IS: 456-2000.	**4**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	**(c)**	**State four factors affecting workability property of concrete.** **Factors affecting workability of concrete:** i. Water content (W/C ratio) ii. Mix proportions of concrete iii. Size of aggregate iv. Shape of aggregate v. Surface texture of aggregate vi. Grading of aggregate vii. Use of admixtures viii. Water absorption of aggregate ix. Temperature	**1 each (any four)**	**4**
	(d) Ans.	**Explain the procedure of determining compressive strength of concrete.** i. Take three cube moulds of 15 cm side and apply oil to its inner surface. ii. Prepare the concrete mixture of required grade and fill it in each mould in three layers. Compact each layer evenly spaced 25 times strokes with 16 mm. diameter standard tamping rod. Compaction of concrete is done by using table vibrator to remove air completely from concrete. iii. Keep all the moulds at room temperature for 24 hrs for initial hardening and at relative humidity 90%. iv. Remove cube moulds and keep concrete cubes under fresh water for curing for 7, 14, 21, 28 days. v. Remove cube from water after curing period and keep it under compression testing machine (CTM) for testing. vi. Apply compressive load at a rate of 4 tones / min for 10 minutes or till failure of cube. Note down the failure load in kN shown by red pointer of dial gauge. vii. Calculate compressive strength of each cube. Take failure load in N and cross sectional area of cube in mm^2. viii. Calculate average compressive strength of three test cubes in N/mm^2.	**4**	**4**
	(e) Ans.	**State any four objectives of concrete mix design.** **Objectives of mix design :** i. To achieve a specified compressive strength of concrete. ii. To reduce wastage of concrete by correct proportioning. iii. To achieve economy by selecting appropriate concrete ingredients. iv. To maintain workability of concrete mix throughout work. v. To avoid chances of harshness, segregation and bleeding in fresh concrete. vi. To obtain maximum possible yield per bag of cement. vii. To get homogeneous mixture of concrete.	**1 each (any four)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	**(f)**	**Write any four types of NDT of concrete and state importance of NDT in present construction practices.**		
	Ans.	**Types of NDT:** i. Ultrasonic Pulse Velocity test ii. Rebound Hammer test iii. Radioactive method iv. Nuclear method v. Electrical method vi. Magnetic method vii. Surface Hardness method viii. Penetration and Pull out techniques	**½ each (any four)**	
		Importance of NDT : i. NDT is important to know the present condition of existing structures. ii. It is also important to get the strength of concrete without breaking the concrete mass. iii. It is significant to test the homogeneity of concrete by finding internal flaws, cavities. iv. It is also essential to get the idea of overall quality of concrete within short period. v. NDT test simple to conduct and the test results of are also easy to interpret. vi. These tests can be conducted at various difficult site conditions, indicating wide applicability.	**2**	**4**
Q.3		**Attempt any FOUR of the following:**		**(16)**
	(a)	**Write classification of aggregates according to source and size.**		
	Ans.	**Classification of aggregate according to source:** i. Natural aggregate: The aggregates are found in the natural sources like river basin, sea bed, slope deposits. e.g. pit run gravel, sand. ii. Crushed rock aggregate: These aggregate is formed by crushing the various rocks obtained from quarries. e.g. stone aggregates iii. Artificial aggregate: The aggregate are made up of various waste materials. e.g. burnt clays, artificial cinders, steel rivet, iron ore etc. iv. Recycled aggregate: These aggregate is manufactured by crushing inert construction and demolition waste.	**2**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3		**Classification of aggregate according to Size:** i. Fine aggregate: The aggregates having size of particles less than 4.75m, are called as fine aggregate ii. Coarse aggregate: The aggregates having size of particles more than 4.75mm are called as coarse aggregate iii. All in one aggregate: The aggregate containing both fine and coarse aggregates is called as all in one aggregate.	**2**	
	(b)	**Write procedure to determine silt content of sand in Lab.**  **Fig. Silt Content** i. Prepare 1% salt solution by adding 10 gm. common salt in 1000 ml water. ii. Fill this salt solution upto 50 ml. mark in measuring cylinder. Now add sand sample in it to reach the mixture upto 100 ml. mark. Finally add more salt solution to reach total volume upto 150 ml. iii. Shake the mixture vigoursly using both palms. Now keep it at room temperature for 3 hours to separate silt layer above sand sample as shown in figure above. iv. Measure the separated volumes of sand and silt as V_1 and V_2 respectively. v. Calculate the silt content of given sand sample in percentage as $(V_2/V_1) \times 100$. vi. Repeat all above steps by taking sand sample at different locations to get accurate and average silt content in sand.	**1** **3**	**4**

Q.3 (c) **Determine FM of fine aggregate from following data.**
Initial weight = 500gm

Sieve size (mm)	4.75	2.36	1.18	600µ	300µ	150µ	Pan
Weight Retained (gm)	10	50	50	90	180	100	30

Ans.

Sieve size	Wt. Retained (gm)	Cumulative wt. retained (gm)	%Cumulative wt. retained
4.75mm	10	10	2
2.36mm	50	60	12
1.18mm	50	110	22
600µ	90	200	40
300µ	180	380	76
150µ	100	480	96
Pan	30	510	-
Total	**510**	-	**248**

Marks: 3 — Total Marks: 4

Fineness Modulus of sand = (Sum of % cumulative wt. retained upto 150µ I.S. Sieve) / 100

F. M. = 248/100

F. M. = 2.48

Marks: 1

(Note: If total weight of sample taken 510gm. and attempted should be considered.)

(d) **Write Lab procedure to determine Impact Value of coarse aggregate.**

Ans.

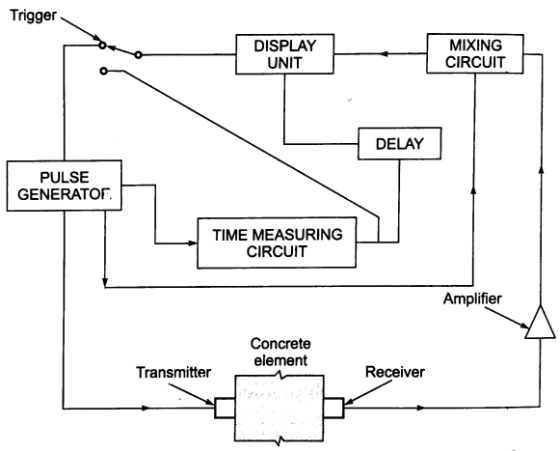
i. Take oven dried aggregate sample passing through 12.5 mm IS sieve and retained on 10 mm IS sieve.
ii. Fill this aggregate in impact mould within 3 layers. Compact each layer evenly spaced 25 times stroke by using standard tamping rod.
iii. Calculate the weight of aggregate filled by subtracting empty weight of mould as W_1 gm.
iv. Put the mould under aggregate impact testing machine and give 15 successive blows per sec. by lifting weight so that aggregate will get crushed.
v. 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.
vi. Calculate % aggregate impact value of given coarse aggregate as (W_2/W_1) X 100.

Marks: 4 — Total Marks: 4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3	**(e)**	**State procedure to determine quality of concrete by ultrasonic pulse velocity test.**		
	Ans.	**Procedure to determine quality of concrete by ultrasonic pulse velocity test.** i. Initially attach the transmitter and receiver end to the target concrete surface by one of the method i.e. direct, indirect or surface transmission. ii. Generate the ultrasonic pulse or waves from pulse generator, so that these waves transmit through transmitter end into the concrete mass and receive at receiver end. iii. Note down the time required to pass the waves through concrete mass on digital display. iv. Calculate the ultrasonic pulse velocity in Km/sec. of the waves as path or wavelength divided by time of travel. v. The average pulse velocity of wave propagation is calculated by testing concrete at two more locations. vi. Depending on pulse velocity, quality of concrete is decided as follows:	**3**	**4**

Sr. No.	**Velocity (Km/sec.)**	**Quality of concrete**	**Comp. 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



½

Fig. Ultrasonic Pulse Velocity Test

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	**(A)**	**Attempt any THREE of the following:**		**(12)**
	(a)	**Write various concreting operations in proper sequence.**		
	Ans.	i. Batching of materials required for concrete mixture. ii. Mixing of materials. iii. Transportation of concrete mixture from mixing plant to site. iv. Placing of concrete into erected formwork. v. Compaction of placed concrete. vi. Curing of casted concrete elements. vii. Finishing of cured concrete surface.	**4**	**4**
	(b)	**Write any four types of formwork and gives four requirements of good formwork.**		
	Ans.	**Types of formwork:** i. Wooden or timber and plywood formwork ii. Steel formwork iii. Aluminum formwork iv. Fibre and plastic formwork	**2**	
		Requirements of good formwork: i. It should be strong enough to carry the weight of concrete without bulging. ii. It should be easy to erect and dismantle on site. iii. It should be reusable for number of times to achieve economy. iv. It should be easily available to avoid delay in construction work. v. It should give uniform and smooth finishing to the concrete surface after its removal. vi. It should be leak-proof with perfect joints. vii. It should be durable with lesser wear and tear.	**2**	**4**
	(c)	**Define curing and list any three methods of curing.**		
	Ans.	**Curing:** It is the process of maintaining satisfactory moisture content or warm of freshly placed concrete to ensure continue hydration of cement.	**1**	
		Method of Curing: **i. Water curing:** a. Immersion b. Ponding c. Spraying or fogging d. Wet covering **ii. Membrane curing:** a. Bituminous compound b. Rubber compound c. Polyester film **iii. Application of heat:** a. Steam curing b. Curing by infra-red radiation c. Electrical curing **iv. Miscellaneous method** a. Calcium chloride as a surface coating	**1 each (any three)**	**4**

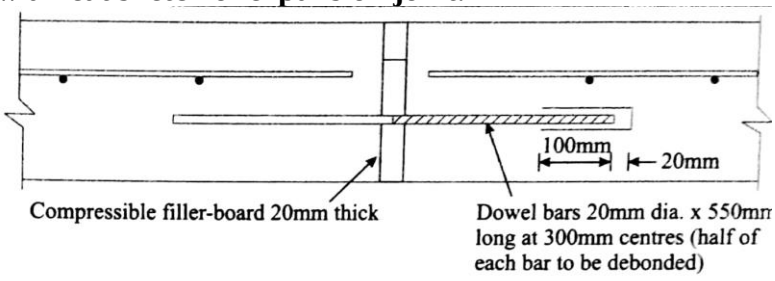
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	**(d)**	**Explain two different methods of waterproofing.**		
	Ans.	i. **Waterproofing by use of pore fillers:** In this method, pore filler materials like silicate of soda, aluminum and zinc sulphates and aluminum and calcium chloride are used. These chemically active pore fillers accelerate setting time which results impermeability in concrete at early stage. Some chemically inactive pore filler materials like chalk, fuller's earth, talc reduces water without disturbing workability to give imperviousness in concrete.	**2**	**4**
		ii. **Waterproofing by use of water repellents:** In this method water repellent materials like soda, potash soaps, resins, vegetable oils, fats and coal tar residues are used. Some water proofing admixture, inorganic salts of fatty acids, calcium or ammonium stearate repels water from concrete. Lime can be added in concrete for waterproofing. Calcium chloride accelerates strength and helps in curing for making impervious concrete.	**2**	
		(Note: Any other method should be considered.)		
	(B)	**Attempt any ONE of the following:**		**(6)**
	(a)	**Write any three methods of transportation of concrete and three precautions of transportation.**		
	Ans.	**Methods of transportation of concrete:** **I)Manual method:** i. Mortar pan ii.Wheel barrow **II)Semi manual method:** i. Belt conveyor ii. Skip and hoist iii. Chutes iv.Ropeway **III)Mechanical method:** i.Truck or dumper ii. RMC vehicle (Transit mixer) iii. Helicopter	**3**	**6**
		Precautions of transportation: i. Establish mixing plant nearest possible to the construction site to reduce time of transportation. ii. Adopt higher w/c ratio, if distance between mixing plant and working site is more. iii. Maintain cold or humid condition around the concrete mixture during transportation. iv. Use retarding admixture, to avoid early setting and hardening of concrete. v. Cover the concrete mixture, if it is transported in open trucks to avoid direct sunlight. vi. Due care should be taken to avoid leakage and wastage of concrete mix during transportation	**1 each (any three)**	

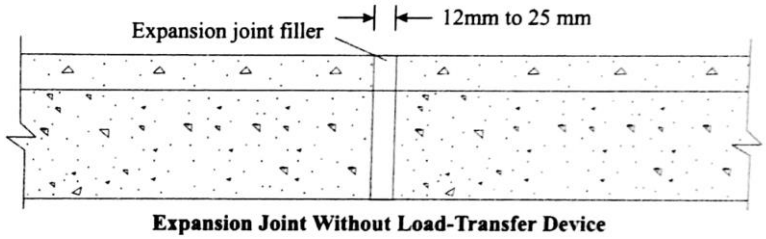
Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	**(b)**	**State importance and need for waterproofing and name two materials used for waterproofing.**		
	Ans.	**Importance and need of waterproofing:** Waterproofing is important because due to leakages life of structure decreases, maintenance cost increases and it also creates unhygienic conditions. i. Waterproofing is necessary to make the water retaining structures more water tight in nature. ii. It is also essential to avoid leakage of water through the terrace slabs. iii. Waterproofing is important to prevent seepage in basement of buildings. iv. To avoid dampness and unhygienic conditions in usable area waterproofing is necessary for concrete.	**4**	**6**
		Materials used for water proofing: i. Felt paper ii. Polyvinyl chloride (PVC) iii. Tar paper iv. Polythene sheets v. EPPM rubber vi. High density Polyethylene (HDPE) vii. Hypalon viii. Polymer based materials ***(Note: Any other relevant material should be considered.)***	**2**	
Q.5		**Attempt any FOUR of the following :**		**(16)**
	(a) **Ans.**	**Define chemical admixture. Write any three types of admixture.** **Chemical admixture:** It is additive materials which are added purposefully in concrete to improve overall engineering properties to suit the site requirements, called as admixture.	**1**	
		Admixtures used in concrete: i. Accelerating admixture ii. Retarding admixture iii. Water reducing admixture iv. Air- entraining admixture v. Plasticizers vi. Super-plasticizers vii. Pozzolanic admixture viii. Damp proofing admixture ix.Grouting admixtures x. Viscosity Modifying Agents xi.Cementious admixture xii.Pigments admixture	**1 each (any three)**	**4**
	(b) **Ans.**	**Write any two advantages and two disadvantages of RMC.** **Advantages of Ready Mix Concrete (RMC):** i. Bulk amount of concrete can be produced at a time to avoid delay in construction. ii. Wastage of materials can be avoided due to mechanized operations at plants. iii. RMC give higher quality mix than ordinary concrete due to computerized working of plant. iv. It can be easily transported longer distance without hardening, hence suitable even in congested urban area.	**1 each (any two)**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5		**Disadvantages of Ready Mix Concrete (RMC):** i. RMC is expensive than ordinary concrete, hence suitable for large projects only. ii. Continuous and bulk supply of materials is necessary for smooth working of RMC plant. iii. It may get affected on its quality due to improper functioning of plant elements. iv. It requires skilled labour for operation and it has low profit margin.	**1 each (any two)**	**4**
	(c) Ans.	**Write four effects of cold weather on concrete.** **Effects of cold weather on concrete:** i. Due to cold weather, the rate of setting of concrete decreases and hence formwork cannot be removed earlier. Hence delay in construction work takes place. ii. Due to formation of ice, concrete undergoes segregation, showing decreased workability. iii. Mixing of concrete becomes difficult due to excessive and accidental addition of snowfall in it. iv. Ordinary curing becomes time consuming in such decreased temperature conditions. v. Due to freezing and thawing effect, concrete may result in contraction cracks. vi. During transportation, concrete becomes lumpy due to formation of ice crystals.	**1 each (any four)**	**4**
	(d) Ans.	**Write significance of admixtures in concrete.** **Significance of admixture:** i. To improve overall engineering performance. ii. To increase the rate of setting of the concrete and for early removal of formwork in cold climate. iii. To reduce the rate of hardening of the concrete in hot weather. iv. To maintain appropriate water in concrete for deep beams, thin walls and tremie concrete. v. To modify the properties of concrete in plastic stage like workability, segregation and of hardened concrete like impermeability and resistance to frost action. vi. To reduce water up to 30 % without reducing workability. vii. To reduce heat of hydration and alkali-aggregate reaction. viii. To increase pump-ability and rate of setting of grouting cement. ix. To join old and new concrete at construction joints.	**4**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	**(e) Ans.**	**Write four uses of super plasticizers in concrete.** **Uses of super plasticizers in concrete:** i. Super plasticizer is useful to reduce water content from concrete mass without reducing its workability. ii. It is also useful to produce self leveling, self compacting and high performance concrete with high flowability. iii. It is used as dispersing agents to make the homogeneous concrete. iv. It is also useful to reduce cement content v. It gives better early strength to the concrete. vi. It is applicable to make cement grout for repairing concrete.	**1 each (any four)**	**4**
	(f) Ans.	**State any four points of difference between FRC and RMC.**	**1 each (any four)**	**4**

Sr. No.	Fibre Reinforced Concrete (FRC)	Ready Mix Concrete (RMC)
1	In this fibres are used as additive materials.	In this fly ash and other cemetitious materials are used as additives.
2	FRC shows less homogeneity.	RMC is more homogeneous mixture.
3	The workability of concrete may reduce due to addition of fibers.	The enhanced workability can be maintained due to proper admixtures.
4	Finishing of FRC is not proper due to presence of fibres.	RMC gives more finished surface due to proper proportion.
5	Self weight or dead load of FRC is less.	RMC has more dead load as compared to FRC.
6	FRC possess more fire resistance.	RMC possess less fire resistance.
7	FRC is cheaper or less costlier than RMC	RMC is more expensive as compared to FRC
8	FRC is useful in machine foundations, canal lining etc.	RMC is useful in all ordinary and mass concrete works.

<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.6</td><td></td><td>Attempt any FOUR of the following:</td><td></td><td>(16)</td></tr>
<tr><td></td><td>(a)</td><td>Differentiate volume batching and weight batching method. (any four points)</td><td></td><td></td></tr>
<tr><td></td><td>Ans.</td><td>
<table>
<tr><th>Sr. No.</th><th>Volume Batching</th><th>Weight Batching</th></tr>
<tr><td>1</td><td>In this, measurement of materials is done by taking volume.</td><td>In this, measurement of materials is done by taking weight.</td></tr>
<tr><td>2</td><td>Gauge boxes are used.</td><td>Weigh machine is used.</td></tr>
<tr><td>3</td><td>It is less accurate.</td><td>It is more accurate.</td></tr>
<tr><td>4</td><td>It is useful for less important works where ordinary mix is used.</td><td>It is useful for more important works where mix-design is adopted.</td></tr>
<tr><td>5</td><td>Volume batching is done for aggregates and water.</td><td>Weigh batching is done for cement.</td></tr>
<tr><td>6</td><td>It requires unskilled labours.</td><td>It requires skilled labours</td></tr>
<tr><td>7</td><td>It requires less time.</td><td>It requires more time.</td></tr>
</table>
</td><td>1 each (any four)</td><td>4</td></tr>
<tr><td></td><td>(b)</td><td>Draw a neat sketch of expansion joint.


Expansion Joint with Load-Transfer Device


Expansion Joint Without Load-Transfer Device
Fig. Expansion Joint</td><td>4</td><td>4</td></tr>
</table>

Q.6 (c) Ans. **Differentiate between Retarders and Accelerators. (any four points)** — **1 each (any four)** — **4**

Sr. No.	Retarders	Accelerators
1	These types of admixtures are useful to reduce the rate of setting or hardening of concrete.	These types of admixtures are useful to increase the rate of setting or hardening of concrete.
2	It increases setting time of concrete.	It reduces setting time of concrete.
3	It is applicable in Hot weather concreting.	It is applicable in Cold weather concreting.
4	Useful in ready mix concrete.	Useful in under water concreting.
5	It delays the time for removal of formwork.	It permits early removal of formwork.
6	Example: Mc-schnell OC, Mc-schnell SIDS	Example: plasticizers ,super plasticizers

(d) Ans. **Write two uses of light weight concrete and two uses of high performance concrete.**

Uses of light weight concrete: — **1 each (any two)**

i. LWC is useful to cast pre-stressed concrete beams and deck slabs for long span bridges.
ii. LWC is useful in structures exposed to excessive heat i.e. construction of chimney, nuclear power plants, etc. as it has more thermal and fire resistance.
iii. LWC is useful to cast various elements like frames, fencing poles, sleepers etc.
iv. Due to less dead load, it is used with less formwork and optimum propping.
v. It is also useful in high rise and mega sky scrapers due to easy handling.

Uses of High performance concrete: — **1 each (any two)** — **4**

i. HPC is useful in all mass concrete works, where high strength is required.
ii. It is also useful in multistoried buildings and high rise structures where high workability and pumpabilty is essential.
iii. HPC is useful to cast water retaining structures as it gives more impermeability.
iv. It is also suitable in seashore or marine constructions and construction in acidic soils to reduce chemical attack.
v. HPC has more dimensional stability and hence does not undergo creep.

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	**(e)**	**Write factors affecting of hardened concrete properties. (any four)**		
	Ans.	**Factors affecting of hardened concrete properties:** The hardened concrete properties like strength, durability, impermeability, fire resistance, creep, shrinkage etc. gets affected by following factors. **i. Quality of materials:** The strength and durability of concrete depends on better quality of cement, sand aggregate used in concrete. Non-reactive type aggregate give fire resistivity. **ii. Mix proportion of concrete:** The proportion of concrete ingredients plays vital role in developing strength. Also concrete becomes impermeable with less creep and shrinkage if w/c ratio, FA/CA, cement content requires ensuring strength and durability for concrete works. **iii. Methods of concreting operation:** If various concreting operations like mixing, placing and compaction are done manually, then one cannot ensure sufficient strength and durability. The concrete may become permeable, and liable to creep and shrinkage as well. **iv. Workmanship:** If the workmanship i.e. tendency of working by engineers and labors is not good, then various defects may occur on concrete, which may reduce strength showing porous nature. **v.Environmental factors:** The hardened properties gets affected drastically due to adverse effect of environmental factors i.e. rain, smog, fog, heat, snowfall etc. ***(Note: Any other factor should be considered.)***	**1 each (any four)**	**4**