Model Answer: Summer 2017

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 Answers	Marks	Total Marks
Q.1	**A)**	**Answer any THREE of the following:**		**12**
	i)	**Which type of cement is required for:** **a) Marine Structure b) Chimney of a factory** **c) Canal Lining d) Dam construction**		
	Ans.	Type of cement required for- a. Marine structure- Sulphate Resisting Cement b. Chimney of a factory - low heat cement c. Canal lining- Portland pozzolana cement d. Dam construction- Blast furnace slag cement.	**1 mark each**	**4**
	ii)	**State precautions to be taken while storing the cement at site.**		
	Ans.	Precautions to be taken while storing the cement are: 1. Bags should not be stacked more than 8-10 bags vertically. 2. Stacking should be lengthwise and widthwise alternatively. 3. Stacking should be 300 mm away from walls with 1 m gap between two rows for easy handling. 4. Stacking should be on wooden planks 300 mm above ground floor to avoid dampness. 5. Exhaust fans and windows should be provided for ventilation. 6. Building should be with 150 mm concrete floor and 9" brick walls.	**1 mark each (any four)**	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**iii)**	**Enlist any four lab tests for OPC . Explain any one of them in brief.**		
	Ans.	Lab tests for OPC -	**½ mark each (any four)**	
		a. Fineness test b. Standard or normal consistency test c. Initial and final setting time d. Compressive strength test e. Soundness Test		
		a. Fineness test –		
		This test is useful to determine % fineness of cement. Fineness is the degree of grinding particles. The brief procedure of fineness test is as follows -		**4**
		1. Take 100 gm. of cement sample as w_1 and put it on 90 micron IS sieve.		
		2. Break any visible lumps if any using fingers without rubbing it on sieve . Keep lid and pan at top and bottom respectively.	**2**	
		3. Shake this assembly for 10-15 min manually by giving wrist motion so that the cement sample will sieved completely.		
		4. Now, take the weight of cement sample retained on 90 micron sieve as W_2 gm.		
		5. Finally, calculate % fineness of cement by using by using formula, % fineness = W_2/ W_1 x 100		
		6. Repeat above steps two more times to calculate average % fineness of given cement sample.		
		(Note - Explanation of any one of the above test should be considered)		
	iv)	**Why rapid hardening cement is not used in mass concreting? Why it gains early strength than OPC ?**		
	Ans.	Rapid hardening cement is not used in mass concreting works like dams, bridges etc . It is because , the rapid hardening cement evolves large heat of hydration at a time . This excessive heat results in expansion cracks, cavity formation, which affects strength and durability of such structures.	**2**	
		Rapid hardening cement gains early strength than OPC .Rapid hardening cement contains more amount of % C_2S and C_3S , hence it gives 3 days strength which OPC gives after 7 days. The fineness of particles of RHC is 5% i.e. more fine particles , hydrates quickly and results in early strength than OPC with comparatively coarse particles.	**2**	**4**

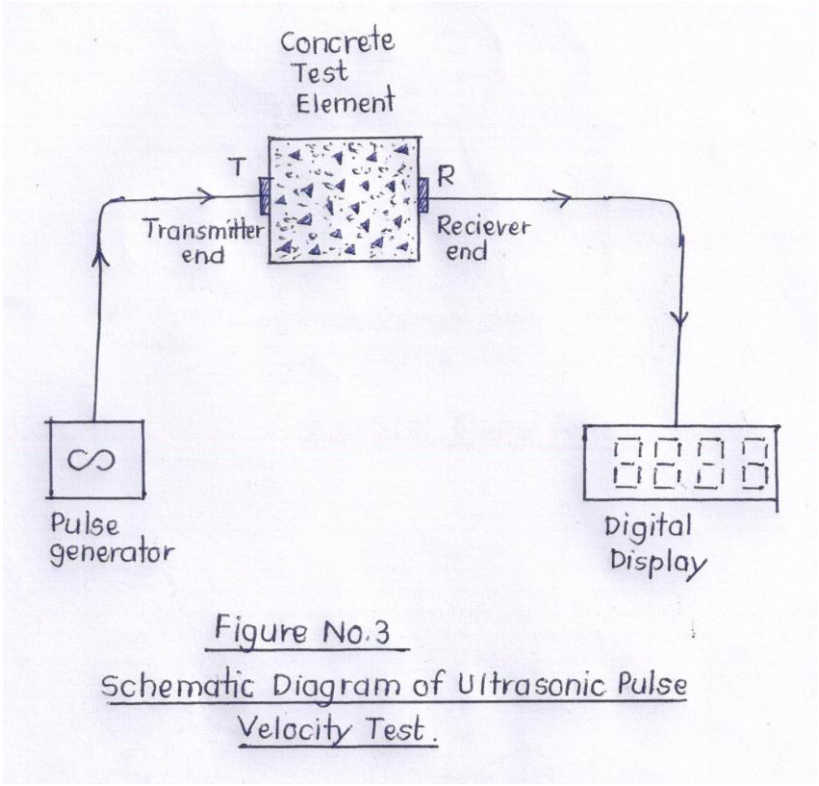
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**B) i) Ans.**	**Answer any ONE of the following :** **Define Hydration. Explain in brief heat of hydration of cement.** Hydration - It is exothermic chemical reaction which takes place when water is added to cement which gives cement paste and large heat is evolved about 120cal/gm is called hydration Heat of hydration - For complete hydration of cement, 38% water by weight of cement is required. During hydration, the large heat is evolved which is useful for development of strength. If heat of hydration is less , then strength development will be slower and ultimate strength will not be achieved. But if heat of hydration is moderate then strength will be maintained and durability will be ensured. When heat of hydration is excessive, then concrete may gives severe cracks on it. Thus heat of hydration of cement plays a vital role in strength of concrete. When cement particles are more fine(i.e. less % fineness), then hydration takes place quickly producing more heat of hydration. This heat of hydration become responsible to bind particles together to ensure target strength.	**2** **4**	**6** **6**
	(ii) Ans.	**What is meant by adulteration of cement? Explain its importance with respect to properties of concrete. How adulteration is determined in laboratory?** Adulteration of cement – The change in engineering properties of cement due to addition of impurities like stone, dust , fine sand, grit particles, broken brick powder etc.; is called as adulteration of cement. Importance of examining adulteration of cement- The cement adulteration is very important to examine before its use. It is because, the above said impurities changes the properties of cement. The fineness of cement increases as coarser impurity particles gets added in it. The adultered cement in the form of lumps , may not mix properly. It results in increased standard consistency. The adulteration increases setting time of cement and results in delay of removal of formwork and construction work. The impure adultered cement shows more expansion under temperature i.e. unsound nature. The compressive strength of adultered cement reduces drastically because of lesser heat of hydration and bonding due to impurities in it.	**1** **2**	**6**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**(ii)**	**Determination of adulteration of cement –** The adulteration of cement is determined by conducting following field tests. 1. The colour of fresh and unadultred should be greenish grey. 2. The cement should not have visible lumps in it. 3. The unadultred cement gives cool feeling, when a hand is put in bag. 4. The pure cement should give smooth feeling, when a pinch of cement is rubbed in fingers. 5. A handful of cement should float on water before its dipping or sinking. 6. The sharp edge cement should remain unchanged even after 24 hours under water. 7. The colour of fresh cement should not be changed after burning.	**1 mark each (any three)**	
Q.2		**Answer any FOUR of the following :**		**16**
	(i) Ans.	**Name any four types of cement and state their uses.** **Types of cement and their uses-** 1. <u>Ordinary Portland cement(OPC)</u> i. Ordinary PCC and RCC construction work ii. Plastering and water proofing works iii.Drainage works 2. <u>Rapid Hardening cement (RHC)</u> 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. <u>Low heat cement (LHC)</u> 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. <u>Portland pozzalana cement-</u> i.All construction works where OPC is used i.e. PCC and RCC. ii.Construction of hydraulic structure iii. Mass concreting work 5. <u>Sulphate resisting cement-</u> 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.	**1 mark each (any four)**	**4**

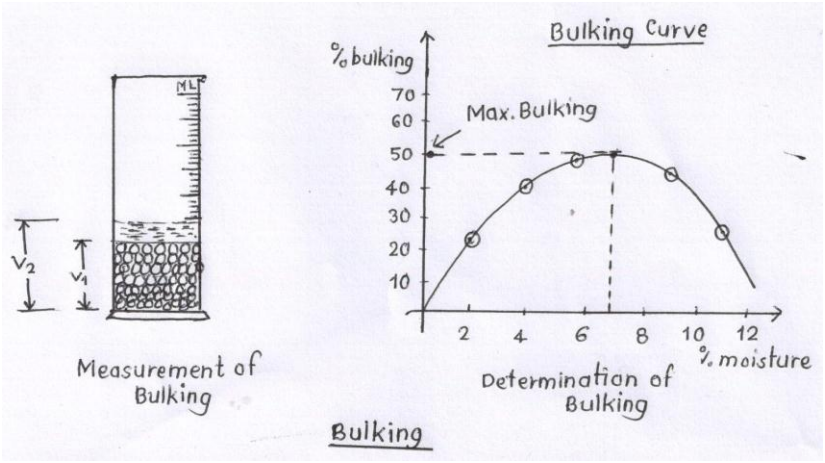
<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answers</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>Q.2</td><td>(i)</td><td>6. Blast furnace slag cement (BFSC) –
i.All construction works where OPC is used.
ii.Mass concreting
iii.Marine works
7. White Cement (WC) -
i.Decoration Works i.e. False ceiling
ii.Finishing works i.e. internal plastering
iii.Waterproofing works
(Note - For each type of cement, at least two uses should be mention.)</td><td></td><td></td></tr>
<tr><td></td><td>ii.
Ans.</td><td>State the factors affecting the workability of concrete.
Factors affecting workability –
1. Water content – If water content i.e. water-cement ratio is more then, concrete shows more workability.
2. Size of aggregate – if aggregate of large i.e. coarser size is more, then concrete shows lesser workability.
3. Shape of aggregate – If aggregate of rounded shape is more, then concrete gives more workability.
4. Use of admixtures – If air entraining admixtures are used, concrete results more workability.
5. Grading – Well graded aggregate gives more workability than poorly graded aggregate.
6. Surface texture – 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, workability of concrete decreases.
8. Temperature – As temperature increases, workability decreases.</td><td>1 mark each (any four)</td><td>4</td></tr>
<tr><td></td><td>iii.
Ans.</td><td>State the minimum grade of concrete for different exposure conditions.
Minimum grade of concrete for different exposure conditions:
<table>
<tr><th>Exposure condition</th><th>Plain concrete</th><th>Reinforced concrete</th></tr>
<tr><td>Mild</td><td>-</td><td>M 20</td></tr>
<tr><td>Moderate</td><td>M 15</td><td>M 25</td></tr>
<tr><td>Severe</td><td>M 20</td><td>M 30</td></tr>
<tr><td>Very severe</td><td>M 20</td><td>M 35</td></tr>
<tr><td>Extreme</td><td>M 25</td><td>M 40</td></tr>
</table></td><td>4</td><td>4</td></tr>
</table>

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	iv. Ans.	**State 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 obtain maximum possible yield per bag of cement.	**1 mark each (any four)**	**4**
	v. Ans.	**State limitations of Rebound hammer test.** Limitations of rebound hammer test: 1. Rebound of hammer may get affected due to roughness of concrete surface. 2. The age of concrete also varies with rebound number i.e. cured concrete gives more rebound no. than fresh one. 3. Surface moisture of concrete may give inaccurate rebound number. 4. Type of concrete ingredients i.e. cement, coarse aggregate may affect rebound number. 5. Size and shape of specimen also affect hammer impact.	**1 mark each (any four)**	**4**
	vi. Ans.	**Explain in detail 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 fig. 3. 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**	**4**

Sr. No.	Velocity (Km/s)	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

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	**vi.**	 Figure No.3 Schematic Diagram of Ultrasonic Pulse Velocity Test.	**1**	
Q.3		**Answer any FOUR of the following:**		**16**
	i)	**Define Fineness Modulus of aggregates .What is the range of value for fine and coarse aggregates?**		
	Ans.	Fineness Modulus of aggregate - It is the ratio of sum of cumulative percentage of weight retained on various sieves taken up to 150 µ I.S. sieve divided by empirical constant 100; called as Modulus of aggregate.	**2**	**4**
		Range of Fineness Modulus- 1. For fine aggregate- 2.2 to 2.6 2. For coarse aggregate – 2.9 to 3.2	**1** **1**	
	ii)	**What are the impurities in aggregates? In what way they affect concrete?**		
	Ans.	The following impurities may present in both fine and coarse aggregates individually or in combination. 1. Silt and clay 2. Decayed vegetable matter and humus 3. Salt 4. Stone Dust 5. Coal and lignite 6. Mica and shale	**½ mark each (any four)**	

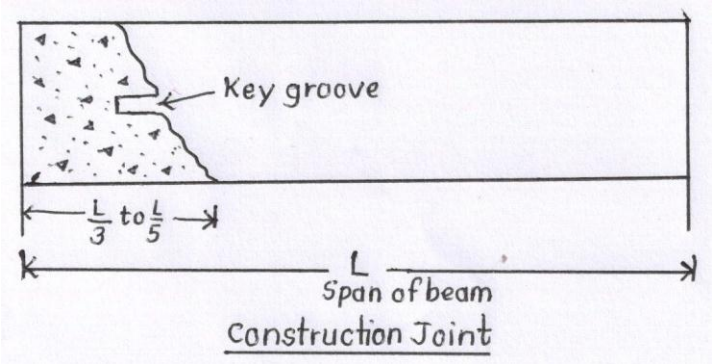
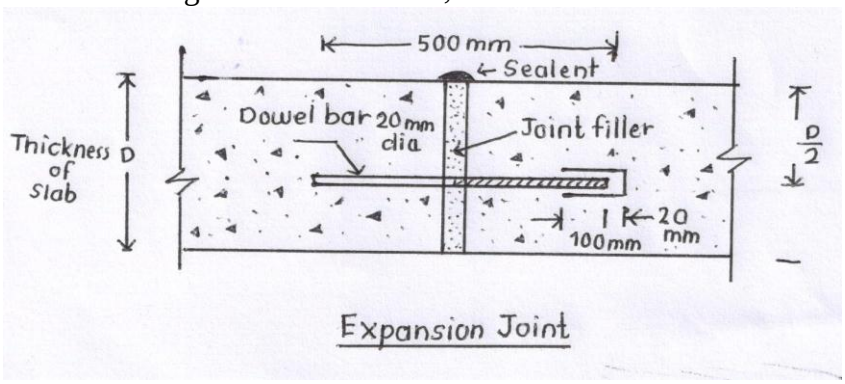
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	**ii)**	**Effect of impurities in aggregate on concrete-** 1. Silt and clay- These impurities mainly presents bond between aggregate particles even with higher w/c ratio. Hence concrete weakens proportionally. 2. Decayed vegetable matter- It presents the process of hydration and reduces strength of concrete. 3. Salt- The hygroscopic nature of salt causes efflorescence and unslighly appearance. It affect setting properties and ultimate strength of concrete. 4. Stone Dust- The excessive stone dust results in segregation and bleeding in fresh concrete. It reduces strength of concrete as well. 5. Coal and lignite- These impurities reduces hydration , bonding of aggregate particles. It found responsible to decrease strength and durability of concrete. 6. Mica and shale- These deleterious materials also affect the concrete strength. Mica reduces strength and durability considerably while shale gets swell when wetted , It results in pitting in concrete.	**½ mark each (any four)**	**4**
	iii) Ans.	**How bulking of sand measured in laboratory?** **Measurement of bulking of sand-** 1. Take 100 gm. of given sand sample and fill it in measuring cylinder about one-third of its weight. Take this volume of sand V_1 ml. 2. Now add 2% water by weight in sand initially. Shake the cylinder vigoursly using palm at top and bottom to cylinder. Note down the increased volume of sand V_2 ml. 3. Calculate % bulking of sand as $b_1 = (V_2 - V_1)/ V_1] \times 100$ 4. Repeat above steps by adding water at suitable intervals (say 2%) i.e. 4%, 6%, 8% etc. and observe increased volumes V_3, V_4, V_5 etc. Also calculate corresponding % bulking as b_2, b_3, b_4% using above formula. 5. Finally draw the bulking curve as % water versus % bulking as shown in fig Below. Note down the maximum % of bulking and corresponding optimum % of water from it.	**3**	

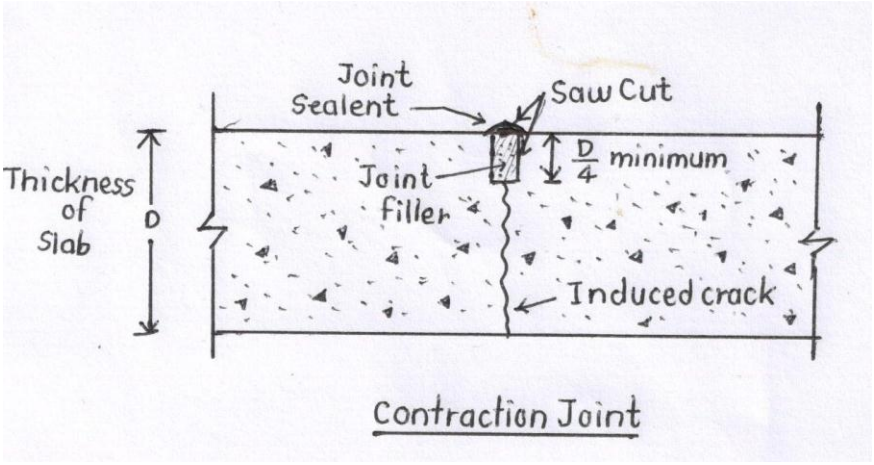
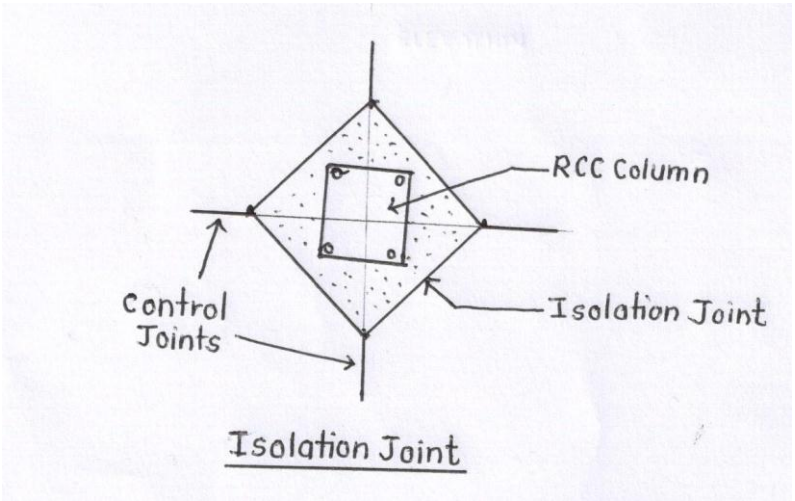
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	**iii)**	 **Bulking**	**1**	**4**
	iv)	**State the effect of following properties of coarse aggregates on compressive strength of concrete:** **(a) Size of aggregate** **(b) Shape of aggregates** **(c) Surface texture** **(d) Water absorption**		
	Ans.	**Effect of following properties of coarse aggregates on compressive strength of concrete-** a. Size of aggregate- If coarse aggregate particles are of large size (say 20 mm) in concrete mixture , then concrete becomes harsh and only strength may reduce due to honey combing. But if coarse aggregate are of smaller sizes only (say 10 mm). then ultimate strength of concrete will be lesser . Therefore coarse aggregate with combination of both sizes (i.e. 10 & 20 mm) will give better workable concrete and more compressive strength. b. Shape of aggregate If shape of concrete aggregate is angular then there is good interlocking of aggregate particles . Hence it give more compressive strength . If shape of coarse aggregate is sub angular or sub rounded then compressive strength reduces due to less bonding between particles. c. Surface texture- If the texture of coarse aggregate is rough then aggregate gets interlocked strongly than smooth textured aggregates in presence of same cement slurry. d. Water absorption- If the % water absorption of coarse aggregate is more than prescribed limit, then concrete becomes harsh result in reduction of strength. But if water absorption is less concrete becomes as per proportion giving required strength.	**1 mark each**	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	**(v)** **Ans.**	**What are different concreting operations? Why the supervision is necessary on these operations?** **Concreting operations –** i. Batching ii. Mixing iii. Transportation iv. Placing v. Compaction vi. Curing vii. Finishing	**2**	
		Necessity of supervision on above concreting operations – 1. If batching is not done as per required proportion , then concrete becomes unworkable resulting lesser strength. 2. If mixing is not made homogeneous, then concrete leads to harshness and honey combing; which shows less strength in concrete. 3. During transportation of concrete, hardening of mix may takes place hence supervision is necessary. 4. Supervision is necessary to observe placing of concrete to avoid wastage, blockage, segregation in concrete mixture. 5. Compaction of concrete should be observed to avoid honeycombing of concrete, which may reduce strength of concrete. 6. Curing is essential to gain desired strength and to ensure durability of structure. Supervision is necessary to maintain continuous curing for it. 7. Finishing is done to reduce atmospheric interaction and creep in concrete. Supervision needs to control plastering work.	**2**	**4**
	(vi) **Ans.**	**How the following structural elements cured?** **Curing of structural elements-** a. <u>Test block</u> – Test blocks are cured by immersion method. Blocks are kept in curing tank by keeping under water at temperature 24^0 to 30^0 C. b. <u>Bridge slab -</u> It is cured by ponding method in which small ponds are made with mortar which are kept filled for curing. c. <u>Precast products-</u> In this, precast products like door and window frames are cured by immersion method. But longer precast items like fencing poles, electric poles or sleepers are cured by steam curing.	**1 mark each**	**4**

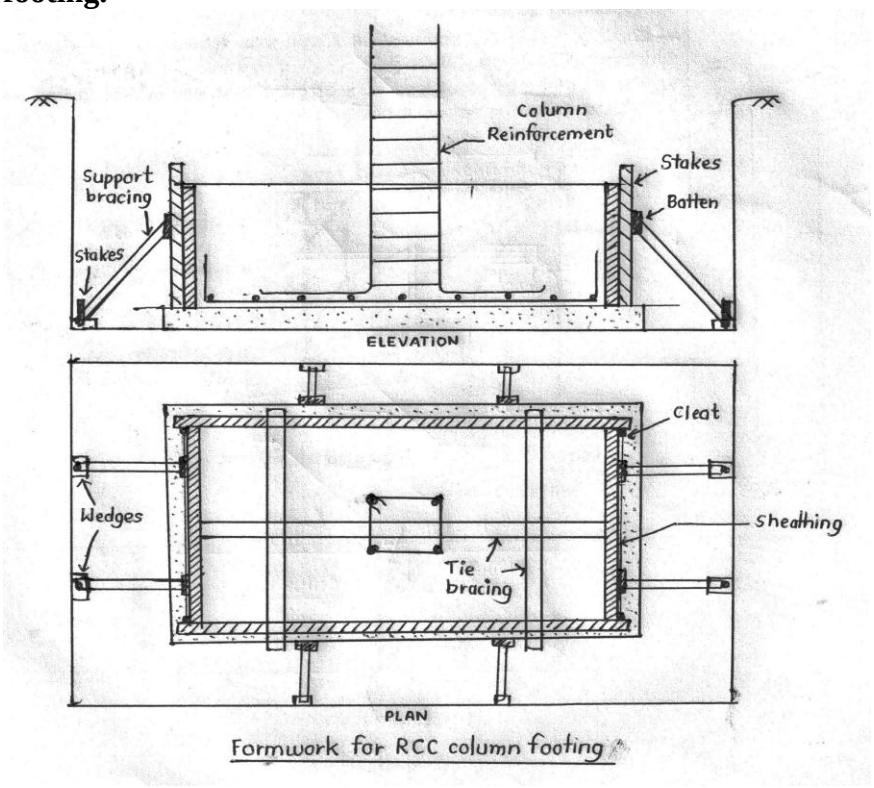
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	**(vi)**	d. Columns-These are cured by water spraying method i.e. wet coverings with gunny bags, hessian cloth, jute matting, straw etc.		
Q.4	**A)**	**Answer any THREE of the following :**		**12**
	(i)	**How Abrasion test on aggregate is carried out?**		
	Ans.	Abrasion test – i. Take about 2.5 to 5 kg oven dried aggregate sample according to grade of aggregate as W_1 gm. ii. Put this aggregate in rotary drum of LOS Angeles abrasion testing machine through its door or opening. iii. Now, Rotate the drum at a rate of 20 – 33 rpm up to maximum 500-1000 revolutions; so that aggregate will get crushed under the effect of abrasive charge i.e. steel balls. iv.Remove crushed aggregate in tray and sieve it through 1.7 mm IS sieve . v. Take the weight of aggregate fraction passed through sieve as W_2 gm. vi. Calculate the aggregate abrasion value in percentage as % AAV = $W_2/ W_1 \times 100$ vii. Repeat the above steps two more times to calculate average abrasion value. viii. If % AAV is less than 16% ; then such aggregate posses better abrasion stress. But when it exceeds up to 30% ; it indicates lesser abrasion resistance of aggregate sample.	**4**	**4**
	(ii)	**State any four properties of fine aggregate.**		
	Ans.	Properties of fine aggregate- 1. Size 2. Shape 3. Specific Gravity 4. Bulk density 5. Moisture Content 6. Bulking 7. Cleanliness 8. Fineness modulus 9. Source 10. Silt content.	**1 mark each (any four)**	**4**
	(iii)	**State meaning of NDT. Enlist the methods of NDT stating suitability of each.**		
	Ans.	**Meaning of NDT-** The properties of hardened concrete are determined without destructing the concrete; such test is known as Non destructing Testing. **Methods of NDT with their suitability-** 1. Surface hardness test- It is useful to estimate concrete strength. 2. Rebound Hammer test- It is suitable to determine strength and for comparative investigations. It also useful determine homogeneity, cavities in concrete mass. 3. Ultrasonic Pulse velocity test- It is applicable to check denseness of concrete, it also determine strength, durability and elastic properties of concrete.	**1** **4**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**(iii)**	4. Penetration and pull out techniques- It is useful to estimate strength of concrete in terms of penetration and pull out resistance 5. Radioactive and nuclear methods- It is applicable to measure density and thickness of concrete. It gives information density and thickness of concrete. It gives information about moisture and cement content in concrete. 6. Magnetic and electrical methods –Magnetic method is useful to determine cover of reinforcement in concrete.. Electric method is useful to measure moisture content and thickness of concrete. 7. Acoustic emission techniques- It is suitable to detect initiation and growth of cracks in concrete.	**1 mark each (any three)**	
	iv)	**State the precautions to be taken during transportation and placing of concrete in formwork.**		
	Ans.	Precautions to be taken during transportation- 1. Keep the least possible distance between mixing plant and construction site by establishing the mixing plant nearest to site as far as possible. 2. Avoid atmospheric interaction of concrete by covering it with polythene cover when it is transported through open trucks or dumpers 3. During transportation , wastage of concrete should not takes place. 4. Select the higher w/c ratio for longer transportations and also maintain humid (moist) conditions around concrete(i.e. in case of RMC vehicles) 5. Use retarding admixtures in concrete to avoid early hardening of concrete.	**½ mark each (any four)**	
		Precautions to be taken while placing of concrete: 1. While placing of concrete, the mixture should reach at all corners uniformly and not intensively at one place. 2. Placing thickness for mass concrete should be less than 30-45 cm and for RCC work should be less than 15-30 cm. 3. Before placing of concrete the formwork joints should be checked to avoid bleeding. 4. Concrete mixture should not be dropped from the height more than 1 m. 5. Before placing of concrete, oiling to inner face of formwork should be done. 6. Flow of placing of concrete should be continuous and joints should be left at appropriate position.	**½ mark each (any four)**	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	(B) i)	**Answer any ONE of the following:** **What are the different joints in concrete? Explain with neat sketch.**		6
	Ans.	**Joints in concrete-** **1. Construction joint-** The temporary joint left between subsequent concreting operations is known as construction joint. It is preplanned joint before concreting located away from maximum bending moment. The construction joint is provided such that there will be strong bond between hard end and fresh concrete. It can be ensured by providing dowels or tongue and groove at a joint shown in figure below.	1	
		 Construction Joint	½	
		2. Expansion joint- The joint which is provided to present the expansion in concrete caused due to thermal stresses. These stresses produces due to extreme temperature conditions. The typical expansion joint is provided with dowel bars at a depth equal to half of slab thickness. This dowel of 20 mm diameter and 550 mm long is covered with metal cap filled with cotton and finally such joint is sealed using sealants like wood, thermocol or bitumen.	1	
		 Expansion Joint	½	
		3. Contraction joint- The joint which is provided to prevent contraction of concrete takes place due to plastic and drying shrinkage is called as contraction joint. These joints are provided at 5- 10 cm interval along the width of road slab. Contraction joints of 3-4 mm width are cut at a ¼ th depth of slab thickness. Sometimes a smooth dowel bar is also provided in it shown in figure below	1	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**i)**		½	
		4. Isolation joint- It is provided to isolate the structural part from the surrounding is known as isolation joint. It is provided where the concrete floor meets the permanent structural elements like walls, columns, foundation blocks, machine foundations. The width of these joints is about 10-12 mm which is filled by resilient materials and locked with joint filling compounds shown in fig below.	**1**	
			½	

Que. No.	Sub. Que.	model answers	Marks	Total Marks
Q.4	**ii) Ans.**	**Explain in detail IS method of mix design with steps.** **IS method of mix design with steps-** The concrete mix design is done by IS 10262-1982 Using following steps- i. Calculation of target mean strength – The concrete mix design is done for specific target strength which is calculated first. It is calculated by using formula, $f'_{ck} = f_{ck} + t.S$ Where, f'_{ck} = target mean strength after 28 days f_{ck} = characteristics compressive strength at 28 days S = standard deviation from IS 456 T = tolerance factor from IS 456 ii. Selection of water-cement ratio- The w/c ratio is selected from the graph of generalized relationship between w/c ratio and compressive strength. The selected w/c ratio is checked against the limiting w/c ratio and lower of two is adopted. iii. Selection of water content- The maximum water content per cubic meter of concrete with nominal maximum size of aggregate s finalized in this step . the water content adopted is used for computing cement content in next step. iv. Calculation of cementitous material content – From adopted w/c ratio and selected maximum water content the quantity of cementious materials is calculated. It is checked against the minimum cementitous content for durability requirement ad larger of the two values is adopted as cement content. v. Calculation of coarse aggregate proportion – The volume of coarse aggregate per unit volume of total aggregate is chosen in this step based on nominal maximum size of aggregate vi. Selection of combination of coarse aggregate fractions- The different sizes viz. 10 mm , 20 mm , 25 mm are taken in proportion from grading , confirming in table 2 of IS 383 vii. Calculation of fine aggregate proportion- From above steps, absolute volume of all ingredients of concrete the mix proportion is calculated for said mix design of concrete.	**6**	**6**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.5		**Answer any FOUR of the following :**		**16**
	i)	**Draw a sketch for formwork for a foundation of R.C.C column footing.**		
	Ans.	 Formwork for RCC column footing	**4**	**4**
		(Note – Any one of the above diagram should be considered.)		
	ii)	**State the requirements of formwork (any four).**		
	Ans.	**Requirements of good formwork:** 1. It should be strong enough to carry the weight of concrete without bulging. 2. It should be easy to erect and dismantle on site. 3. It should be reusable for no. of times to achieve economy. 4. It should be easily available to avoid delay. 5. It should give uniform and smooth finishing after removal. 6. It should be leakproof with perfect joints. 7. It should be durable with lesser wear and tear.	**1 mark each (any four)**	**4**
	iii)	**What are the problems faced in hot weather concrete. Write any four.**		
	Ans.	**The problems faced in hot weather concrete-** 1. The handling of ingredient materials becomes difficult as it get hotter. 2. The concreting cannot be done during day time hence concrete may affected at night time. 3. Water gets evaporated rapidly from concrete resulting in harshness in concrete. 4. Water from concrete mixture get absorbed by formwork and ground itself resulting dryness in it . 5. Compaction is required to perform immediately to ensure homogeneity.	**1 mark each (any four)**	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.5	**iii)**	6. Continuous curing is required or otherwise surface causes effloresance and cracks. 7. During transportation concrete get harden quickly hence requires more care to keep moisten it. 8. Uncovered casted concrete surface leads to expansion cracks on it.		
	iv) **Ans.**	**Name any four admixtures used in concrete.** Admixtures used in concrete- i. Accelerating admixture ii. Retarding admixture iii. Water proofing iv. Air- entraining admixture v. Super-plasticizers admixture vi. Pozzolana admixture vii. Pigments admixture viii. Plasticizers admixture	**1 mark each (any four)**	**4**
	v) **Ans.**	**Define Admixture and state any three purposes of adding admixtures in concrete.** **Admixture-** it is the fifth ingredient added in concrete to improve overall engineering properties to suit the site requirements, called as admixture. **Purpose of Admixture: -** 1. To improve overall engineering performance. 2. To increase the rate of setting of the concrete and for early removal of formwork in cold climate. 3. To reduce the rate of hardening of the concrete in hot weather. 4. To maintain appropriate water in concrete for deep beams, thin walls and tremie concrete. 5. To modify the properties of concrete in stage plastic concrete like workability, segregation and of hardened concrete like impermeability and resistance to frost action. 6. To reduce water up to 30% without reducing workability. 7. To reduce heat of hydration and alkali-aggregate reaction. 8. To increase pump-ability and rate of setting of grouting cement. To join old and new concrete at construction joints	**1 mark each** **1 mark each (any three)**	**4**
	vi) **Ans.**	**What do you meant by RMC? State its application.(Any three)** Ready mix concrete: The concrete which is mixed at batching plant and made readily available at construction site is called as Ready Mix Concrete. Application of RMC 1. RMC is applicable to large scale projects i.e. construction of mega structure. 2. RMC is useful to construct high rise buildings in highly congested areas.	**1**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.5		3. RMC is beneficial for underground constructions i.e. construction of pipe lines , tunnel. 4. RMC is helpful in underwater construction i.e. tremie method of concreting, construction of piers of bridges. 5. RMC is important for mass concreting works like dams, bridge etc. 6. RMC is used in casting of precast and Prestressed concrete members.	**1 mark each (any three)**	**4**
Q.6		**Answer any FOUR of the following:**		**16**
	i.	**State the situations where white cement is used. Why white cement is costly as compared to OPC?**		
	Ans.	<u>Situations where white cement is used-</u>		
		1. White cement or grey portland cement is used as base for manufacturing various coloured cements. 2. It is used for decorative works like false ceiling 3. It is used for internal plastering works and flooring works. **4.** White cement is preferred for water proofing works also.	**1 mark each (any two)**	**4**
		<u>Reasons why white cement is costlier as compared to OPC-</u> 1. The white cement is used as a base to produce various colour cement with dispersing colour pigment in it 2. The white cement is costlier due to raw materials containing very less iron and manganese in it. 3. The production process of white cement required 40% higher energy than OPC.	**1 mark each (any two)**	
	ii.	**Explain in brief infrared radiation method of curing.**		
	Ans.	**Infrared radiation method of curing-** **1.** This method of curing is useful to cure concrete very rapidly than steam curing. 2. In this, initial temperature in concrete does not reduce ultimate strength. **3.** Infrared radiations are generated at a temperature of 90^0c to cure the target surface. **4.** This method is adopted generally in cold regions , where curing by other methods does not found effective **5.** Infrared curing is adopted for curing of hollow concrete blocks.	**4**	**4**
	iii.	**State need of water proofing. Name two materials used for water proofing.**		
	Ans.	**Need of waterproofing** i. Due to defective construction there is need of waterproofing. ii. Poor drainage at building site causes leakages in structure,		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6		therefore, need arises for waterproofing. iii. If ground water table is at shallow depth, then, in case of basement waterproofing is needed. iv. In case of retaining wall to prevent the seepage from wall, waterproofing is necessary. v. To avoid dampness in usable are and unhygienic conditions waterproofing is necessary for concrete	**1 mark each (any three)**	**4**
		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	**½ mark each (any two)**	
	iv. Ans.	**State the properties of accelerating and air – entraining admixture.** Properties of accelerating admixture – 1. Quick setting time (less than 1 hour) 2. Water reducer up to 8% 3. More early strength development in concrete 4. Less resistance to sulphate attack 5. More drying shrinkage	**1 mark each (any two)**	**4**
		Properties of air – entraining admixture – 1. Ability of formation of tiny , stable, air bubbles in concrete 2. Easy to disperse in concrete 3. Resistance to segregation and bleeding 4. Good bonding between aggregate particles.	**1 mark each (any two)**	
	v. Ans.	**State four points of difference between reinforced concrete and fibre reinforced concrete.**		
		Sr.No / **Reinforced concrete (RCC)** / **Fibre reinforced concrete (FRC)** 1 / The concrete reinforced with steel bars. / This concrete is reinforced with one or more type of fibres. 2 / Steel bars are responsible to take major loads. / Fibres are useful to bind aggregate particles. 3 / Cracks may from due to temperature stresses. / Fibres acts as crack arrester due to uniformly dispersed fibres. 4 / Reinforced concrete possess more self-weight / The self-weight of FRC is comparatively less. 5 / Mixing of ordinary RCC is easier and less tedious. / Due care is required while mixing fibres. 6 / Workability of concrete mixture remains unaffected. / Workability of FRC may reduce due to addition of fibres. 7 / RCC has less fire resistance. / FRC possess more fire resistance.	**1 mark each (any four)**	**4**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6	**vi)**	**State one application each for following types of concrete?** i. **RCC** ii. **Prestressed concrete** iii. **Precast concrete** iv. **Fibre-reinforced concrete**		
	Ans.	RCC - i. Ordinary building construction ii. Small scale projects with normal strength requirements iii. Construction of road pavement, retaining wall, compound wall etc. Prestressed concrete- i. Construction of deck slab of bridges. ii. Construction of long span foot over bridges. Precast concrete- i. Casting railway sleepers ii. Casting of precast elements like fencing poles, door and window frames, electric poles etc. iii. Construction of pre-engineered building. iv. Casting of concrete (hollow and solid blocks. Fibre-reinforced concrete- i. Construction of air field , road pavements , industrial floorings , bridge decks, etc. ii. Useful in canal lining, refractory lining. iii. Useful in fabrication of precast products like pipes , boats, beams , staircase steps, wall panels etc. iv. Applicable in construction of explosive resistive structures. **(Note- For each type of concrete, at least two application should be mention.)**	**1 mark each**	**4**