Model Answer: Winter 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)**	**Attempt any THREE of the following:**		**(12M)**
	a)	**Define hydration of cement and enlist four compounds of cement.**		
	Ans.	**Hydration of cement:** It is exothermic chemical reaction takes place when water is added to cement, which gives rise cement paste and large heat evolved about 120cal/gm. ,is called as hydration of cement.	**2M**	**4M**
		Four compounds of cements:		
		1) Di-Calcium Silicate C_2S 2) Tri-Calcium Silicate C_3S 3) Tri-Calcium Aluminate C_3A 4) Tetra-Calcium Alumino Ferrite C_4AF	**2M**	
	b)	**State effect of storage of cement on its strength. State four precautions while storing the cement.**		
	Ans.	**Effect of storage of cement on strength of cement :** As cement is susceptible for hydrolysis ,it may undergoes hardening due to atmospheric moisture, therefore the strength of cement goes on decreasing with increase in period of its storage as mentioned below		

Sr. No.	Period of storage	Strength of cement
1	3 months	100%
2	6 months	75%
3	1 year	60%
4	2 year	50%
5	3 year	45%

2M

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**b)**	**Precaution while storing the cement:** 1. cement should be stored in separate industrial shed on site. 2. The wall thickness of shed should be minimum 230mm 3. The floor of shed should be made up of concrete material with DPC(1:4:8) to avoid dampness 4.There should be ventilators for continuous ventilation 5. All the cement bags should be stacked on wooden platform placed at 300mm away from walls and floors. 6. There should be stacking of maximum 8-15 bags max one over another. 7. There should be minimum 500mm gap between two rows for easy handling of bags 8. In addition to this, a large polythene sheet should be used to cover all cement bags.	**½ Mark each (any four)**	**4M**
	c) **Ans.**	**Write applications of blast furnace slag cement and low heat cement.** **Application of blast furnace slag cement:** 1. All construction works when OPC is used. 2. Mass concreting 3. Marine works 4. sea walls and break waters **Application of low heat cement:** 1. Mass concreting works like construction of abutments, retaining wall, bridge, dam etc. 2. Construction of chimney of factory 3. Construction of machine foundation 4. Nuclear power plant	**1 Mark each (any two)** **1 Mark each (any two)**	**4M**
	d) **Ans.**	**Define normal consistency of cement. If normal consistency of cement is 32% , find percentage water required for soundness test and setting time test of cement.** **Normal Consistency-** it is the water percentage required to penetrate the Vacates plunger in cement paste upto 33 to 35 mm from top of vacates mould Here, normal consistency of cement=32% Therefore percentage of water required for soundness test = 0.78x32= 24.96% Therefore, percentage of water required for setting time test = 0.85x32= 27.2%	**1M** **3M**	**4M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**B)**	**Attempt any ONE of the following:**		**(6M)**
	a)	**Enlist different properties of fine aggregate and state step-by-step procedure for determination of silt content of sand and their standards for silt content as per IS 383**		
	Ans.	**a) Properties of fine aggregate:** i) Source ii) Size iii) Shape iv) Sp. Gravity v) Bulk density vi) Water Absorption vii)Bulking viii) Cleanliness or Silt Content	**½ Mark each (any four)**	
		Determination of silt content: 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. Finally 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. 4. Measure the separated volumes of sand and silt as V_1 and V_2 resp. 5. Calculate the silt content of given sand sample in percentage as (V_2/V_1) x 100. The silt content should be less than 6% as per IS (other than road concrete).	**3M**	**6M**
		IS-Standards- According to IS383, the % silt content in sand should not exceed 6%.	**1M**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**b)**	**Explain need and importance of impact value and abrasion value for course aggregate.**		
	Ans.	**Need and importance of impact value of coarse aggregate:**		
		Aggregate Impact Value(AIV) is necessary to know the resistance of aggregate to sudden shock or impact load coming on it .it is required to measure the toughness of aggregate	**1M**	
		AIV is important to decide the suitability of aggregate for various construction works. If AIV < 30%, it is more strong and hence useful in wearing surfaces i.e. roadway, runways etc. But when AIV > 45%,it is weak aggregate and hence not useful in important construction	**2M**	
		Thus AIV is important to judge quality and suitability of aggregate depending upon toughness		**6M**
		Need and importance of Abrasion value of coarse aggregate:		
		Aggregate Abrasion Value (AAV) is needful to know resistance of aggregate to its wear and tear under dynamic loading. it is helpful to measure hardness of aggregate	**1M**	
		AAV is important to decide the suitability of aggregate for various works. If AAV < 30%,then such stronger aggregate is useful in concreting of wearing surfaces. But if AAV >50%then, it is not useful for important constructions. If AAV = 30-50%,It is useful for non-wearing surfaces i.e. ordinary construction works.	**2M**	
Q.2		**Attempt any FOUR of the following:**		**(16M)**
	a)	**Explain significance of water cement ratio.**		
	Ans.	**Significance of Water Cement Ratio:**		
		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 fresh and hardened concrete.		
		If W/C ratio is less (say w/c= 1/4 = 0.25), then concrete will become harsh and results in honeycombing or porous nature due to poor workability.		
		If w/c ratio is more ((say w/c= 5/4= 1.25) ,then concrete undergoes segregation and bleeding. Thus finally concrete shows defects in it.	**4M**	**4M**
		Therefore 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		
		If w/c ratio is opted out properly as mentioned above ,then concrete possess good workability, compressive strength and durability ultimately		

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	b)	**State the minimum grade of concrete for different exposure condition.**		
	Ans.	**Minimum grade of concrete for different exposure conditions as per IS 456:2000**	1 Mark each (any four)	4M

Sr. No.	Exposure Condition	Plain Concrete	Reinforced Concrete
1	Mild	-	M20
2	Moderate	M15	M25
3	Severe	M20	M30
4	Very Severe	M20	M35
5	Extreme	M25	M40

c) Define workability and state range values of workability requirement for different type of concrete work.

Ans. **Workability:** It is the ability of concrete for its easy handling in various concreting operations viz. Mixing, transportation, placing and compacting. — **1M**

Sr.No.	Placing Condition	Slump (mm)
1	Building Concrete, Shallow Section, Pavers	Less than 25
2	Mass concrete ,lightly reinforced section in slabs,floors ,canal lining,strip footing	25-75
3	Heavily reinforced sections in slabs,beams,walls ,columns	50-100
4	Slip form work, Pumped concrete	75-100
5	Trench fill	100-150
6	Tremie concrete	More than 150

1 Mark each (any three) — **4M**

d) State the step by step procedure for determination of compressive strength of concrete cubes.

Ans.
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 16 mm dia. steel rod.
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.

4M — **4M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	**d)**	6. Apply load at a rate of 35 N/mm2/min for 10 minutes or till failure load in N by cross sectional area of cube in mm2. 7. Finally calculate compressive strength of cubes as failure load in N by cross sectional area of cube in mm2. 8. The average of three test cubes can be calculated as average compressive strength in MPa.		
	e)	**Enlist the methods of mix design and state the necessity of concrete mix design.**		
	Ans.	**Methods of mix design:** 1. Arbitrary proportion method 2. Maximum density method 3. Fineness modulus method 4. ACI Committee 211 method 5. Road note no. 4 method (Grading Curve Method) 6. IRC 44 method 7. High strength concrete mix design method 8. Indian Standard method (IS 10262: 2009) 9. Trial and error method 10. Surface area method 11. Mix design based on flexural strength 12. DOE method	**½ Mark each (any four)**	**4M**
		Necessity of concrete mix design: 1. To achieve a 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.	**½ Mark each (any four)**	
	f)	**State different methods of NDT and explain Rebound Hammer test.**		
	Ans.	**Method 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 Mark each (any four)**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	f)	**Rebound Hammer Test:** i) Initially the plunger of rebound hammer is Kept touching to the target concrete surface ii) Then the tubular casing of hammer is pushed towards concrete, so that the spring gets wind up around the plunger iii) Now release the mass attached to plunger using dash pot ,so that hammer will impact on concrete surface and rebound back depending on strength of concrete. iv) Due to backward motion of hammer, pointer on graduated scale will move in same direction. v) Observe the distance travelled by pointer/rider on graduated scale as rebound Number. vi) If this rebound Number is less ,the strength of concrete will be less ,But if it is more ,then concrete possess sufficient strength.	**2M**	**4M**
Q.3		**Attempt any FOUR of the following :**		**(16M)**
	a) Ans.	**Classify the aggregates based on its size and shape.** **Classification of aggregate according to size -** 1) Fine aggregate- The aggregates having size of particles less than 4.75m, are called as fine aggregate 2) Coarse aggregate- The aggregates having size of particles more than 4.75mm are called as coarse aggregate 3) All in one aggregate- The aggregate containing both fine and coarse aggregates is called as All in one aggregate. **Classification of aggregate according to shape -** **1. Rounded:** This type of aggregate is completely shaped by attrition or water worn. Hence it possess 33-35% void ratio. This type of aggregate is not suitable for concreting. **2. Irregular or partly rounded:** This type of aggregate is naturally irregular or partly shaped by attrition. It possess 35- 37% void ratio. Useful for medium quality concrete. **3. Angular:** This type of aggregate contains well defined edges, formed at intersection of roughly Planer faces. It possesses 38-41% voids. **4. Flaky and elongated:** This type of aggregate having small thickness as compared to width or length. It has highest % of voids. It is suitable for lower grade of concrete.	**2M** **2M** **2M**	**4M**

Q. 3 b) **Sieve analysis was conducted on 3000 gm of fine aggregate and following observations were recorded .Find Fineness Modulus of sample.**

Sieve size (mm)	**4.75**	**2.36**	**1.18**	**0.6**	**0.3**	**0.15**	**0.075**	**pan**
Wt of F.A. retained (gm)	**150**	**235**	**830**	**725**	**515**	**298**	**142**	**105**

Ans. Total weight of fine aggregate- 3000 gm

Sr. No.	**IS sieve size(mm)**	**Wt. of F.A. retained(gm)**	**Cumlative Wt.retained**	**Cumulative %weight retained**
1	4.75	150	150	5
2	2.36	235	385	12.83
3	1.18	830	1215	40.5
4	0.6	725	1940	64.66
5	0.3	515	2455	81.83
6	0.15	298	2753	91.76
7	0.075	142	2895	96.5
8	pan	105	3000	100
	Sum			

2M

Fineness Modulus of F. A = Sum of Cumulative % weight retained upto 0.15mm sieve/ 100 = (5+12.83+40.5+64.66+81.83+91.76) / 100

1M

= 296.58 / 100

1M

Fineness Modulus of F. A = 2.9658

4M

c) **Explain procedure for determination of water absorption of coarse aggregate.**

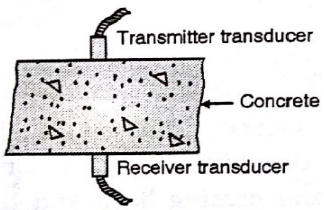
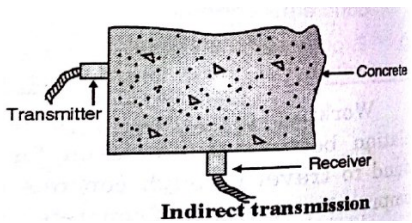
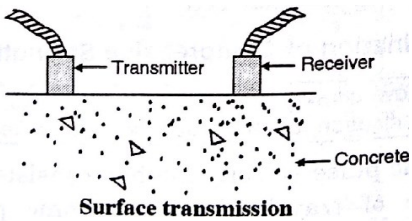
Ans.

Procedure of Water absorption of coarse aggregate

1. Take Sample of aggregate not less than 2000 gm.
2. Wash the sample thoroughly to remove dust particles and dust.
3. Drain out the sample and immerse it in water at a temperature of 30ºC with a cover of at least 5 cm of water above the top of the container and keep the sample immersed for a period of 24 hrs afterwards.
4. After 24 hrs remove the water from container and allow to drain for few minutes and allow to aggregate to surface dry.
5. Take weight of this surface dry and saturated aggregate. (W_1).

4M **4M**

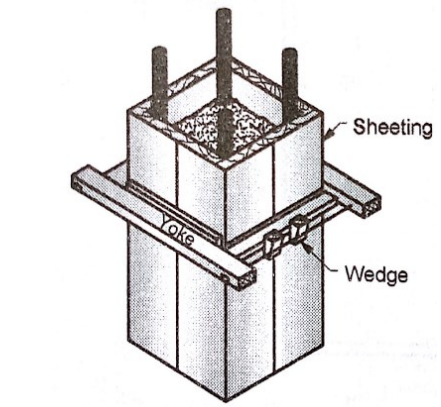
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 3	**c)**	6. Place the aggregate in the tray, at a temperature of 100°c to 110°c in an oven and maintain under the same temperature for 24 hrs. 7. Remove the sample from oven, allow it to cool in air and record its weight.(W_2) 8. Water absorption of Coarse aggregate = ((W_1-W_2) /W_2) x100		
	d) Ans.	**State the procedure of find crushing value of coarse aggregates.** **Crushing value of aggregate:** **1.** The aggregate passing through 12.5 mm IS sieve and retained on 10 mm IS sieve is selected. **2.** The Cylindrical measure is filled by the test sample of aggregate in three layers of approximately equal depth, each layer being tamped 25 times by tamping rod. **3.** After the third layer is tamped , using tamping rod with straight edge levels off the aggregate at the top of Cylindrical measure .then this test sample is taken and weigh it .(W_1) **4.** The cylinder of test apparatus is placed in position on the base plate filled by this sample. The surface of aggregate is leveled and plunger inserted so that it rests on this surface in level position. **5.** The cylinder with test sample and plunger in position is placed on compression testing machine. **6.** Load is then applied through the plunger at uniform rate of 4 tonnes per minutes until the total load of 40 tonnes and then the load is released. **7.** Aggregate including crushed portion is removed from cylinder and sieved on 2.36 mm IS sieve. The material passes through 2.36 mm sieve is collected and weigh it.(W2) **8.** Aggregate Crushing Value = (W_2 / W_1) x 100 **9.** Aggregate crushing value is less than 30%, then aggregate is used for wearing and non-wearing surface and Aggregate crushing value is in between 30 % to 45 % then aggregate is used for Non wearing surface.	**4M**	**4M**

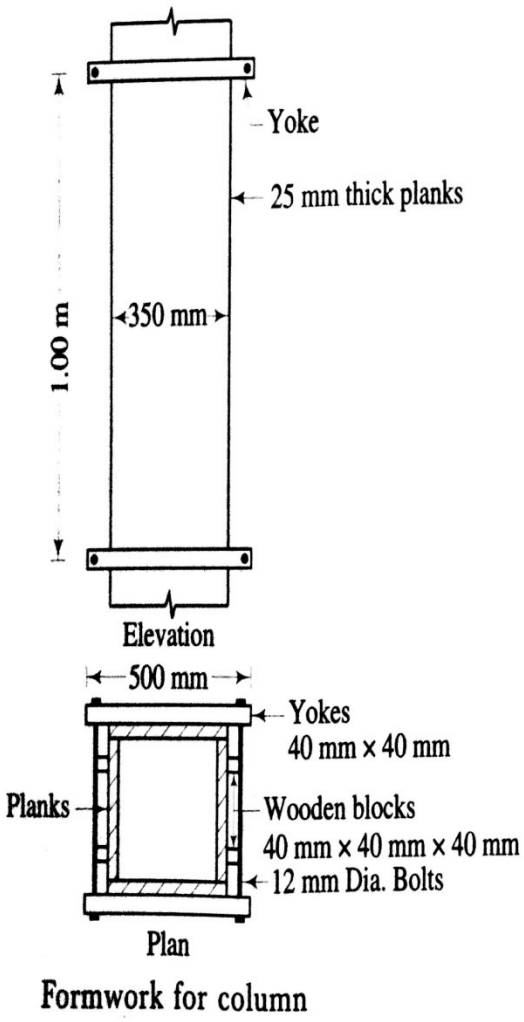
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 3	e)	**State the methods of measuring ultrasonic pulse velocity with appropriate sketches.**		
	Ans.	**Methods of measuring ultrasonic pulse velocity** 1. Direct transmission 2. Indirect transmission 3. Surface transmission **1. Direct transmission-**  **Direct transmission** The transmitting and receiving transducers are placed on opposite surfaces of the concrete slab. This will give maximum sensitivity and provide a well-defined path length. **2. Indirect transmission**  **Indirect transmission** The transmitting and receiving transducers are placed on adjacent surfaces of the concrete slab. **3. Surface transmission**  **Surface transmission** The transmitting and receiving transducers are placed on same surfaces of the concrete slab	**4M**	**4M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	A)	**Attempt any THREE of the following :**		(12M)
	a)	**State the different types of vibrators with their uses at different locations.**		
	Ans.	**Types of Vibrator -** 1) **Internal Vibrator (Needle vibrator)** – Internal vibrators are used for slabs, beams or any concrete structure 2) **External Vibrator (Form vibrator)** – External vibrators are used for column, thin walls, casting of precast units and where concrete section is heavily reinforced. 3) **Surface vibrators (Screed vibrator)-** Surface vibrator are used for roof slab and road pavement of shallow depth. 4) **Table vibrators-** Table vibrators are mainly used in laboratories. 5) **Vibropressing-** Vibropressing has been used for mass manufacturing of concrete cerbs. 6) **Centrifugation or Spinning-** This method is used in production of elements which are in circular cross section.	**1 Mark each (any four)**	4M
	b)	**Enlist the different methods of curing and explain any one method in detail.**		
	Ans.	**Methods of Curing** 1. Water curing a. Immersion b. Ponding method c. Spraying of water d. Wet covering by gunny bags 2. Membrane Curing 3. Application of heat 4. Miscellaneous methods	**½ Mark each (any four)**	4M
		Water curing- 1. This is best method of curing. It is suitable for curing horizontal surfaces such as floors, roof slabs, road and air field pavements. 2. In this method, after placing the concrete, its exposed surface is first covered with moist canvas (gunny bags). Then after 24 hrs, these gunny bags are removed and small ponds of sand are built across and along the pavements. 3. In ponding method the area is divided into number of rectangles. The water is filled between the ponds. 4. The filling of water in these ponds is done twice or thrice a day depending upon the atmospheric conditions. 5. The precast concrete items are normally immersed in curing tanks for certain duration.	**2M**	

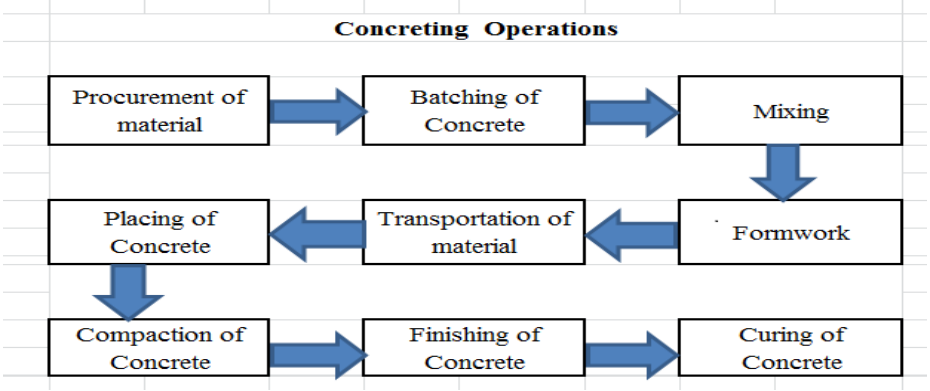
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**b)**	6. The column or vertical member is cured by spraying of water **OR** **Membrane curing:** 1. Sometimes concrete works are carried out in places where there is acute shortage of water. Therefore lavish application of water for water curing is not possible for the reason of economy. 2. Normally for making concrete more than sufficient water is used to hydrate the cement. But this water should not be allowed to get out from the body of concrete. For this reason concrete can be covered with membrane which will effectively seal the concrete. 3. A membrane will prevent the evaporation of water from the concrete. The membrane can be either in solid or liquid form. It is also known as sealing compound. 4. Other membrane curing sealing compounds are: Rubber latex emulsion, emulsion of resins, varnishes etc. **OR** **Application of heat:** 1. The development of strength is not only a function of time but also that of temperature. 2. Concrete subjected to higher temperature accelerates the hydration resulting in faster development of strength. Prefabricated members are normally steam cured. 3. In this method the ingredients of concrete heated and the strength is gained at very fast rate. 4. This can be done in following manner: a. Steam curing b. Curing by infra-red radiation c. Electrical curing **(Note - Any one of the above mentioned method should be considered.)**		
	c) **Ans.**	**State requirement of good formwork. Draw a neat sketch of formwork for rectangular column.** **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 leak-proof with perfect joints. 7. It should be durable with lesser wear and tear.	**½ Mark each (any four)**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**c)**	**Formwork for rectangular Column**	**2M**	**4M**





Formwork for column

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	d)	**Enlist types of joints Provided. Also state their necessity. Mention any two materials used for filling concrete joints.**		
	Ans.	**Types of Joints -** 1. Construction Joint - Construction joint is necessary for strong bond between hard and fresh concrete. 2. Expansion Joints - Expansion joints are necessary to allow the expansion in concrete caused due to thermal stresses. 3. Contraction Joint - Contraction joint are necessary to prevent contraction of concrete takes place due to plastic and drying shrinkage. 4. Isolation Joint - Isolation joint is necessary to isolate the structural part from the surrounding.	1 Mark each (any three)	4M
		Materials used for filling concrete joint- 1. Asphalt, tar, bituminous material 2. Fibre or fibre product 3. Sponge rubber 4. Cork	½ Mark each (any two)	
	B	**Attempt any ONE of the following:**		(6M)
	a)	**State the different stages in concreting operations & precautions to be taken to avoid the wastage of material.**		
	Ans.	**Different stages in Concreting operations –** 	2M	6M
		Precautions to be taken to avoid the wastage of material- 1. Proper proportioning of mix is to be done so as to avoid excess use of any constituent of concrete. 2. Weigh batching should be adopted as volume batching being not accurate due to improper consideration of water content and specific gravity of aggregate 3. Concrete should be transported quickly before its setting. 4. Quantity of material should be accurately estimated. 5. Formwork should be checked. It should be strong enough to carry the weight of concrete without bulging.	1 Mark each (any four)	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**b) Ans.**	**State the methods of Waterproofing and explain any one method.** **Methods of Waterproofing-** 1. Brick bat coba system 2. Bituminous treatment 3. Box-type waterproofing system 4. Sheet membranes 5. Surface coating/liquid membrane 6. Integral method a. Hydrophilic system /Crystalline b. Hydrophobic Admixtures 7. By use of Pore Fillers 8. By use of Water repellent **Brick bat coba system –** 1. Brick bat coba treatment provides insulation for thermal comfort and also waterproofing for leakages. Roof slab top should be removed by cleaning it by hard wire brush and then washing it with water. Surface should be free from impurities like oil, dust, grease etc. 2. Over this prepared surface, 15 mm thick cement sand mortar (1:4) admixed, with water proofer is laid. 3. Brick bat laying:- A layer of brick bats, soaked overnight in water is laid on the above prepared surface, which have an average thickness of about 110 mm,150 mm at ridge and 70 mm near rain water pipe. 4. There should be a gap of 15to 20 mm between the brick bats. These gaps are filled with cement sand mortar with one part cement and four part sand, admixed with water proofer. 5. Wet gunny bags should be used to cover the surface in hot and dry weather immediately after finishing. For the next 7 days curing should be done. 6. After the curing is done the top surface is to be finished smooth forming a 20 mm layer of cement sand mortar, 1:4, admixed with water proofer. Liquid admixtures should be mixed while mixing water .Curing is to be done by ponding. **OR**	**½ Mark each (any four)** **4M**	**6M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 4	**b)**	**By use of Pore Fillers** 1. The chief materials in the pore filing class are silicate of soda, aluminum and zinc sulphates and aluminum and calcium chloride. They are chemically active pore fillers. 2. In addition, they also accelerate the setting time of concrete and thus render concrete more impervious at early stage. 3. The chemically inactive pore filling materials are chalk, fullers earth and talk and these are usually very finely ground. 4. Their chief action is to improve the workability and facilitate the reduction of water for given workability and to make dense concrete which is basically impervious. **OR** **By use of Water repellent** 1. Some materials like soda, potash soaps, calcium soaps, resins, vegetable oils, fats and coal tar residues are added as water repelling , materials as this group of admixtures. 2. In some kind of water proofing admixtures inorganic salts of fatty acids, usually calcium or ammonium steroids or oleate will mainly act as water repelling material, lime as pore filling material 3. Calcium chlorides accelerates the early strength development . 4. It helps in efficient curing of concrete all of which contribute towards making impervious concrete. ***(Note- Explanation of any one of the above mentioned method should be considered.)***		
Q. 5		**Attempt any FOUR of the following:**		**(16M)**
	a) Ans.	**Write properties and applications of Retarding admixtures.** **Properties Retarding admixtures:** 1. Delays the setting time- counteract the accelerating effect of hot weather on concrete Setting 2. Slows hydration & therefore water is available for reaction. 3. Reduces water requirement 4. Gives good strength to the concrete. **Applications :** 1. Mass concreting 2. Hot weather conditions 3. Concrete construction involving sliding formwork	**½ Mark each** **1 Mark each (any Two)**	**4M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5	**b) Ans.**	**Define RMC and state advantages and limitations of RMC.** The concrete which is mixed at batching plant and made readily available at construction site is called as Ready Mix Concrete. **Advantages of RMC:** i. RMC can be ordered in bulk amount at a time. ii. It has more homogeneity as compared to other concrete. iii. It becomes economical in large projects. iv. It can be easily transported at a longer distance without hardening. **Limitations of Ready Mix Concrete (RMC):** 1. RMC is expensive than ordinary concrete, hence suitable for large projects only. 2. Continuous and bulk supply of materials is necessary for smooth working of RMC plant. 3. It may get affected on its quality due to improper functioning of plant elements. 4. It requires skilled labours for operation and it has low profit margin.	**1M** **½ Mark each (any Three)** **½ Mark each (any Three)**	**4M**
	c) Ans.	**State any four precautions to be taken in cold weathering concreting.** **Precautions to be taken during cold weather concreting:** 1. Concrete work should be done during day time or on sunny days. 2. Warm water should be added for mixing of ingredients of concrete. 3. Before placing of concrete, the formed ice, snow or frost should be removed from formwork. 4. The accelerating admixtures should be used to increase hardening of concrete. 5. A protective cover should be used over casted concrete to avoid cold winds and snow fall. 6. Aggregates (fine and coarse) should be heated before its use.	**1 Mark each (any four)**	**4M**
	d) Ans.	**Define admixture in concrete and state the purpose of admixtures.** The materials added in concrete to improve few properties & to get required results are s are known as admixtures. **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.	**1M** **1 Mark each (any Three)**	**4M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5	**d)**	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. 9. To join old and new concrete at construction joints.		
	e)	**State the properties of air entraining admixtures and accelerating admixtures.**		
	Ans.	**<u>Properties of accelerating admixture –</u>** 1. Quick setting of concrete 2. Early removal of formwork reduces time period of curing. 3. More early strength development in concrete 4. Less resistance to sulphate attack 5. More drying shrinkage	**½ Mark each (any four)**	
		<u>Properties of air – entraining admixture –</u> 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. 5.Better resistance to frost action 6.Easier placing	**½ Mark each (any four)**	**4M**
	f)	**Explain the application of high performance concrete.**		
	Ans.	**<u>1. In Pavements</u>** a) High Performance concrete is being used for highway pavements due to the potential economic benefits b) Fast track concrete paving (FTCP) technology can be used for complete pavement reconstruction. **<u>2. In Bridges</u>** a) HPC is being extensively used now for the fabrication of precast pylons, piers, and girders of many long span bridges b) Concrete structures are preferable for railway bridges to eliminate noise and vibration problems and minimize the maintenance cost c) Fast track concrete paving (FTCP) technology can be used for complete pavement reconstruction **<u>3. In High-rise Buildings</u>** a) The reasons for using the high strength concrete in the area of high-rise buildings are to reduce the dead load, the deflection, the vibration and the noise, and the maintenance cost. **<u>4. Miscellaneous Applications</u>** a) Fiber reinforced concrete has been used with and without conventional reinforcement in many field applications. These include bridge deck overlays, floor slabs, pavements and pavement	**1 Mark each (only one applica-tion)**	**4M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q. 5	**f)**	overlays, refractories, hydraulic structures, thin shells, rock slope stabilization, mine tunnel linings and many precast products.		
Q. 6		**Attempt any FOUR of the following:**		**(16M)**
	a)	**State the purpose of mixing of concrete and types of mixer used for mixing of concrete ingredients.**		
	Ans.	**Purpose of mixing of concrete:** 1. To achieve the designed/ desired workability in the plastic stage 2. To achieve the desired minimum strength in the hardened stage 3. To achieve the desired durability in the given environment conditions 4. To produce concrete as economically as possible.	**1 Mark each (any two)**	**4M**
		Types of mixer : 1. Non-tilting mixer 2. Split drum mixer 3. Tilting drum mixer 4. Reversing drum mixer 5. Drum Truck Mixers	**1 Mark each (any two)**	
	b)	**Explain the procedure for joining old and new concrete work.**		
	Ans.	When new concreting is done in continuation with old concrete after a gap of some days, months or even years, then the new and old concrete must have a strong bond with each other. Hence some points should be kept in mind for joining old and new concrete. 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. **4. Providing overlap:** To give homogeneity to the reinforcing bars, overlap is provided and the overlap portion is bound tightly with high tensile wire.	**4M**	**4M**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6	**c)**	**State the purpose of water reducing admixtures and enlist any two.**		
	Ans.	**Purpose of water reducing admixtures:** 1. Reduces the water content by 5-10% 2. Decreases the concrete porosity 3. Increases the concrete strength by up to 25% 4. Increases the workability 5. Reduces the water permeability 6. Reduces the diffusivity of aggressive agents in the concrete and so improves the durability of concrete 7. Gives a better finish to surfaces	**1 Mark each (any two)**	**4M**
		Types of water reducing admixtures: 1. Low range plasticizers or regular plasticizers 2. High range or super-plasticizers Trade name : Complast 211,Plastiment BV40	**1 Mark each**	
	d)	**Write short Note on i) Light Weight Concrete ii) Self compacting concrete**		
	Ans.	**i) Light Weight Concrete -** The concrete whose self-weight is lesser comparative to ordinary concrete is called light weight concrete. This concrete is produced by using light weight aggregates (LWA). The LWA used may be the natural materials like volcanic pumice, thermal treatment materials like clay, slate or shale or industrial by-product containing fly-ash, slag etc. The properties of light weight concrete depends on the properties of light weight aggregates used. If high thermal insulation is required, light and weak aggregates can be used but it results in low strength to concrete. Light weight concrete has following advantages : 1. Reduction in dead load gives saving in cost foundation and reinforcement. 2. More thermal and fire resistance. 3. Reduction in transportation and handling cost of precast unit. 4. Reduction in formwork and propping.	**2M**	**4M**
		ii) Self compacting concrete It is the concrete which settle down under its own weight so that it does not require any type of external vibration for its compaction. The self-compacting concrete is highly flow able concrete which flows through even highly reinforced and thin sections also. As it does not contain air voids, it gives homogeneous and smooth finished surface. SCC can be manufactured by adding mineral admixture like fly ash	**2M**	

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6	**d)**	and chemical admixture like super plasticizers in regular ingredients of concrete. The fine aggregates are more than coarse aggregates in SCC. The w/c ratio is less for SCC due to chemical additive. It has high flow ability, more workability, more homogeneity, better finish, more strength. But it is costlier due to chemicals and laborious for mix design.		
	e) **Ans:**	**Describe the procedure for determination of workability by using compaction factor test.** Compacting factor of fresh concrete is done to determine the workability of fresh concrete by compacting factor test as per IS: 1199 – 1959. The apparatus used is Compacting factor apparatus. **Procedure to determine workability of fresh concrete by compacting factor test:** i) The sample of concrete is placed in the upper hopper up to the brim. ii) The trap-door is opened so that the concrete falls into the lower hopper. iii) The trap-door of the lower hopper is opened and the concrete is allowed to fall into the cylinder. iv) The excess concrete remaining above the top level of the cylinder is then cut off with the help of plane blades. v) The concrete in the cylinder is weighed. This is known as weight of partially compacted concrete. vi) The cylinder is filled with a fresh sample of concrete and vibrated to obtain full compaction. The concrete in the cylinder is weighed again. This weight is known as the weight of fully compacted concrete. Compacting factor = (Weight of partially compacted concrete) / (Weight of fully compacted concrete)	**4M**	**4M**