Model Answer: Winter 2016

Subject: - Concrete Technology

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
1	A.	Attempt **any three**.		(12)
	a)	**State Bogue's compounds with their effect on properties of cement.**		
	Ans.	Bogue's compound and their effect on cement properties- 1. Tri-calcium Silicate – It gives early strength to cement by producing more heat of hydration. 2. Di-calcium Silicate- It gives ultimate strength to cement by generating comparatively lesser heat. 3. Tri-Calcium aluminate – It varies setting time of cement. 4. Tri-Calcium Alumino-ferrite – It is chemically inactive and dose not contributes compressive strength and setting time of cement.	1 Mark each	4
	b)	**State various field tests on cement.**		
	Ans.	Four field test on cement. 1) The colour of fresh cement should be greenish grey. 2) The hand in cement bag should give cool feeling. 3) A pinch of cement should give smooth feeling to fingers. 4) The handful cement should float on water for some time before its dipping. The sharp edged cake under water should remain sharp edged even after 24 hrs. 5) The color of cement should not be changed after burning. 6) The cement should not contain visible lumps in it. 7) The cement roll should give shiny surface after cutting with knife.	1 Mark each (Any four)	4

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1.	c)	**State the various grade of concrete w.r.t different groups.**		
	Ans.	There are three categories of concrete grades as follows depending upon compressive strength obtained after 28 days curing; 1. **Ordinary concrete** – In this category, low to medium strength concrete grades are included i.e. M10, M15 and M20. The lean concrete M7.5 is also included in it. It is useful for ordinary PCC and RCC works. 2. **Standard concrete** – In this, medium to high strength concrete grades are taken i.e. M25, M30, M35, M40, M45, M50 and M55. Such concrete requires concrete mix design. It is useful in mega projects, mass concrete works, etc. 3. **High strength concrete** – In this, very high strength concrete grades are considered i.e. M60, M65, M70, M75 and M80. It also requires special concrete mix design. It is useful in special type of works like atomic power stations, launching stations, etc.	1 1 2	4
	d)	**State the requirements of form work.**		
	Ans.	**Requirements of 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.	1 Mark each (Any four)	4
	B)	Attempt **any one:**		(6)
	a)	**Define initial and final setting time of cement. Explain the laboratory method to final initial and final setting time of cement.**		
	Ans.	**Initial Setting Time-** It is the time elapsed from mixing of cement and water up to when IST needle penetrates up to 33-35mm from top of Vicat's mould, is called as Initial Setting Time **Final Setting Time-** It is the time elapsed from mixing of cement and water up to when FST needle gives just impression on cement paste in Vicat's mould, is called as Final Setting Time.	1 1	

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1.		**Laboratory method to find initial and final setting time of cement-** 1. Take 400 gm. of cement sample and add 0.85 times water required for its standard consistency to prepare homogenous cement paste. 2. Note down the time at which water is added to cement as T_1 min. 3. Fill this cement paste in vicat's mould. Keep this mould under vicat's app. With IST needle attached to it. 4. Now allow the IST needle to penetrate in the paste by realize pin observe the total penetration. If the penetration is not 33 to 35 mm then change the position of penetration surface. 5. Note down the time at which IST needle will give required penetration as T_2 min. Hence calculate the initial setting time i.e. IST = T_2 - T_1 min. 6. Replace IST needle with FST needle and allow FST needle to penetrate in same cement paste. 7. Note down the time at which FST needle will give the Just impression on a cement surface as T_3 min. 8. Calculate final setting time i.e. FST = T_3-T_1 min.	**4**	**6**
	b) **Ans.**	**i. State the qualities of good sand.** **ii. Explain bulking of sand.** **The qualities of good sand: -** 1. Good sand should be clean i.e. free from silt, lumps, impurities etc. 2. A good sand should be well graded 3. Good sand should possess less amount of bulking. 4. It should have less water absorption 5. A good sand should of smooth texture to increase workability 6. It should be hard , strong and durable 7. It should be chemically inert. **Bulking of Sand: -** **i.** Bulking of sand means increase in volume of sand due to surface moisture. **ii.** The volume of sand increases with increase in moisture content up to a certain limit and thereafter it begins to decrease. **iii.** Maximum increase in volume may be up to 20 to 40% when moisture content is 5 to 10% by weight. **iv.** Bulking is due to thin film of water around the sand grains and the interlocking of air between the sand grains and the film of water.	**1 Mark each (Any three)** **2**	**6**

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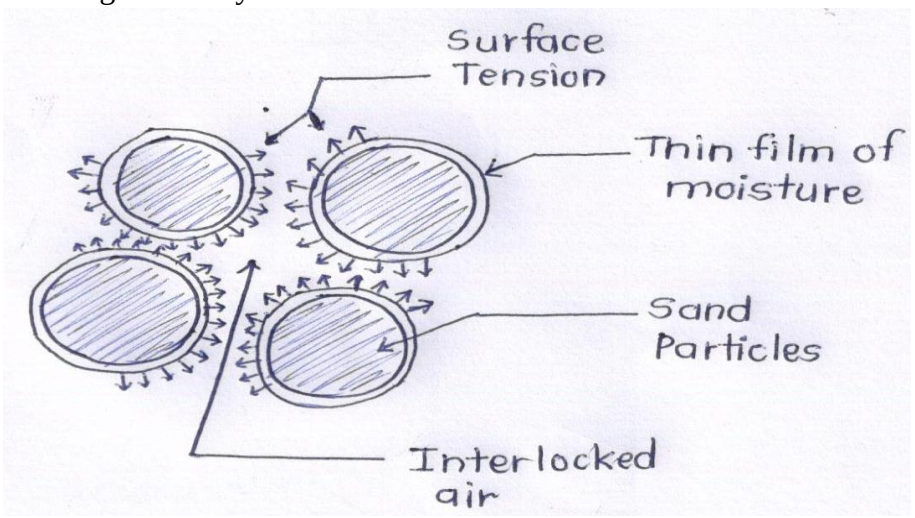
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
1.		v. The film of water produces surface tension and keeps the sand grains away from each other. 	1	
2.		Attempt **any four.**		(16)
	a)	**State various types of cement. Explain any one.**		
	Ans.	**Types of cement-** i) Ordinary Portland cement ii) Rapid Hardening cement iii) Low heat cement iv) Portland pozzolana cement V) Sulphate resisting cement Vi) Blast furnace slag cement Vii) White cement	½ Mark each (Any four)	
		Ordinary Portland cement: - It is the cement which is commonly used in ordinary construction works. It satisfies the criteria as per IS-269-1967 OPC has following properties. a) fineness →10% by IS sieving method b) Soundness → 10mm max. for unaerated cement c) Setting time → IST > 30 mins. And FST < 600 mins. d) Comp strength → 3 days = 115 kg/cm^2 & 7 days -175 kg/cm^2	2	4

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2.		OPC is useful in the following: - a) OPC is used for making mortar, concrete to be used under normal conditions. b) OPC is also useful for all types of RCC works including plastering and water - proofing		
	b) Ans.	**Classify the aggregates w.r.t shape.** Classification of aggregate according to shape: **i. 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. Example: River or sea shore gravel, desert, sea shore, windblown sand etc. **ii. 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. Example: Pit sand and gravel, cuboid rock etc. **iii. Angular:** This type of aggregate contains well defined edges, formed at intersection of roughly planer faces. It possesses 38-41% voids. Best for concreting: - Crushed rock of all types. **iv. 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. Example:- Laminated Rock	**1 Mark each**	**4**
	c) Ans.	**Explain various properties of coarse aggregate.(any four)** **Properties of Coarse Aggregate-** i) Size-The size of coarse aggregate should be minimum 5mm and 20mm maximum for ordinary RCC construction. But the size of 80mm (max) is limited to mass concreting. ii) Shape-The shape of coarse aggregate may be rounded , surrounded , angular , flaky or elongated . But angular shaped aggregates are more useful due to good interlocking of particles. iii) Texture- The coarse aggregate may be smooth or rough in texture. The rough textured aggregates are preferred due to better bonding of particles.	**1 Mark each (Any four)**	**4**

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2.		iv) Water absorption-The coarse aggregate may absorb the part of added water. It should absorb less water to maintain w/c ratio. V) Specific gravity- It is the ratio of weight of aggregate of any specific volume to weight of distilled water of equal volume. It may define self - weight of concrete. Vi) Bulk density- It is the ratio of weight of aggregate to volume of aggregate. The more bulk density, then denser concrete will be produce. Viii) Fineness modulus- It is the ratio of sum of % cumulative weight retained up to 150~to empirical constant 100. F.M may range between 2.9 to 3.2 ix) Impact strength - It shows the resistance of aggregate to impact loading. More impact strength of aggregate becomes suitable for X) Crushing strength-It indicates resistance of aggregate to compressive load. It shows capacity to carry loads without crushing. Xi) Abrasion strength-It shows resistance of aggregate to its wear and tear .It is important to know shock absorbing ability. Xii) Alkali-Aggregate reaction→ It is the reaction between alkalis from cement with aggregate, which give rise to cracks .Therefore aggregate should be chemically inactive.		

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2.	d) Ans.	**Following observations are taken during the fineness modulus test on aggregate. The initial weight of sample is 500 gms. Calculate F.M.**		

Sieve Size	Mass retained (in gms)	Cumulative mass retained (in gms)	Cumulative mass retained (in %)
4.75mm	16	16	3.2
2.36mm	76	92	18.4
1.18mm	104	196	39.2
600µ	84	280	56
300µ	128	408	81.6
150µ	82	490	98
75µ	4	494	-
Less than 75µ	6	500	-
	$\sum$% *cumulative wt. retained* = 296.4		

2

$$\text{Fineness Modulus} = \frac{\sum \%\ \textit{cumulative wt. retained}\ \text{upto}\ 150\mu\ \text{I.S. sieve}}{100}$$

1

$$FM = \frac{296.4}{100} = 2.96$$

1

4

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
2.	e)	**Define concrete. State the necessity of supervision of concreting operations.**		
	Ans.	**Concrete: -**Concrete is a homogenous mixture of cement, sand, aggregate and water in proportion.	1	
		Necessity of supervision for concrete operation : 1. Supervision is necessary to complete all concreting operations in standard manner. 2. It is necessary to avoid any type of delay in concrete work. 3. It is also beneficial to reduce wastage of concrete during concreting. 4. It is required to get overall quality in concrete work at site 5. Supervision becomes essential in maintaining smooth flow of concreting operations at each stage of project. 6. It found very effective in controlling bad workmanship.	1 Mark each (Any three)	4
	d)	**Explain the terms:** **i) Segregation.** **ii) Bleeding.**		
	Ans.	**i. Segregation: -** It is the separation of ingredients of concrete from each other, called as segregation.	1	
		If w/c ratio is not proper, then concrete leads to segregation. When the mixture is non- homogenous due to improper mixing, then concrete results in segregation. The dropping height more than 1m may leads to concrete segregation.	1	4
		ii. Bleeding: -It is the removal of water from rest of concrete mass, called as bleeding.	1	
		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.	1	

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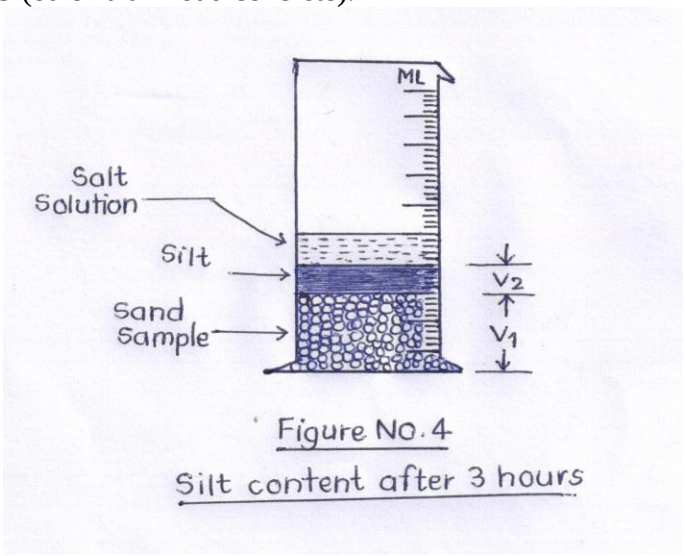
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3.		Attempt **any four**		(16)
	a)	**Explain silt content test.**		
	Ans.	1. Prepare 1% salt solution by adding 10 gm common salt in 1000 ml water. 2. Fill this salt solution up to 50 ml mark in measuring cylinder. Now add sand sample in it to reach 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 as shown in fig. 4. 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).	3	4
		 Figure NO.4 Silt content after 3 hours	1	
	b)	**Explain aggregate impact test.**		
	Ans.	1. Take oven dried aggregate passing through 12.5 mm IS Sieve and retained on 10 mm IS sieve. 2. Fill this aggregate in impact mould within 3 layers. Compact each layer 25 times using tamping rod. 3. Calculate the weight of aggregate filled by subtracting empty weight of mould as W_1 gm. 4. Put the mould under aggregate impact testing machine and give 15 successive blows by lifting handle of it; so that aggregate gets crushed. 5. Take out sample from mould and sieve it through 2.36 mm IS sieve. Take weight of aggregate fraction passing through 2.36 mm IS sieve as W_2 gm. 6. Calculate % aggregate impact value of given coarse aggregate as (W_2/W_1) X 100.	4	4

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3.	c) Ans.	**State requirement of good aggregate. Give classification of aggregate.** i) A good aggregate should be strong having sufficient impact, crushing and abrasion strength. ii) A good aggregate should be durable to resist atmospheric variation. iii) It should be non-reactive type to avoid alkali- aggregate reaction. iv) It should be clean i.e. free from organic and inorganic impurities. v) It should be well graded with minimum voids. vi) It should have rough texture for better bonding. vii) It should not absorb water more than 5%from added water to avoid variation in w/c ratio. viii) It should have angular shape for strong interlocking of particular. **Classification of aggregate-** i) **Fine aggregate-** The aggregate whose size of particles is less than 4.75m, is called as fine aggregate. OR The aggregate which passes through 4.75mm I.S sieve, is known as fine aggregate. ii) **Course aggregate-** The aggregate whose size of particles is more than 4.75mmis taken as course aggregate. OR The aggregate which retains on 4.75mm I.S sieve is Considered as course aggregate.	½ Mark each (Any four) 2	4
	d) Ans.	**Define w/c ratio. State Duff-Abraham's law with its significance.** **W/C ratio: -** It is the ratio of weight of water to weight of cement taken in the particular mix proportion, called as w/c ratio. **Duff Abraham's Law –** For workable concrete, the compressive strength of concrete depends on water-cement ratio. Expression – $S = \frac{A}{B^x}$ where, S = Strength of concrete X = water-cement ratio A, B = Empirical constants **Significance of Duff- Abraham's law-** 1. The Duff-Abraham's law is important to know optimum w/c ratio to get desired compressive strength. 2. It plays significant role to decide the mode of compaction of concrete mix having particular w/c ratio. 3. It highlights the effect of w/c ratio on concrete by considering other factors at normal condition. 4. It proves that lesser w/c ratio gives more compressive strength and vice-versa.	1 1 1 Mark each (Any two)	4

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
3.	e) Ans.	**State the methods of NDT. Explain any one.** **Methods of NDT :-** i. Rebound Hammer Test ii. Ultrasonic Pulse Velocity Test iii. Surface hardness test using pistol and impact hammers iv. Penetration and pull-out technique using spit pin and Windsor probe v. Radioactive and nuclear method using X-ray and Gamma ray vi. Magnetic and electrical method using microwave absorption vii. Acoustic emission technique **Rebound Hammer Test: -** 1. It consists of spring control hammer that slides on a plunger within a tubular housing. 2. When the plunger is pressed against the surface of concrete, the mass is rebound from the plunger. 3. The hammer impacts against the concrete and the spring control mass rebound, taking the rider along with the guide scale. 4. By pushing a button the rider can be held in position to allow the reading to be taken. The distance travelled by the mass is called rebound hammer. 5. The test can be conducted horizontally, vertically, upwards or downward or at any intermediate angle. **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; 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 **(Note: - Any Other method explained of the above should be considered)**	½ Mark each (Any 4) 2 Mark (Any one)	4

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4.	A.	Attempt **any three.**		(12)
	a)	**State the factors affecting workability.**		
	Ans.	Factors affecting the workability of concrete are as follows; 1. Water – cement ratio 2. Size of aggregate 3. Shape of aggregate 4. Use of admixtures 5. Grading of aggregate 6. Surface texture of aggregate 7. Water absorption of aggregate 8. Temperature	1 Mark each (Any four)	4
	b)	**Explain the procedure to determine compressive strength of concrete in laboratory.**		
	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. 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.	4	4

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4.	c)	**Compare manual mixing with mechanical mixing of concrete.**		
	Ans.		**1 Mark each (Any 4)**	**4**

Manual mixing	Mechanical mixing
i)The mixing is done manually by using phawrah, gumboot etc.	i) The mixing is done mechanically by using various types of mixers.
ii) It is suitable for low important constructions i.e P.C.C, compound wall etc.	ii) It is applicable for highly important works i.e RCC buildings, dams etc.
iii) It is required less time but quality of mixture is not homogeneous.	iii) It is require slightly more time but gives homogeneous quality of concrete mix.
iv) The wastage of material is more.	iv) The wastage of material is less comparatively.
v) It is tedious and uneconomical.	v) It is quite simple and gives overall economy.

	d)	**Explain fiber reinforced concrete.**		
	Ans.	When concrete mixture is prepared by adding individual or combination of different types of fibers in it, then such formed concrete is termed as Fiber Reinforced Concrete (FRC). The fiber types like asbestos, glass, plastic, steel fibers can be used as reinforcement in concrete to increase various strength characteristics.	**1**	
		Properties : - 1. Very high tensile strength 2. Crack arrester 3. Uniform load distribution through matrix 4. More fire resistance 5. High shear and torsional strength 6. Resistance to freezing and thawing damage 7. More resistance to shocks and vibration 8. Self-weight is less 9. Smooth finishing	**2**	**4**
		<u>Application:</u> – 1. Machine foundations – To resist shock and dynamic loading. 2. Canal lining and precast elements – To gain impermeable finish. 3. Refractory lining – To resist temperature stresses.	**1**	

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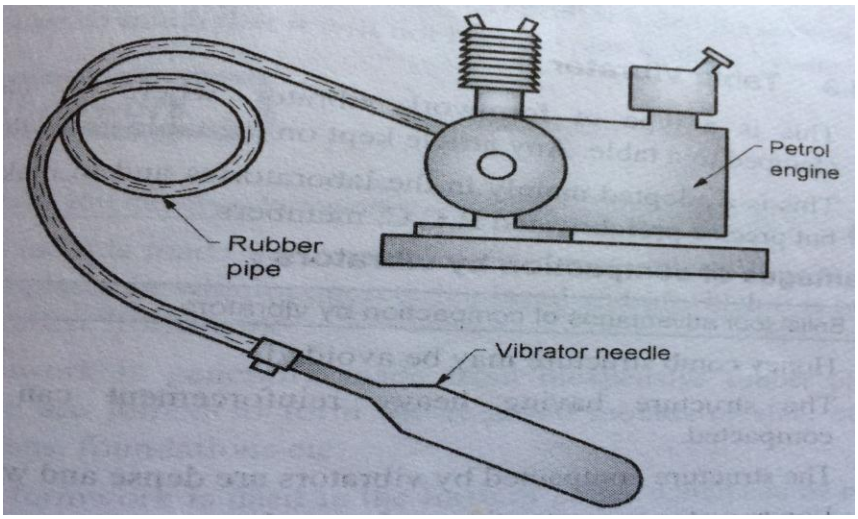
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4.	B.	Attempt **any one.**		(6)
	a)	**Define compaction. State various types of vibrators used and explain with neat sketch poker vibrator.**		
	Ans.	**Compaction:** - It is the process to remove air voids from concrete mixture to produce dense and compacted concrete, called as compaction.	1	
		Types of vibrators- i) Needle or Poker vibrator ii) Screed board vibrator iii) Form vibrator iv) Platform vibrator v) Table vibrator vi) Vibratory roller	2 Marks each (Any four)	
		Poker vibrator- The poker or needle vibrator has a vibrating needle operates on petrol or diesel engine as shown in fig.1 above. It gives 12000 cycles of vibration per minutes, which is useful to compact column and deep beams. Pocker vibrator is used to compact concrete internally by immersing it in concrete.	1	
		 Fig. Poker vibrator	2	

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
4.	b)	**Define curing. State the objective. Explain any one method of curing.**		
	Ans.	**Curing –** Curing may be defined as the operation of maintaining humidity and temperature of freshly placed concrete during some definite period following placing, or finishing to assure satisfactory hydration of the cement and proper hardening of the concrete. **Or** Curing may be defined as the process of keeping the concrete moist and warm enough so that the complete hydration of the cement can take place	**1**	
		Objective of curing: - 1. Curing is essential to maintain sufficient moisture in concrete for completing hydration. 2. It is necessary to maintain uniform temperature of concrete i.e. above freezing point. 3. It is useful to avoid chances of formation of shrinkage cracks and to attain uniform finishing. 4. It helps to increase impermeability and durability of concrete by achieving characteristic compressive strength.	**2**	
		Method of Curing: - **i. Water curing:** 1. This is the best method of curing, because it satisfies all the requirements of curing. 2. The precast concrete items are normally immersed in curing tanks for certain duration. 3. Pavement slab, roof slab etc. are covered under water by making small pond. 4. Water curing can be done in following ways: a. Immersion b. Ponding method c. Spraying or fogging d. Wet covering. **ii. 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.	**3 (Any one Method)**	

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4.		**iii. 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. 3. Prefabricated members are normally steam cured. 4. In this method the ingredients of concrete heated and the strength is gained at very fast rate. This can be done in following manner: a. Steam curing b. Curing by infra-red radiation c. Electrical curing **iv. Miscellaneous method** 1. Calcium chloride is used either as a surface coating or as an admixture. It has been satisfactorily used as a curing medium. 2. Both of these based on the fact that calcium chloride, being a salt shows affinity for moisture. 3. The salt not only absorbs moisture from atmosphere but also retains it at the surface. The moisture held at the surface prevents the mixed water from evaporation and thereby keeps the concrete wet for a long time to promote hydration.		
5.		Attempt **any four.**		**(16)**
	a)	**Explain:** **i) Screeding** **ii) Floating operations on concrete.**		
	Ans.	**Screeding: -** In this operation of concrete finishing, excess concrete, hollow or cavities present on concrete surface are striker off using chisel or hammer.	**1**	
		When Screeding is done all over concrete surface, then the surface becomes rough and approximately leveled.	**1**	
		Floating: - In this second operation of finishing, the cement mortar is applied uniformly using wooden float of 60cm length and 20 cm width.	**1**	
		Sometimes a large metallic or aluminum float is used to level and finish the target concrete surface.	**1**	

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5.	b)	**Define admixture. State its purpose.**		
	Ans.	**Admixture** – It is the fifth ingredient of concrete, which is purposefully added to modify one or more specific properties of concrete, which is called 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. 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.	**1** **1 Mark each (Any three)**	**4**
	c)	**State the various precautions to be taken in placing of concrete.**		
	Ans.	**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.	**1 Mark each (Any four)**	**4**

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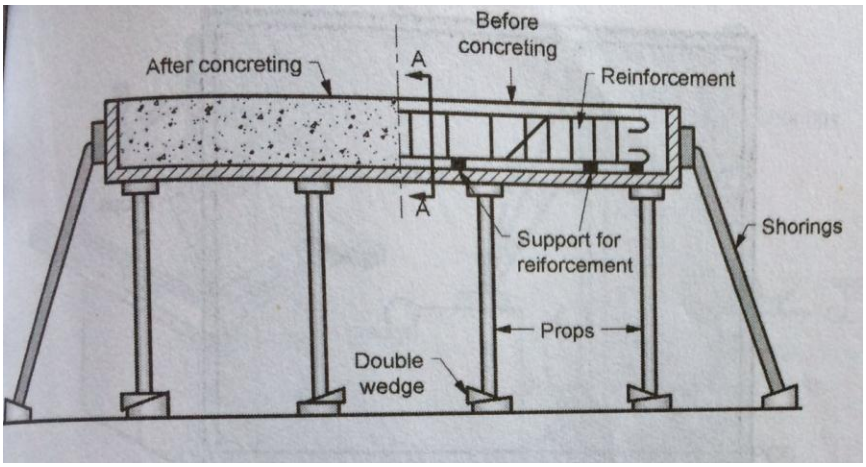
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
5.	d)	**Draw sketch of formwork for beam.**		
	Ans.	 Fig. Formwork for Beam.	**3 Marks sketch** **1 Marks label**	**4**
	e)	**State any four precautions to be taken in cold weather concreting.**		
	Ans.	**Precautions to be taken during cold weather concreting:** 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)**	**4**
	f)	**Explain IS method of concrete mix design.**		
	Ans.	**Indian Standard (IS 10262 – 2009) Method –** This method is suitable to design concrete of grades more than 20 N/mm2. The basic steps in design procedure are as follows; 1. Target mean strength $\overline{fck} = fck + t.s$ 2. Selection of water-cement ratio from graph as per IS 456 – 2000. 3. Selection of water content and fine to total aggregate ratio. 4. Calculation of cement content per m^3 of concrete. 5. Calculation of fine and coarse aggregate content per m^3 of concrete.	**4**	**4**

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6.		Attempt **any four.**		(16)
	a)	**Differentiate between weight batching and volume batching.**		
	Ans.		1 Mark each (Any four)	4

Weight batching	Volume batching
1. In this, measurement of materials is done by taking weight.	1. In this, measurement of materials is done by taking volume.
2. Weight machine is used.	2. Gauge boxes are used.
3. It is more accurate.	3. It is approximate or less accurate.
4. It is useful for more important constructions where mix-design is adopted.	4. It is useful for less important works where ordinary mix is used.
5. Weigh batching is done for cement generally.	5. Volume batching is done for aggregates and water.
6. It requires skilled labours and more time is required.	6. It requires less time even with unskilled labours.

	b)	**State the effects of hot weather on concrete.**		
	Ans.	**Effect of hot weather on concrete:** 1. Due to hot weather, concrete shows rapid rate of hardening, which results difficulty in transportation of concrete. 2. Water from concrete mix gets evaporated fastly, which results on w/c ratio and less workability of concrete. 3. Water may get absorbed by formwork, aggregate or ground due to excessive heat. 4. More shrinkage cracks get developed on concrete surface due to incomplete hydration with less water in concrete. Hence, early finishing becomes more essential. 5. Continuous curing is required to keep humidity and to avoid further development of cracks. 6. Air entrained in concrete may get expelled due to temperature, hence workability may reduce additionally.	1 Mark each (Any four)	4
	d)	**Explain R.M.C.**		
	Ans.	**Ready mix concrete:** The concrete which is mixed at batching plant and made readily available at construction site is called as Ready Mix Concrete.	1	

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6.		1. Bulk amount of RMC concrete can be produced at a time to avoid delay in construction. Wastage of materials can be avoided due to mechanized operations at RMC plants. 2. RMC give higher quality mix than ordinary concrete due to computerized working of plant. It can be easily transported longer distance without hardening, hence suitable even in congested urban area. 3. RMC is expensive than ordinary concrete, hence suitable for large projects only. Continuous and bulk supply of materials is necessary for smooth working of RMC plant. 4. RMC may get affected on its quality due to improper functioning of plant elements. It requires skilled labours for operation and it has low profit margin. RMC can be easily transported longer distance	**3Marks (Any three)**	**4**
	d) **Ans.**	**State different types of admixture with functions of each.** 1. Accelerating admixture – To increase the rate of setting of the concrete and for early removal of formwork in cold climate. 2. Retarding admixtures – To reduce the rate of hardening of the concrete in hot weather. 3. Water reducing admixtures – To maintain appropriate water in concrete for deep beams, thin walls and tremie concrete. 4. Air entraining admixtures – To modify properties of plastic concrete like workability, segregation and of hardened concrete like impermeability and resistance to frost action. 5. Super plasticizers – To reduce water up to 30% without reducing workability. 6. Pozzolanic admixture – To reduce heat of hydration and alkali-aggregate reaction. 7. Grouting agents – To increase pump-ability and rate of setting of grouting cement. 8. Bonding admixtures – To join old and new concrete at construction joints.	**1 Mark each (Any four)**	**4**
	e) **Ans.**	**What is high performance concrete? State its advantages.** **High performance concrete:** The high performance concrete is a concrete in which certain characteristics are developed for a particular application and environment, so that it will give excellent performance in the structure to be built, is called as High performance concrete.	**1**	

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
6.		Advantages of High performance concrete – 1. HPC has highly improved workability than other type of concretes 2. It gives high strength and durability to the structure. 3. It does not undergo segregation and bleeding in its plastic stage. 4. HPC has more dimensional stability and hence undergoes creep. 5. It has low permeability and can be used in water retaining structures effectively. 6. HPC has high resistance to chemical attack hence suitable to marine structures. ----------*****----------	**1 Mark each (Any three)**	**4**