Model Answer: Winter- 2022

Subject: Concrete Technology | **Sub. Code: 22305**

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 candidate and 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 model answer.
6) In case of some questions credit may be given by judgement 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.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1		**Attempt any FIVE of the following:**		**(10)**
	a)	**Define:-** **i) Initial setting time (IST)** **ii) Final setting time (FST) of cement.**		
	Ans.	**i) 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. **ii) 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**	**2**
	b)	**Enlist four Bogue's compounds with their formula.**		
	Ans.	**Sr. No. / Name of compound / Formula** 1 / Tricalcium Silicate (C_3S) / 3 CaO SiO_2 2 / Dicalcium Silicate (C_2S) / 2 CaO SiO_2 3 / Tricalcium Aluminate (C_3A) / 3 CaO Al_2O_3 4 / Tetracalcium Aluminoferrite (C_4AF) / 4 CaO $Al_2O_3Fe_2O_3$	**½ (each)**	**2**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.1	**c)**	**Define:-** **i) Flakiness Index** **ii) Elongation Index**		
	Ans.	**Flakiness Index:** It is the percentage by weight of particles whose least dimension (thickness) is less than $(3/5)^{th}$ of its mean dimension passing through thickness gauge, is called as Flakiness Index.	**1**	**2**
		Elongation Index: It is the percentage by weight of particles whose greatest dimension (length) is more than $(14/5)^{th}$ of its mean dimensionretained on length gauge, is called as Elongation Index.	**1**	
	d)	**State Duff Abraham's law for water cement ratio.**		
	Ans.	**Duff Abraham's Law for water cement ratio:** For workable concrete, the compressive strength of concrete depends on water-cement ratio.	**2**	**2**
	e)	**State two purposes of using retarding admixtures in concrete.**		
	Ans.	**Purposes of using retarding admixtures in concrete:** 1. To reduce the rate of hardening or setting of cement concrete. 2. To avoid sudden or rapid hardening of concrete due to hot weather. 3. To get sufficient time for mixing, transportation, placing and compaction. 4. To avoid formation of expansion cracks on concrete surface.	**1 each (any two)**	**2**

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>Q.1</td><td>f)

Ans.</td><td>Give the two points of comparison between volume batching and weight batching.

<table>
<tr><th></th><th>Volume Batching</th><th>Weight Batching</th></tr>
<tr><td>1</td><td>In volume batching, measurement of materials is done by taking volume.</td><td>In weight batching, measurement of materials is done by taking weight.</td></tr>
<tr><td>2</td><td>Gauge boxes are useful for volume batching.</td><td>Weight machine is used for weight batching.</td></tr>
<tr><td>3</td><td>Volume batching gives approximate measure of materials.</td><td>Weight batching gives accurate measure of materials.</td></tr>
<tr><td>4</td><td>Volume batching is useful for less important works where ordinary mix is used.</td><td>Weight batching is useful for more important works where standard mix is used.</td></tr>
<tr><td>5</td><td>Volume batching is useful for aggregates and water.</td><td>Weight batching is useful for cement.</td></tr>
<tr><td>6</td><td>Volume batching requires less time even with unskilled labours.</td><td>Weight batching requires skilled labours and more time.</td></tr>
</table></td><td>1 each (any two)</td><td>2</td></tr>
<tr><td></td><td>g)

Ans.</td><td>State the principle of Rebound Hammer Test.

Principle of Rebound Hammer Test: Rebound hammer test method is based on the principle that the rebound of an elastic mass attached to plunger i.e. rebound number depends on the hardness of the concrete surface against which the mass strikes.
If the rebound of hammer is more, it indicates surface is hard, solid and dry. But if rebound of hammer is less, then tested concrete may be soft, porous and moist.</td><td>2</td><td>2</td></tr>
</table>

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q. 2		**Attempt any <u>THREE</u> of the following:**		**(12)**
	a)	**Explain the experimental procedure for the determination of standard consistency of cement.**		
	Ans.	**Procedure of standard consistency test on cement:** 1. Take 400 gm cement sample and add 20% water by weight to prepare cement paste within gauge time. 2. Fill this cement paste in Vicat's mould completely, having height 40 mm. 3. Now, attach the plunger of 10 mm dia. to Vicat's apparatus and take the initial reading 'd1' mm by keeping the plunger touching to top surface of cement. 4. Allow the penetration of plunger in cement paste by releasing dash-pot. Take the final reading on graduated scale as 'd2' mm. 5. Calculate total penetration of plunger as (d1 – d2) mm. if it is not 33-35 mm, then repeat all above steps by increasing water % in cement. 6. Note down the % water, which gives exact 33-35 mm penetration from top of mould. This water % should be taken as standard consistency of cement	**4**	**4**
	b)	**Explain the procedure to determine the crushing value of aggregate.**		
	Ans.	**Procedure for determination of aggregate crushing value :** 1. Take air dried aggregate passing through 12.5 mm and retained on 10 mm IS sieve. 2. Fill it in crushing mould within 3 layers. Compact each layer 25 times using tamping rod. 3. Calculate the weight of aggregate filled by subtracting empty weight of crushing mould as W_1 gms. 4. Now, keep the mould under plunger of compression testing machine and apply load 4 ton per minute for total 10 minutes; so that aggregate will crush. 5. Sieve the crushed material through 2.36 mm IS sieve and take the weight of aggregate retained on this sieve as W_2 gms. 6. Finally calculate percentage Aggregate Crushing Value i.e. %ACV as $(W_2 / W_1) \times 100$.	**4**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2				
	c)	**Explain in detail classification of the aggregate based on it's size and shape.**		
	Ans.	**Classification of aggregate based 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 are called as all in one aggregate.	**2**	
		Classification of aggregate based to shape: **1. Rounded aggregate:** The aggregate is of rounded or circular shape completely shaped by attrition or water worn. Generally fine sized aggregate i.e. fine sand is considered as rounded aggregate. **2. Partly rounded aggregate:** The aggregate is of partly circular shape formed by attrition. The medium and coarse type of sand is partly rounded aggregate. **3. Angular aggregate:** The aggregate is of triangular or angular shape which contains well defined edges, formed at intersection of roughly planer faces. **4. Flaky aggregate:** The aggregate whose thickness is less than its $(3/5)^{th}$ mean aggregate passing through thickness gauge. **5. Elongated aggregate:** The aggregate whose length is more than its $(14/5)^{th}$ mean aggregate retained on length gauge.	**2**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.2	**d)**	**Sieve analysis test was conducted on sand and following observations are taken. Determine fineness modulus (FM) of sand.**		

Sieve size (mm)	**4.75**	**2.36**	**1.18**	**0.6**	**0.3**	**0.15**	**Pan**
Weight retained on sieve (gm)	**22**	**115**	**225**	**240**	**280**	**105**	**13**

Ans.

Sieve size (mm)	**Weight retained on sieve (gm)**	**Cumulative weight retained (gm)**	**% Cumulative weight retained (%)**
4.75	22	22	2.2
2.36	115	137	13.7
1.18	225	362	36.2
0.6	240	602	60.2
0.3	280	882	88.2
0.15	105	987	98.7
Pan	13	1000	--
∑ % cumulative wt. retained upto 150µ IS sieve			**299.2**

2

F. M.=∑ % cumulative wt. retained upto 150µ IS sieve / 100 **1**

F.M. = 299.2/100

F.M. = 2.992 **1**

4

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3		**Attempt any THREE of the following:**		**(12)**
	a)	**Explain the slump cone test in details for the determination of workability of fresh concrete.**		
	Ans.	**Procedure of slump cone test**: 1. Clean and apply oil to inner surface of slump cone and place it on non-porous plate. 2. Fill the freshly mixed concrete into cone in four layers. Tamp each layer 25 times using round headed rod. Remove the excess concrete using trowel. 3. Now lift the cone vertically using both handles, so that concrete will subside down in one of the form i.e. true, shear or collapse slump. 4. Calculate the slump height of concrete as height of cone minus height of concrete subsidence. 5. The degree of workability based on slump height is defined as per following.	**3**	
				4
		Slump Height / **Degree of Workability** 0 to 25 mm — Very Low 25 to 50 mm — Low 50 to 100 mm — Medium 100 to 175 mm — High More than 175 mm — Very High	**1**	
	b)	**Illustrate the effect of following properties of coarse aggregate on compressive strength of concrete:-** **i) Size of aggregate** **ii) Shape of aggregate**		
	Ans.	**Effect of properties of coarse aggregates on compressive strength ofconcrete:** **i) 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 and 20 mm) will give better workable concrete with more compressive strength.	**2**	
				4
		ii) Shape of aggregate: If shape of coarse aggregate is angular, then there is good interlocking of aggregate particles. Hence it gives more compressive strength. But if shape of coarse aggregate is sub-angular or sub-rounded, then compressive strength reduces due to less bonding between particles.	**2**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.3	**c)**	**State the necessity of supervision of concreting operations and precautions to be taken to avoid the wastage of material.**		
	Ans.	**Necessity of supervision for concreting operation:** 1. Supervision is necessary to complete all concretingoperations in standard manner. 2. It is necessary to avoid any type of delay in concrete work. 3. It is also beneficial to reduce wastage of concrete during concreting. 4. It is required to get overall quality in concrete work at site. 5. Supervision becomes essential in maintaining smooth flow of concreting operations at each stage of project. 6. It found very effective in controlling bad workmanship.	**1 each (any two)**	**4**
		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 each (any two)**	
	d)	**Define workability of concrete. Also state the factors affecting workability.**		
	Ans.	**Workability of concrete:** It is the ability of concrete for its easy handling in various concreting operations viz. mixing, transportation, placing and compacting, is called as workability of concrete.	**2**	
		Factors affecting workability : 1. Water content (W/C ratio) 2. Mix proportions of concrete 3. Size of aggregate 4. Shape of aggregate 5. Surface texture of aggregate 6. Grading of aggregate 7. Use of admixtures 8. Method of mixing of concrete	**1 each (any two)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4		**Attempt any THREE of the following:**		**(12)**
	a)	**Enlist the various concrete operations in sequence and explain any one in detail.**		
	Ans.	**Concreting operations in sequence:** 1. Batching of materials 2. Mixing of materials 3. Transportation of concrete 4. Placing of concrete 5. Compaction of concrete 6. Curing of concrete 7. Finishing of concrete	**2**	
		Batching: The measurement of materials for making concrete mixture is known as batching. The batching is the first operation of concreting, which can be done in two ways.		**4**
		1. Volume Batching: The method of measuring the materials by volume of ingredients used for concrete. Generally sand, aggregate and water is measured in terms of its volume. It is approximate, hence useful for less important constructions like PCC, compound wall etc.	**2**	
		2. Weight Batching: The method of measuring the materials by weight of ingredients used for concrete. Generally cement is taken based on its weight. It is accurate, hence useful for more important constructions like high rise buildings, sky-scrappers etc. ***(Note: Explanation of any one concreting operation mentioned above should be considered.)***		
	b)	**Define Concrete Mix Design. Write four objectives of concrete mix design.**		
	Ans.	**Concrete Mix Design:** The process or method of determining the quantity and proportions of materials required for particular grade of concrete is called as Concrete Mix Design.	**2**	
		OR The stepwise procedure to find the quantities of materials required for particular grade of concrete is called as Concrete Mix Design.		**4**
		Objectives 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 ingredients. 4. To maintain workability of concrete mix throughout work. 5. To obtain maximum possible yield per bag of cement. 6. To ensure less defects and enhanced durability of concrete.	**1 each (any two)**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
	c)	**Write two advantages and two disadvantages of vacuum dewatered concrete floor.**		
	Ans.	**Advantages of vacuum dewatered concrete floor:** 1. Vacuum dewatered concrete floor has more compressive strength due to dewatering process. 2. In this floor, additional cement is not required for finishing as it requires 40% less cement. 3. The floor possesses more hardness with enhanced tensile strength than ordinary concrete floor. 4. Vacuum dewatered floor has less permeability, hence advantageous in water reservoirs. 5. It has better resistance to wear and tear, cracks; hence gives more durability compared to ordinary floors. **Disadvantages of vacuum dewatered concrete floor:** 1. Vacuum dewatered floor requires high initial cost due to heavy machineries. 2. This floor requires skilled labours to attain the required quality. 3. It is applicable to large areas only i.e. mega projects due to more cost. 4. Excessive dewatering leads to reduction in water content, which may result in incomplete hydration.	**1 each (any two)** **1 each (any two)**	**4**
	d)	**Enlist any four precautions to be taken during cold weather concreting.**		
	Ans.	**Precautions to be taken in cold weather concreting:** 1. Concreting 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. Both fine and coarse aggregate should be heated before its use. 7. Rapid hardening or quick setting cement should be used for fast setting of concrete	**1 each (any four)**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.4	**e)**	**Explain fibre reinforced concrete.**		
	Ans.	**Fibre Reinforced Concrete:** 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 **Properties of Fibre Reinforced Concrete:** 1. Very high tensile strength 2. Crack arrester 3. More fire resistance 4. High shear and torsional strength 5. Resistance to freezing and thawing damage 6. More resistance to shocks and vibration 7. Self-weight is less 8. Smooth finishing **Applications of Fibre Reinforced Concrete:** 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.	**4**	**4**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5		**Attempt any TWO of the following:**		**(12)**
	a)	**Explain the laboratory procedure to determine the compressive strength of concrete cubes as per IS 516-1959 w.r.to following points:-** **i) Preparation of test specimen** **ii) Procedure of testing** **iii) Interpretation of results**		
	Ans.	**Procedure to determine the compressive strength of concrete:-** **i) Preparation of test specimen:** 1. Take concrete cube mould of 15cm side and apply oil to internal surface of mould. 2. Prepare the fresh concrete mixture of required specific grade and fill it in cube mould by properly compacting it using tamping rod. Prepare the two more cubes in similar manner. 3. Compact each cube on table vibrator to remove air voids for 5 minutes. 4. Keep all the compacted moulds at room temperature for 24 hrs for initial hardening and at relative humidity 90%. 5. Remove cube moulds and keep cement cubes under fresh water i.e. in curing tank for curing for 1, 3, 7, 14, 21, 28 days. **ii) Procedure of testing:** 6. Remove cube from water after required curing period and keep it under Compression Testing Machine (CTM) for testing. 7. Apply compressive load at a rate of 4 Tonnes/min for 10 minutes or till failure of cube. Note down the failure load in N shown by red pointer in dial gauge. 8. Finally calculate compressive strength of cube as failure load in N by cross sectional area of cube in mm^2. 9. The average of three test results can be considered as average compressive strength in N/mm^2 or MPa. **iii) Interpretation of results:** 1. The calculated result of compressive strength gives the idea about the grade of concrete. If concrete possess strength 23 N/mm^2 or 23 MPa, then the grade of concrete will be designated as M20 i.e. M=Mix; and 20 = 20 N/mm^2. 2. Similarly, strength of concrete lies in between 25 and 30 MPa, i.e. say 28.5 N/mm^2; then the grade of concrete is considered to be M25. 3. It means that the lower value than the test result value is used to designate the grade of tested concrete. 4. In other words, when we test the known grade say M25, then the test result value should be come out more that the requirement. Otherwise such concrete is rejected and casted concrete is needed to demolish.	**2** **2** **2**	**6**

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	**b)**	**Explain in details the ultrasonic pulse velocity test and technique of measuring pulse velocity through concrete.**		
	Ans.	**Procedure of measuring ultrasonic pulse velocity as per I.S.13311:** 1. Identify the target concrete surface and clean it properly. Then define two end points of application of ultrasonic pulses. Note down the path length L in mm between two ends. (Generally 100-150mm) 2. Apply one of the acoustical coupling materials i.e. grease or oil to both the points of the concrete. 3. Attach the transmitter and receiver end of transducer to the identified concrete surface in one of the form given in figure below. 4. Generate the ultrasonic pulses or waves of 50 to 60 kHz using electro-acoustical or ultrasonic pulse generator; so that it will pass through the transmitter end attached to concrete and will reach to receiver end depending upon homogeneity of concrete mass. 5. Note down the time of travel i.e. transit time (T) of these waves displayed on display unit of electronic timing device in seconds. 6. Calculate the ultrasonic pulse velocity (V) of transmitted waves as V=(L/T) in Km/s. 7. Repeat all above steps at other locations to calculate the average ultrasonic pulse velocity of all such observations. 8. Determine the overall quality of concrete based on calculated ultrasonic pulse velocity by using table given below.	**3**	**6**
		Specification for deciding the quality of concrete by Ultrasonic pulse velocity as per I.S.13311 (part 1 and 2)		

Velocity (Km/s)	Quality of concrete	Comp. Strength (N/mm^2)
4.5 and above	Very good	S > 40
3.5 to 4.0	Good	S = 25 -40
3.0 to 3.5	Medium	S = 10 - 20
2.0 to 3.5	Poor	S = 4 - 10
2.0 and below	Very poor	S < 4

1

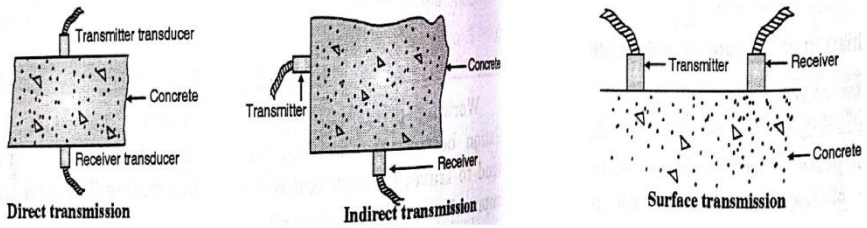


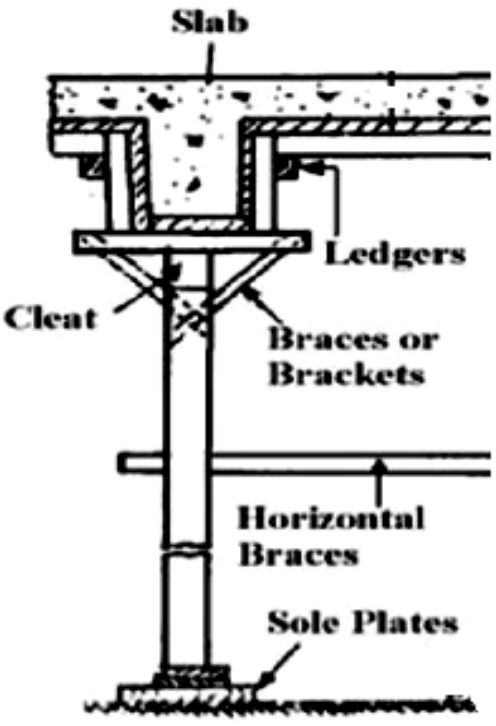
Fig. :Techniques of UPVT

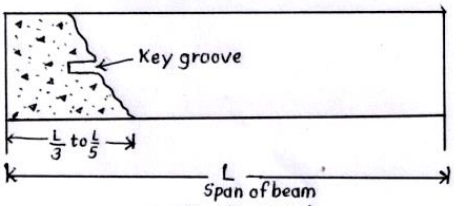
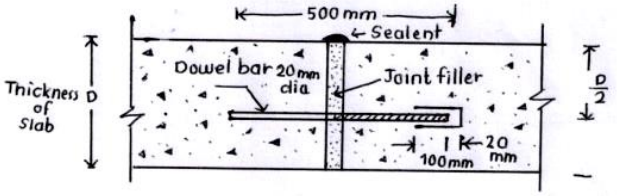
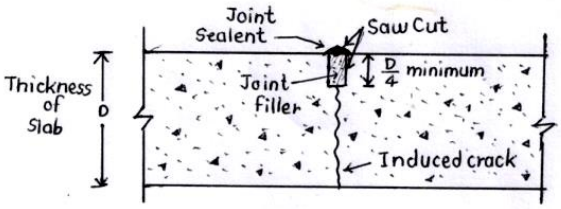
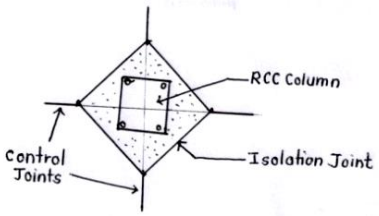
1

Techniques of Ultrasonic Pulse Velocity Test:

1. **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:** The transmitting and receiving transducers are placed on adjacent surfaces of the concrete slab. **1**
3. **Surface transmission:** The transmitting and receiving transducers are placed on same surfaces of the concrete slab.

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.5	**c)**	**Discuss the Non-destructive testing of concrete. List the various methods of NDT and explain any one in brief.**		
	Ans.	**Non-destructive testing of concrete:** The testing of concrete in which concrete need not to break physically to determine its properties, is called as Non-Destructive Testing (NDT). The strength can be tested without physical breaking of concrete; hence it is safe. It can give internal flaws, cavities and homogeneity details of concrete within short period. It avoids wastage of concrete, hence becomes economical up to certain extent. It is applicable in any type and position of concrete members shows wide applicability. Its results are simple and easy to interpret.	**2**	
		List of methods of NDT: 1. Ultrasonic Pulse Velocity test 2. Rebound Hammer Test 3. Radioactive method 4. Nuclear method 5. Electrical method 6. Magnetic method 7. Surface Hardness Method 8. Penetration and Pull out techniques.	**1 each (any two)**	**6**
		Rebound Hammer Test: 1. Initially the plunger of rebound hammer is kept touching to the target concrete surface 2. Then the tubular casing of hammer is pushed towards concrete, so that the spring gets wind up around the plunger 3. 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. 4. Due to backward motion of hammer, pointer on graduated scale will move in same direction. 5. Observe the distance travelled by pointer/rider on graduated scale as Rebound Number. 6. If this rebound Number is less, the strength of concrete will be less, But if it is more, then concrete possess sufficient strength. ***(Note: Explanation of any one method mentioned above should be considered.)***	**2**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6		**Attempt any TWO of the following:**		**(12)**
	a)	**Write four requirements of a good form work and draw a sketch showing c/s of formwork for R.C.C. beam.**		
	Ans.	**Requirements of a good form work:** 1. A good formwork 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.	**4 (any four)**	**6**
		 **Fig. : C/S of Formwork for R.C.C. Beam**	**2**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	**b)**	**Enlist the types of joints provided with neat sketch. Also state their necessity.**		
	Ans.	**List of joints in concrete:** 1. Construction joints 2. Expansion joints 3. Contraction joints 4. Isolation joints	**2**	
		Joints in concrete with necessity: **1. Construction joints:** To join two stages of concreting of construction elements like beam, column, slab, beam-column junction, wall, pardi, dam, bridge etc.  Construction Joint	**1**	
		2. Expansion joints: To allow the expansion of concrete slab due to temperature increase in case of concrete road.  Expansion Joint	**1**	**6**
		3. Contraction joints: To allow the contraction of concrete slab due to temperature decrease in case of concrete road.  Contraction Joint	**1**	
		4. Isolation joints: To isolate the construction element from remaining structure i.e. column and footing can be isolated to protect from earthquake.  Isolation Joint	**1**	

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
Q.6	**c)**	**Illustrate the curing of concrete. Explain the different methods of curing of concrete.**		
	Ans.	**Curing of concrete:** It is the process or method of keeping humidity or temperature of freshly placed concrete to ensure complete hydration of cement. Curing is the process of keeping the concrete moist and warm enough so that the hydration of the cement can take completed and concrete starts gaining required strength.	**2**	
		Methods of curing of concrete: **Water curing:** This is the best method of curing, because it satisfies all the requirements of curing. The precast concrete items are normally immersed in curing tanks for certain duration. Pavement slab, roof slab etc. are covered under water by making small pond. Water curing can be done in following ways: Immersion, Ponding method, Spraying or fogging, Wet covering.	**1**	
		Membrane curing: 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. 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. Other membrane curing sealing compounds are: Rubber latex emulsion, emulsion of resins, varnishes etc.	**1**	**6**
		Application of heat: The development of strength is not only a function of time but also that of temperature. Concrete subjected to higher temperature accelerates the hydration resulting in faster development of strength. Prefabricated members are normally steam cured, like sleepers, electric poles and fencing poles etc. In this curing is done by 3 ways: Steam curing- Water Vapors at 70-80^0; Curing by infra-red radiation- infra red rays of 90-100^0; Electrical curing- A.C. or D.C. current to produce heat.	**1**	
		Miscellaneous method: Calcium chloride is used either as a surface coating or as an admixture. It has been satisfactorily used as a curing medium. Both of these based on the fact that calcium chloride, being a salt shows affinity for moisture. The salt not only absorbs moisture from atmosphere but also retains moisture at the surface.	**1**	