**WINTER – 2015 EXAMINATION**

**MODEL ANSWER**

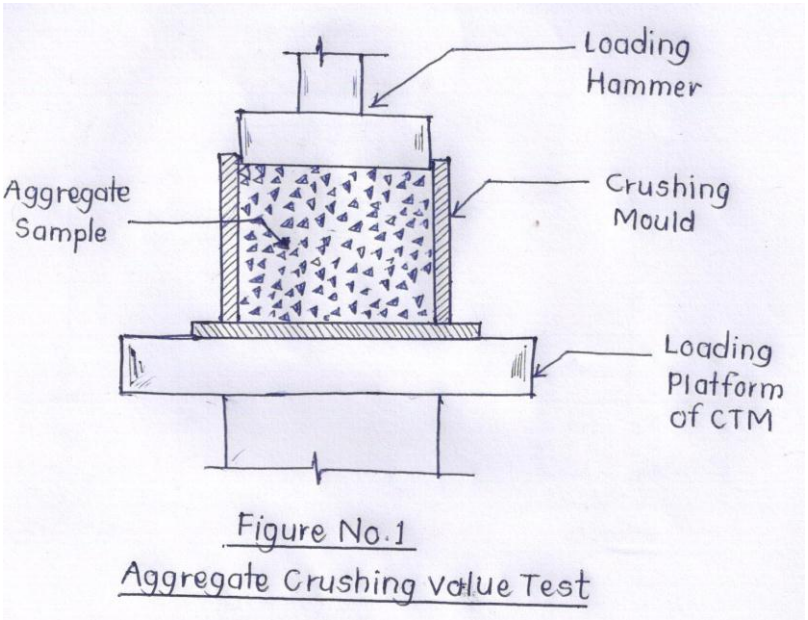
**Subject: Concrete Technology** **Subject Code**: **17504**

**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.

# Model Answer

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.1** | **A)** | Attempt **any three** of the following: | | **12** |
| | **a)** | **Define hydration and hardening of cement.**<br>**Ans: Hydration:** It is an exothermic chemical reaction which takes place due to addition of cement and water giving cement paste and heat evolved about 120 cal/gm of cement. | **2** | **4** |
| | | **Hardening of cement:** It is the process of gaining strength to cement due to its hydration. | **2** | |
| | **b)** | **What is initial and final setting time of cement?**<br>**Ans: Initial Setting Time-** It is the time elapsed from mixing of cement and water upto when IST needle penetrates upto 33-35mm from top of Vicat's mould. | **2** | **4** |
| | | Final Setting Time- It is the time elapsed from mixing of cement and water upto when FST needle gives just impression on cement paste in Vicat's mould. | **2** | |
| | **c)** | **Enlist four field tests for cement.**<br>**Ans:**<br>1. The control of fresh cement should be greenish grey.<br>2. The hand in cement bag should give cool feeling.<br>3. A pinch of cement should give smooth feeling to fingers.<br>4. The handful cement should float on water for some time before its dipping. | **1 mark each (Any four)** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.1** | **A)** | 5. The sharp edged cake under water should remain sharp edged even after 24 hrs.<br>6. The colour of cement should not be changed after burning.<br>7. The cement should not contain visible lumps in it.<br>8. The cement roll should give shiny surface after cutting with knife. | | |
| | **d)** | **Enlist ingredients of cement.**<br>**Ans:**<br>1. Lime – (CaO) – 60-67%<br>2. Silica – ($SiO_2$) – 17-25%<br>3. Alumina – ($Al_2O_3$) – 3-8%<br>4. Gypsum – ($CaSO_4$) – 2-3%<br>5. Minor compounds in the form of oxides – ($Fe_2O_3$, MgO, $SO_3$, $Na_2O$, $K_2O$) – 0.1-2% | **1 mark each (Any four)** | **4** |
| | **B)** | Attempt **any one** of the following: | | **6** |
| | **a)** | **Explain with neat sketch the experimental procedure to determine crushing value of aggregates.**<br>**Ans:**<br>  <br><br>Figure No.1<br>Aggregate Crushing Value Test<br>1. Take the aggregate sample passing through 12.5 mm and retained on 10 mm I.S. sieve.<br>2. Fill it in crushing mould in three layers by tamping each layer 25 times with tamping rod.<br>3. Calculate the weight of aggregate filled in mould by subtracting empty weight of crushing mould as ‘A’ grams.<br>4. Now keep it under compression testing machine (CTM) with plunger touching to top of aggregates filled.<br>5. Apply the load uniformly at a rate of 4 tonne/min for 10 minutes, so that aggregates will crush into fine particles. | **2**<br>**4** | **6** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.1** | **B)** | 6. Take out crushed sample and sieve it through 2.36 mm I.S. Sieve. Take the weight of aggregate particles passed through 2.36 mm I.S Sieve as 'B' grams.<br>7. Calculate aggregate crushing value as B/A X 100 in percentage for given aggregate. | | |
| | **b)** | **Sieve analysis was conducted on sand with 500 gm of sample and observations are as below. Determine F. M. of sand.**<br>**Sieve size (mm): 10 \| 4.75 \| 2.36 \| 1.18 \| 600µ \| 300µ \| 150µ**<br>**Weight Retained (gm): 0 \| 10 \| 50 \| 50 \| 95 \| 185 \| 110**<br>**Ans:** | | |
| | | **Sieve size (mm) / Wt. Retained (gm) / Cumulative Wt. Retained (gm) / % cumulative wt. retained (%)**<br>10 / 0 / 0 / 0<br>4.75 / 10 / 10 / 2<br>2.36 / 50 / 60 / 12<br>1.18 / 50 / 110 / 22<br>0.6 / 95 / 205 / 41<br>0.3 / 185 / 390 / 78<br>0.15 / 110 / 500 / 100<br>Tota / 500 / - / 255 | **4** | **6** |
| | | Fineness Modulus of sand = (Sum of % cumulative wt. retained upto 150µ I.S. Sieve) / 100 | **1** | |
| | | F. M. = 255/100<br>F. M. = 2.55 | **1** | |

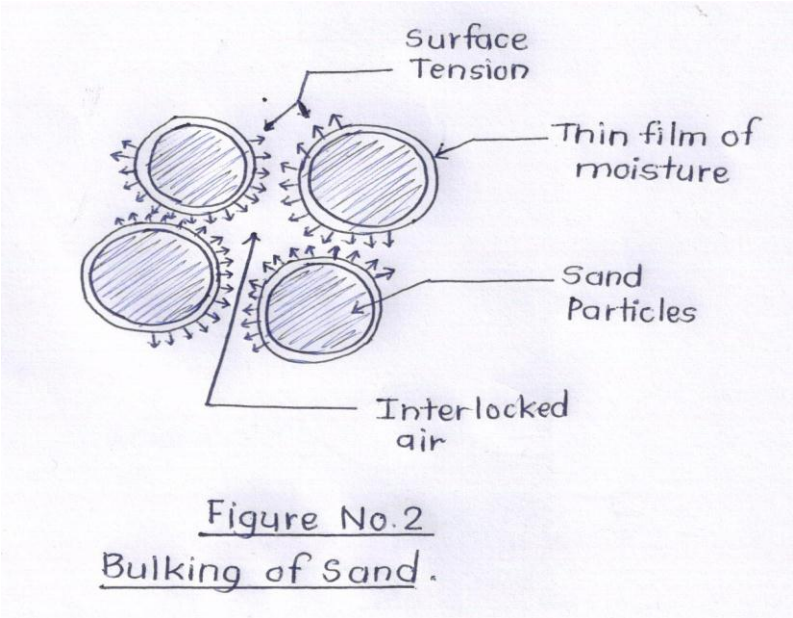
| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.2** | | Attempt **any four** of the following: | | **16** |
| | **a)** | **Define workability and explain any 3 factors affecting workability of concrete.**<br>**Ans: Workability –** It is the easiness in handling of concrete mixture for its mixing, transportation, placing and compaction.<br><br>**Factors affecting workability –**<br>1. Water content – If water content i.e. water-cement ratio is more then, concrete shows more workability.<br>2. Size of aggregate – if aggregate of large i.e. coarser size is more, then concrete shows lesser workability.<br>3. Shape of aggregate – If aggregate of rounded shape is more, then concrete gives more workability.<br>4. Use of admixtures – If air entraining admixtures are used, concrete results more workability.<br>5. Grading – Well graded aggregate gives more workability than poorly graded aggregate.<br>6. Surface texture – Aggregate having smooth surface texture give more workability than aggregate having rough surface texture.<br>7. Porosity and absorption of aggregate – Porous aggregate absorb water of concrete mix and water cement ratio decreases, workability of concrete decreases.<br>8. Temperature – As temperature increases, workability decreases. | **1**<br><br>**3 marks (Any three)** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.2** | **b)** | **State different methods of mix design and explain any one in detail.**<br>**Ans:** Methods of mix design are as follows;<br>1. Indian Standard Method<br>2. Arbitrary proportions method<br>3. Maximum density of aggregate method<br>4. Fineness modulus method<br>5. American Concrete Institute method<br>6. Indian Road Congress 44 method<br>7. High strength concrete mix design method<br>8. Flexural strength method<br>9. Surface area of aggregate method<br>10. Trial and error method<br><br>**Indian Standard (IS 10262 – 2009) Method –**<br>This method is suitable to design concrete of grades more than 20 N/mm2. The basic steps in design procedure are as follows;<br>1. Target mean strength<br>$\overline{fck} = fck + t.s$<br>2. Selection of water-cement ratio from graph as per IS 456 – 2000.<br>3. Selection of water content and fine to total aggregate ratio.<br>4. Calculation of cement content per $m^3$ of concrete.<br>5. Calculation of fine and coarse aggregate content per $m^3$ of concrete.<br><br>***Note: Explanation of any one of the above methods should be considered.*** | **2 marks (Any four)**<br><br>**2** | **4** |
| | **c)** | **State two advantages and two disadvantages of rebound hammer test.**<br>**Ans: Advantages of rebound hammer test;**<br>1. It is easy to operate within short duration.<br>2. The results of rebound number are easy to interpret.<br>3. Rebound hammer can be used horizontally, vertically and in inclined position.<br><br>**Disadvantages of rebound hammer test;**<br>1. Rebound of hammer may get affected due to roughness of concrete surface.<br>2. The age of concrete also varies with rebound number i.e. cured concrete gives more rebound no. than fresh one.<br>3. Surface moisture of concrete may give inaccurate rebound number. | **2 marks (Any two)**<br><br>**2 marks (Any two)** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.2** | **d)** | **Define bleeding, segregation, shrinkage and creep.**<br>**Ans: Bleeding –** It is the one type of segregation in which water came out on top of concrete surface. | **1** | |
| | | **Segregation –** It is the separation of concrete ingredients from each other. | **1** | **4** |
| | | **Shrinkage –** It is the formation of cracks on concrete due to water evaporation or evaporation during and after concrete. | **1** | |
| | | **Creep –** It is the deformation of concrete takes place even after removal of load by the age of concrete. | **1** | |
| | **e)** | **Explain the procedure for determining of compressive strength of concrete cubes.**<br>**Ans:**<br>1. Take three cubes of 15 cm sides and apply oil to its inner surface.<br>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.<br>3. Keep all the moulds at room temperature for 24 hrs for initial hardening and at relative humidity 90%.<br>4. Remove cube moulds and keep concrete cubes under fresh water for curing for 7, 14, 21, 28 days.<br>5. Remove cube from water after curing period and keep it under compression testing machine (CTM) for testing.<br>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.<br>7. Finally calculate compressive strength of cubes as failure load in N by cross sectional area of cube in mm2.<br>8. The average of three test cubes can be calculated as average compressive strength in MPa. | **4** | **4** |
| | **f)** | **State Duff Abraham's Law and its equation.**<br>**Ans: Duff Abraham's Law –** For workable concrete, the compressive strength of concrete depends on water-cement ratio.<br>Expression –<br>$S = \frac{A}{B^x}$<br>where, S = Strength of concrete<br>X = water-cement ratio<br>A, B = Empirical constants | **2**<br>**2** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.3** | | Attempt **any four** of the following: | | **16** |
| | **a)** | **Define formwork and enlist four requirements of good formwork.**<br>**Ans: Formwork –** It is the temporary structure constructed to place the concrete mass in it for attaining required shape of concrete. | **2** | |
| | | Requirements of good formwork;<br>1. It should be strong enough to carry the weight of concrete without bulging.<br>2. It should be easy to erect and dismantle on site.<br>3. It should be reusable for no. of times to achieve economy.<br>4. It should be easily available to avoid delay.<br>5. It should give uniform and smooth finishing after removal.<br>6. It should be leakproof with perfect joints.<br>7. It should be durable with lesser wear and tear. | **½ mark each (Any four)** | **4** |
| | **b)** | **Enlist different methods of transportation of concrete and explain any one.**<br>**Ans:** The different methods of transportation of concrete are;<br>1. Fully manual method<br>2. Semi- manual method<br>3. Mechanical method | **2 marks (Any two)** | **4** |
| | | Fully manual method – In this method, concrete is carried with mortar pan or ghamelas through the hands of labours. Sometimes, concrete is transported in wheel barrows so that labours can move along walkway.<br>This manual method is suitable when distance of transportation is les. It is more suitable for such condition where mechanical method becomes unsuitable.<br>***Note: Explanation of any one of the above method should be considered.*** | **2** | |
| | **c)** | **Enlist four precautions to be taken while placing the concrete.**<br>**Ans:** Precautions to be taken while placing of concrete are;<br>1. While placing of concrete, the mixture should reach at all corners uniformly and not intensively at one place.<br>2. Placing thickness for mass concrete should be less than 30-45 cm and for RCC work should be less than 15-30 cm.<br>3. Before placing of concrete the formwork joints should be checked to avoid bleeding.<br>4. Concrete mixture should not be dropped from the height more than 1 m.<br>5. Before placing of concrete, oiling to inner face of formwork should be done.<br>6. Flow of placing of concrete should be continuous and joints should be left at appropriate position. | **1 mark each (Any four)** | **4** |

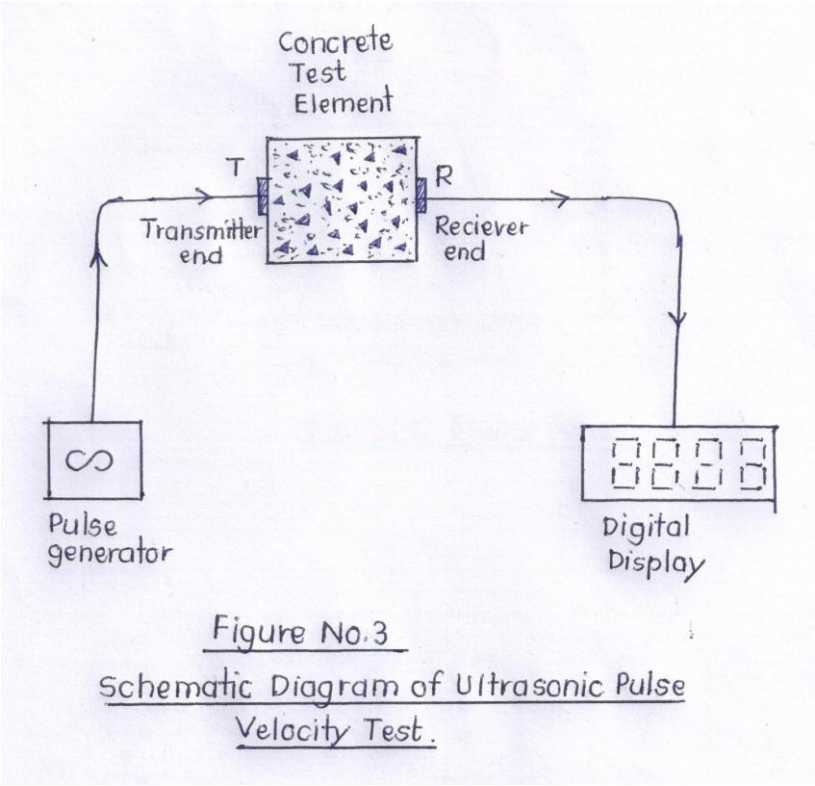
| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.3** | **d)** | **State four precautions to be taken during compaction of concrete.**<br>**Ans:** The precautions to be taken during compaction of concrete are;<br>1. Concrete should be compacted for a thickness of layers up to 20-25 cm.<br>2. Vibrator should be operated completely on concrete so that full compaction can be obtained.<br>3. Formwork should be tight enough to avoid leakage and hence over vibration should be avoided.<br>4. Excess vibration should be avoided to displace concrete laterally from one position to other position.<br>5. Vibrator should not be allowed to touch the formwork and reinforcement to avoid damages.<br>6. Revibration of concrete is not harmful, provided that concrete is not set hard. | **1 mark each (Any four)** | **4** |
| | **e)** | **Define curing and state necessity of curing.**<br>**Ans: Curing –** It is the process or method of keeping humidity or temperature of freshly placed concrete to ensure complete hydration of cement. | **1** | |
| | | Necessity of curing –<br>1. Curing is essential to maintain sufficient moisture in concrete for completing hydration.<br>2. It is necessary to maintain uniform temperature of concrete i.e. above freezing point.<br>3. It is useful to avoid chances of formation of shrinkage cracks and to attain uniform finishing.<br>4. It helps to increase impermeability and durability of concrete by achieving characteristic compressive strength. | **3 marks (Any three)** | **4** |
| | **f)** | **Give types of joints and enlist any 6 materials used for filling joints.**<br>**Ans:** Types of joints in concrete are;<br>1. Construction joint<br>2. Expansion joint<br>3. Contraction joint<br>4. Isolation joint | **1 mark (Any two)** | |
| | | Materials used for filling joints;<br>1. Asphalt, tar, bituminous materials<br>2. Fibre and fibre products<br>3. Sponge rubber<br>4. Cork<br>5. Polymer<br>6. Thermoplastic<br>7. Glass | **1/2 mark each (Any six)** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.4** | **A)** | Attempt **three** of the following: | | **12** |
| | **a)** | **Explain phenomenon of bulking of sand.**<br>**Ans:** As bulking is a phenomenon of increasing total volume of sand due to surface moisture present on sand particles; it takes place due to surface tension between adjacent sand particles.<br>The thin film of moisture gets formed around the surface of particles. During formation some air get interlocked between film and particle, which exerts surface tension as shown in fig. 2.<br>Due to this surface tension is developed. Each particle tends to push or move away from each other. This results in increase in total volume of sand ultimately.<br>  <br><br>Figure No.2<br>Bulking of Sand. | **3**<br><br>**1** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.4** | **A)** | | | |
| | **(b)** | **Explain in detail ultrasonic pulse velocity test.**<br>**Ans:** It is simple and quick test in which pulse velocity is determined passing through concrete.<br>1. The ultrasonic pulse or waves are generated from pulse generator.<br>2. These waves transmit through transmitter end into the concrete mass and receive at receiver end as shown in fig. 3.<br>3. The digital display shows the time required to pass the waves through concrete mass.<br>4. The pulse velocity is then calculated by dividing path or wavelength by time of travel.<br>5. The average pulse velocity of wave propagation is calculated by testing concrete at two more locations.<br>6. Depending on pulse velocity, quality of concrete is decided as follows; | **2** | |

| 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 |

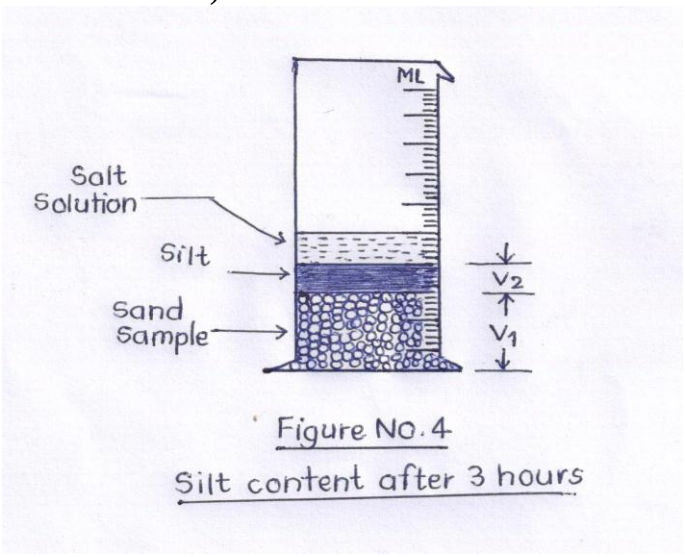
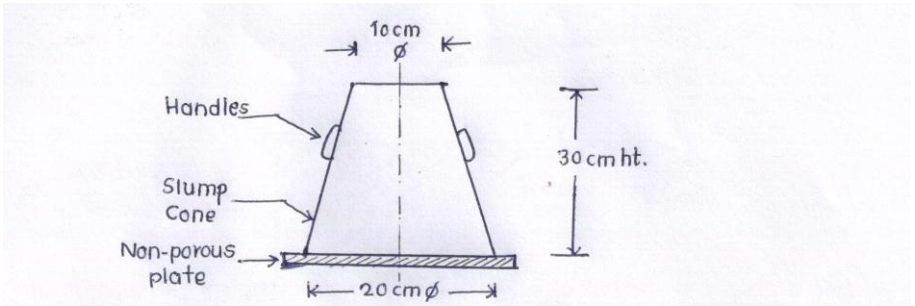
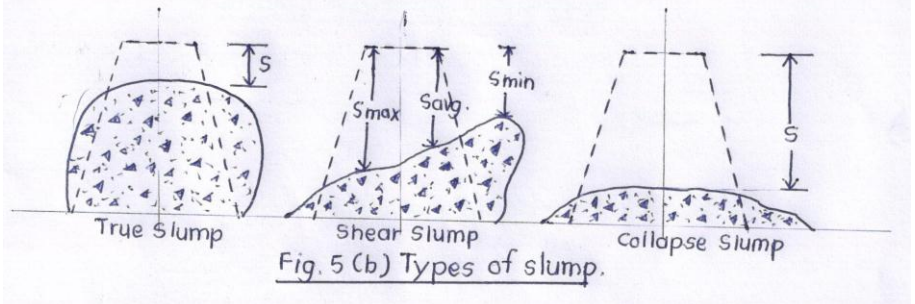
**1** **4**




**1**

Figure No.3
Schematic Diagram of Ultrasonic Pulse Velocity Test.

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.4** | **A)** | | | |
| | **c)** | **Differentiate between weight batching and volume batching (any 4 points).**<br>**Ans.**<br>**Weight batching** / **Volume batching**<br>1. In this, measurement of materials is done by taking weight. / 1. In this, measurement of materials is done by taking volume.<br>2. Weight machine is used. / 2. Gauge boxes are used.<br>3. It is more accurate. / 3. It is approximate or less accurate.<br>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.<br>5. Weigh batching is done for cement generally. / 5. Volume batching is done for aggregates and water.<br>6. It requires skilled labours and more time is required. / 6. It requires less time even with unskilled labours. | **1 mark each (Any four)** | **4** |
| | **d)** | **Enlist any 4 precautions to be taken while storing the cement.**<br>**Ans:** Precautions to be taken while storing the cement are;<br>1. Bags should not be stacked more than 8-10 bags vertically.<br>2. Stacking should be lengthwise and widthwise alternatively.<br>3. Stacking should be 300 mm away from walls with 1 m gap between two rows for easy handling.<br>4. Stacking should be on wooden planks 300 mm above ground floor to avoid dampness.<br>5. Exhaust fans and windows should be provided for ventilation.<br>6. Building should be with 150 mm concrete floor and 9" brick walls. | **1 mark each (Any four)** | **4** |
| | **B)** | Attempt **one** of the following: | | **6** |
| | **a)** | **Explain the experimental procedure to determine silt content of sand sample.**<br>**Ans:**<br>1. Prepare 1% salt solution by adding 10 gm common salt in 1000 ml water.<br>2. Fill this salt solution upto 50 ml mark in measuring cylinder. Now add sand sample in it to reach the mixture upto 100 ml mark. Finally add more salt solution to reach total volume upto 150 ml.<br>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.<br>4. Measure the separated volumes of sand and silt as V1 and V2 resp. | **4** | |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.4** | **B)** | 5. Calculate the silt content of given sand sample in percentage as (V2/V1) x 100. The silt content should be less than 6% as per IS (other than road concrete). | | **6** |
| | |  <br>Figure No. 4<br>Silt content after 3 hours | **2** | |
| | **b)** | **Explain with sketch slump cone test.**<br>**Ans:** | | |
| | |  <br>Fig. 5 (a) Slump Cone | **1** | |
| | |  <br>Fig. 5 (b) Types of slump. | **1** | |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.4** | **B)** | 1. Clean and apply oil to inner surface of slump cone and place it on non-porous plate as shown in fig. 5 (a).<br>2. Fill the freshly mixed concrete into cone in 4 layers. Tamp each layer 25 times using round headed rod.<br>3. Remove the excess concrete using trowel.<br>4. Now lift the cone vertically using both handles, so that concrete will subside down in one of the form as shown in fig. 5 (b).<br>5. Calculate the slump height of concrete as height of cone minus height of concrete subsidence.<br>6. The degree of workability is proportional to slump height. | **4** | **6** |
| **Q.5** | | Attempt **any four** of the following: | | **16** |
| | **a)** | **Enlist any 4 methods of waterproofing and material used for each method.**<br>**Ans:**<br>1. Water –proofing by using pore-fillers – Calcium chloride, zinc sulphate, chalk, fullers earth, talc etc.<br>2. Water proofing by using water repellent materials – Potash soaps, resins, vegetable oils, fats etc.<br>3. Water proofing by using integral compounds – CICO, Pudlo, Impermo, Complast, Protapin.<br>4. Water proofing by using liquid membrane – Roofex<br>5. Waterproofing by using slurry coatings – Hydraulic setting powder + liquid polymer.<br>6. Water proofing by injection grouting – Silicifying compounds. | **1 mark each (Any four)** | **4** |
| | **b)** | **Enlist different types of admixtures and function of each (any 4).**<br>**Ans:**<br>1. Accelerating admixture – To increase the rate of setting of the concrete and for early removal of formwork in cold climate.<br>2. Retarding admixtures – To reduce the rate of hardening of the concrete in hot weather.<br>3. Water reducing admixtures – To maintain appropriate water in concrete for deep beams, thin walls and tremy concrete.<br>4. Air entraining admixtures – To modify properties of plastic concrete like workability, segregation and of hardened concrete like impermeability and resistance to frost action.<br>5. Super plasticizers – To reduce water upto 30% without reducing workability.<br>6. Pozzolanic admixture – To reduce heat of hydration and alkali-aggregate reaction.<br>7. Grouting agents – To increase pumpability and rate of setting of grouting cement.<br>8. Bonding admixtures – To join old and new concrete at construction joints. | **1 mark each (Any four)** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.5** | | | | |
| | **c)** | **State 2 advantages and 2 limitations of RMC.**<br>**Ans: Advantages of Ready Mix Concrete (RMC);**<br>1. Bulk amount of concrete can be produced at a time to avoid delay in construction.<br>2. Wastage of materials can be avoided due to mechanized operations at plants.<br>3. RMC give higher quality mix than ordinary concrete due to computerized working of plant.<br>4. It can be easily transported longer distance without hardening, hence suitable even in congested urban area. | **2 marks (Any two)** | **4** |
| | | **Limitations of Ready Mix Concrete (RMC);**<br>1. RMC is expensive than ordinary concrete, hence suitable for large projects only.<br>2. Continuous and bulk supply of materials is necessary for smooth working of RMC plant.<br>3. It may get affected on its quality due to improper functioning of plant elements.<br>4. It requires skilled labours for operation and it has low profit margin. | **2 marks (Any two)** | |
| | **d)** | **What is fibre reinforced concrete? Write any 2 applications of it.**<br>**Ans:** When concrete mixture is prepared by adding individual or combination of different types of fibres in it, then such formed concrete is termed as Fibre Reinforced Concrete (FRC).<br>The fibre types like asbestos, glass, plastic, steel fibres can be used as reinforcement in concrete to increase various strength characteristics. | **2** | **4** |
| | | <u>Application of FRC</u> –<br>1. Machine foundations – To resist shock and dynamic loading.<br>2. Canal lining and precast elements – To gain impermeable finish.<br>3. Refractory lining – To resist temperature stresses. | **1 mark (Any two)** | |
| | **e)** | **Write short note on light weight concrete.**<br>**Ans:** The concrete whose self-weight is lesser comparative to ordinary concrete by using light weight aggregates (LWA).<br>The variety of LWA are the natural materials like volcanic pumice, thermal treatment materials like clay, slate or shale, industrial by-product containing fly-ash, slag etc.<br>The properties of light weight concrete depend 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.<br>Light weight concrete has following advantages;<br>1. Reduction in dead load gives saving in cost foundation and reinforcement.<br>2. More thermal and fire resistance. | **4** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.5** | **e)** | 3. Reduction in transportation and handling cost of precast unit.<br>4. Reduction in formwork and propping. | | |
| | **f)** | **Enlist any 4 effects of hot weather on concrete.**<br>**Ans:**<br>1. Due to hot weather, concrete shows rapid rate of hardening, which results difficulty in transportation of concrete.<br>2. Water from concrete mix gets evaporated fastly, which results on w/c ratio and less workability of concrete.<br>3. Water may get absorbed by formwork, aggregate or ground due to excessive heat.<br>4. More shrinkage cracks get developed on concrete surface due to incomplete hydration with less water in concrete. Hence, early finishing becomes more essential.<br>5. Continuous curing is required to keep humidity and to avoid further development of cracks.<br>6. Air entrained in concrete may get expelled due to temperature, hence workability may reduce additionally. | **1 mark (Any four)** | **4** |
| **Q.6** | | Attempt **four** of the following: | | **16** |
| | **a)** | **Write four reasons why grading of aggregate is necessary.**<br>**Ans:** The reasons for necessity of grading of aggregate are;<br>1. As grading of aggregate is analysis of particles, it is essential to classify aggregates in various categories like well graded, poorly graded etc.<br>2. These graded aggregates helps to produce required dense and compactable concrete.<br>3. Grading is useful to decide proportions in concrete to fill voids and to achieve strength of concrete.<br>4. Graded aggregates require less cement paste for its workability, which results in economy.<br>5. The problems like segregation, bleeding can be overcome by using well graded aggregates.<br>6. The concrete can give impermeability and smooth finish by the use of graded aggregates. | **1 mark (Any four)** | **4** |
| | **b)** | **Define flakiness index and elongation index.**<br>**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.<br><br>**Elongation index –** It is the percentage by weight of particles whose greatest dimension (length) is more than $(14/5)^{th}$ of its mean dimension retained on length gauge. | **2**<br><br>**2** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.6** | **c)** | **Write stripping time for removal of formwork for**<br>**i) Slabs with props left in position.**<br>**ii) Beams soffits with props left in position.**<br>**Ans:**<br>**i) Slabs with props left in position –** 7 to 14 days<br>Slabs up to span 4.5 m – 7 days<br>Slabs more than 4.5 m span – 14 days<br><br>**ii) Beams soffits with props left in position –** 14 to 21 days<br>Beams up to span 6 m – 14 days<br>Beams more than 6 m span – 21 days | **2**<br><br>**2** | **4** |
| | **d)** | **Enlist any 4 precautions to be taken during cold weather concreting.**<br>**Ans:** Precautions to be taken during cold weather concreting are as follows;<br>1. Concrete work should be done during day time or on sunny days.<br>2. Warm water should be added for mixing of ingredients of concrete.<br>3. Before placing of concrete, the formed ice, snow or frost should be removed from formwork.<br>4. The accelerating admixtures should be used to increase hardening of concrete.<br>5. A protective cover should be used over casted concrete to avoid cold winds and snow fall.<br>6. Aggregates (fine and coarse) should be heated before its use. | **1 mark (Any four)** | **4** |
| | **e)** | **Define admixtures and state any 3 purposes of using admixtures in concrete.**<br>**Ans: Admixture –** It is the fifth ingredient of concrete which is added in it to improve overall engineering properties required for different working conditions.<br><br>**Purpose of using admixtures in concrete;**<br>1. To increase or decrease the rate of setting the concrete.<br>2. To increase the degree of workability of concrete.<br>3. To improve water-proofing nature i.e. impermeability.<br>4. To reduce alkali-aggregate reaction.<br>5. To avoid corrosion due to saline water. | **1**<br><br>**1 mark each (Any three)** | **4** |

| Que. No. | Sub. Que. | Model Answers | Marks | Total Marks |
|---|---|---|---|---|
| **Q.6** | **f)** | **Write short note on self-compacting concrete.**<br>**Ans:** 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.<br>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.<br>SCC can be manufactured by adding mineral admixture i.e. flyash and chemical admixture i.e. 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.<br>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. | **4** | **4** |