# GUJARAT TECHNOLOGICAL UNIVERSITY

## 4th Semester Civil Engineering – PDDC

**Subject Code & Name :** X40602 - Concrete Technology

| Sr. No. | Course content |
|---|---|
| 1. | **General:**<br>Historical background, composition of concrete, general note on strength mechanism, current practice and future trends. |
| 2. | **Ingredients of Concrete:**<br>○ Cement - Chemical composition, hydration, heat of hydration, hydrated structure, various types of cement, testing of cement as per Indian standard.<br>○ Aggregates - Function in concrete, classification, effect of geometry & texture, strength, mechanical properties, moisture content, water absorption, bulking of sand, deleterious substances, sieve analysis, various grading and grading requirements, sampling & testing as per Indian Standards.<br>○ Water - General Requirements & limiting values of impurities.<br>○ Admixtures - Additives and admixtures, types, need and benefits Mineral admixture - Fly ash, silica fume, blast furnace slag, and other pozzolanic materials.<br>○ Chemical admixtures - Accelerator, retarder, water reducing elements, plasticizer and super-plasticizer, their functions and dosage. |
| 3. | **Fresh concrete:**<br>○ Methods of mixing, transporting and placing of concrete.<br>○ Workability – Definition and need, factors affecting workability, various tests as per IS and ASTM.<br>○ Segregation and bleeding, stiffening, re-tempering.<br>○ Curing: necessity and various methods, micro cracking. |
| 4. | **Hardened concrete:**<br>○ Compressive and tensile strength and their relationship, various tests as per IS and ASTM<br>○ Factors affecting strength – water cement ratio, gel space ratio, aggregate cement ratio, properties of ingredients, effect of age, maturity, aggregate cement-paste interface, various finishes of concrete.<br>○ Introduction to aspects of elasticity, shrinkage and creep.<br>○ Tests for strength of concrete: Destructive, semi destructive and non- destructive tests with their limitations, test methods as per IS and ASTM. |
| 5. | **Durability and permeability of concrete:**<br>Definitions, causes, carbonation, cracking |
| 6. | **Concrete in aggressive environment:**<br>Alkali - aggregate reaction, sulphate attack, chloride attack, acid attack, effect of sea water, special coating for water proofing, sulphate chloride and acid attack, concrete for hot liquids. |
| 7. | **Special Concrete:**<br>Review of behaviour and characteristics of high strength concrete, high performance concrete, fibre reinforced concrete, mass concrete, light weight and heavy weight concrete, Precast concrete. |

| | |
|---|---|
| **8.** | **Special concreting techniques:**<br>Pumped concrete, shotcrete, underwater concrete, pre-placed concrete, vacuum dewatered concrete, hot and cold weather concreting, Ready mixed concrete. |
| **9.** | **Concrete mix design:**<br>○ Principles of mix proportioning, probabilistic parameters, factors governing selection of mix.<br>○ Road note - 4, DOE, ACI and IS method of concrete mix design<br>○ Variability of test results, acceptance criteria, various IS code provisions. |
| **10.** | **Repair and rehabilitation:**<br>Distress in structure – causes and precautions, damage assessment of structural elements, repairing techniques and repairing materials. |

**Term Work :**

1. Term work shall consist of tests on cement and aggregate, fresh concrete and hardened concrete. It includes destructive, partial destructive and non- destructive tests.
2. Term work shall include report on topic assigned by respective lab in-charge.
3. Term work shall include field visit and students will have to submit a report on it.
4. Oral/Practical marks include viva-voce on practical performed and submitted reports.

**References Books:**


1. A.M. Neville : Properties of Concrete
2. D.F. Orchard : Concrete Technology
3. P Kumar Mehta, Monteiro : Concrete Technology
4. A.R. Santhakumar : Concrete Technology
5. M.S. Shetty : Concrete Technology
6. M.L. Gambhir : Concrete Technology

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–IV • EXAMINATION – WINTER • 2014**

**Subject Code: X40602** **Date: 29-12-2014**

**Subject Name: Concrete Technology**

**Time: 02:30 pm - 05:00 pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** Define Coarse and fine aggregates Explain the role of aggregates in Fresh and Hardened concrete. **07**

**(b)** Define Heat of hydration. Explain the Structure of the Hydrated cement. **07**

**Q.2** **(a)** Which are the various raw materials used for making concrete. List out the steps of manufacturing of concrete. **07**

**(b)** List out the raw materials required for making cement. Explain any one process of manufacturing of cement in detail. **07**

**OR**

**(b)** Differentiate between the following: (a) Initial setting time & final setting time of cement (b) Stiffening of cement & Hardening of cement. **07**

**Q.3** **(a)** Which are the various laboratory tests performed on Fresh Concrete. Explain the Compaction factor test in detail with proper figure. **07**

**(b)** Define Workability of concrete. Explain the various factors that influence workability **07**

**OR**

**Q.3** **(a)** Define Fineness Modulus. Find the fineness modulus of the aggregates for the given sieve analysis result. Also comment on what does the result indicates. **07**

| IS sieve size | 10 mm | 4.75 mm | 2.36 mm | 1.18 mm | 600 µm | 300 µm | 150 µm | 75 µm |
|---|---|---|---|---|---|---|---|---|
| Percentage passing | 100 | 92 | 74 | 55 | 23 | 12 | 9 | 7 |

**(b)** Explain the Bulking of sand in detail. If the sand is measured by volume and no allowance is made for bulking of sand, what will be its effect on a nominal concrete mix 1:2:4 for a bulking of 15%. **07**

**Q.4** **(a)** Why do we need to compact the concrete. Explain the various methods of compacting the concrete. **07**

**(b)** Define the following: **07**

1. M20 grade of concrete
2. 43 grade cement
3. Duff Abram's Law
4. 20 mm aggregate
5. 28 day strength of concrete
6. Bulk Density
7. Specific gravity

**OR**

**Q.4** **(a)** Explain Grading of aggregates. Explain the sieve analysis test in detail. **07**

**Q.4** **(b)** Define Non Destructive testing of Concrete. Explain any one NDT in detail **07**

**Q.5** **(a)** What leads to cracking of concrete. Explain Carbonation and corrosion of concrete in this context. **07**

**(b)** Write down the various steps of Concrete mix design as per IS method **07**

**OR**

**Q.5** **(a)** Write short notes on the following ( any four) **14**

1) Methods of curing the concrete
2) Segregation and bleeding
3) Physical tests on aggregates
4) Admixture of your choice
5) Compare strength cube & cylindrical specimen under compression
6) Cement of your choice
7) Special concreting techniques
8) Standard consistency of cement.

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–IV • EXAMINATION – SUMMER • 2014**

**Subject Code: X40602** **Date: 19-06-2014**

**Subject Name: Concrete Technology**

**Time: 10:30 am - 01:00 pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | |
|---|---|---|---|
| **Q.1** | **(a)** | Explain hydration process of cement and water requirements for hydration. | **07** |
| | **(b)** | Enlist various tests of cement and aggregate. Explain any one in detail with neat sketch. | **07** |
| **Q.2** | **(a)** | Describe effect of size, shape and texture of aggregate on concrete. | **07** |
| | **(b)** | Explain in brief various factors affecting strength of concrete? | **07** |
| | | **OR** | |
| | **(b)** | Enlist various tests for measurement of workability. Explain compacting factor test. | **07** |
| **Q.3** | **(a)** | The strength of a sample of fully matured concrete is found to be 30Mpa. Find the strength of identical concrete at the age of 7 days when cured at an average temperature during day time at 35°C, and night time at 15°C. Plowman's Coefficients at maturity 19800°Ch, A = 21 & B = 61. | **07** |
| | **(b)** | What is durability? Explain the impact of water-cement ratio on durability. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | What is sulphate attack? Explain in brief various methods of controlling sulphate attack. | **07** |
| | **(b)** | Enlist various non-destructive methods of testing concrete. Explain rebound hammer test with their limitations. | **07** |
| **Q.4** | **(a)** | Write steps involved in mix design using IS 10262 (2009) method. | **07** |
| | **(b)** | Explain in brief the problems encountered in hot weather concreting. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Write steps involved in mix design using DOE method. | **07** |
| | **(b)** | Write short note on creep and shrinkage. | **07** |
| **Q.5** | **(a)** | Write short notes on the following (any three)<br>(i) Retempering<br>(ii) Repairing materials for rehabilitation<br>(iii) Causes of distress<br>(iv) Retarders and Accelerators<br>(v) Underwater Concrete | **14** |
| | | **OR** | |
| **Q.5** | **(a)** | Write short notes on the following (any three)<br>(i) Carbonation<br>(ii) Gel-space ratio<br>(iii) Light Weight Concrete<br>(iv) Segregation<br>(v) Methodology of damage assessment | **14** |

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–IV • EXAMINATION – WINTER 2013**

**Subject Code: X40602 Date: 05-12-2013**

**Subject Name: Concrete Technology**

**Time: 02.30 pm - 05.00 pm Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** Define Standard Consistency of Cement. Explain the test procedure to find the same and also state its importance. **07**

**(b)** Explain the Structure of the Hydrated cement. **07**

**Q.2** **(a)** Give the detailed classification of the aggregates. **07**

**(b)** List out the raw materials required for making cement. Explain any one process of manufacturing of cement in detail. **07**

**OR**

**(b)** Enlist the Bogue's compounds. Explain the role of each compound in hydration of cement **07**

**Q.3** **(a)** Discuss the various moisture conditions of aggregates. Explain its effects on the concrete mix **07**

**(b)** Define Workability of concrete. Explain the various factors that influence workability **07**

**OR**

**Q.3** **(a)** Define Fineness Modulus. Find the fineness modulus of the aggregates for the given sieve analysis result **07**

| IS sieve size | 80 | 40 | 20 | 10 | 4.75 | 2.36 | 1.18 | 600 | 300 | 150 | Lower than 150 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Weight retained kg | 0 | 0 | 6 | 5 | 4 | - | - | - | - | - | - |

**(b)** Explain any one test on aggregates in detail **07**

**Q.4** **(a)** Briefly explain the quality of mixing water to be used for preparation of concrete. **07**

**(b)** Define the following: **07**

1. Gel water
2. Bound water
3. Maturity of concrete
4. Gel –space ratio
5. Creep
6. Bulk Density
7. Specific gravity

**OR**

**Q.4** **(a)** Explain various Laboratory and Physical tests conducted on cement. Explain the test procedure to determine the compressive strength of cement **07**

**Q.4** **(b)** Define Non Destructive testing of Concrete. Explain any one NDT in **07**

detail

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Why do we need to cure the concrete. Explain various methods of curing of concrete. | **07** |
| | **(b)** | Write down the various steps of Concrete mix design as per IS method | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Write short notes on the following ( any four) | **14** |

I. Fly-ash as an admixture
II. Alkali – aggregate reaction
III. Causes of cracks in concrete structures
IV. Fibre reinforced concrete
V. Factors affecting the durability of concrete
VI. Grading of aggregates
VII. Segregation and Bleeding
VIII. Destructive tests on hardened concrete

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER – IV • EXAMINATION – WINTER 2012**

**Subject code: X40602** **Date: 27/12/2012**

**Subject Name: Concrete Technology**

**Time: 02.30 pm - 05.00 pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** Describe any one method of manufacturing of cement. **07**

**(b)** Write procedure to test cement for following : **07**
(i) Setting time, (ii) compressive strength

**Q.2** **(a)** Differentiate between **07**
(i) Quick setting cement and Rapid hardening cement
(ii) Sulphate resisting cement and super sulphate cement
(iii) Ordinary Portland cement and Portland pozzolana cement

**(b)** Describe functions of following compound in cement **07**
(i) Tri-calcium silicate (ii) Di-calcium silicate (iii) Tetra calcium alumino ferrate

**OR**

**(b)** What do you understand by grading of aggregate? Explain different types of grading and their effect on ptroperties of concrete? **07**

**Q.3** **(a)** Write the desired properties of water to be used in concrete. Why sea water cannot be used in concrete? **07**

**(b)** Write ten percent fine test for aggregate and its significance. **07**

**OR**

**Q.3** **(a)** Discuss various factors affecting workability of concrete. **07**

**(b)** What do you understand by water absorption, water adsorption and surface moisture? Explain their effect on concrete manufacturing and how are they accounted in mix design. **07**

**Q.4** **(a)** What do understand by rebound number? How it is determined? Write factors affecting rebound number. **07**

**(b)** Why does a concrete cracks? Describe various types of cracks and various method of repairing of cracks. **07**

**OR**

**Q.4** **(a)** Give steps of ACI mix design method of concrete. **07**

**(b)** What is pumped concrete? Where it is used? Write the factors affecting pumpability of concrete. **07**

**Q.5** Write short note on following (any four) **14**

**(a)** Hot weather concreting **(b)** Ferrocement **(c)** Fiber reinforced concrete
**(d)** Heavy weight concrete **(e)** Bulking of sand **(f)** Jacketing
**(g)** Additives in cement **(h)** Carbonation of concrete

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - IV$^{th}$ Semester–Examination – May- 2012**

**Subject code: X40602**

**Subject Name: Concrete Technology**

**Date:09/05/2012** **Time: 02:30 pm – 05:00 pm**

**Total Marks: 70**

## Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | |
|---|---|---|---|
| **Q.1** | **(a)** | What is cement. What are the functions of cement. Explain in detail the 2 main types of cement. | **07** |
| | **(b)** | State in detail the chemical composition of Portland Cement. Explain the manufacturing process of cement. | **07** |
| **Q.2** | | Explain briefly **(any Two)** | **04** |
| | **(a)** | 1. Standard Consistency of Cement 2. Fineness Modulus of Aggregate 3. Duff Abram's Law 4. Durability of concrete | |
| | **(b)** | Enlist the various physical properties of aggregates. | **03** |
| | **(c)** | What do you mean by Non Destructive Testing. Explain any one of the NDT test in detail | **07** |
| | | **OR** | |
| | **(c)** | Enlist various Moisture conditions of aggregates. Explain each one in detail. Also explain Bulking of sand and its effects. | **07** |
| **Q.3** | **(a)** | What do you understand by workability of concrete mix? Give details of parameters affecting workability. | **07** |
| | **(b)** | Explain in detail the Compression test on concrete cubes. Also comment on the failure of compression specimen and comparison of cube and cylinder strength. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Enlist the various tests available to measure workability. Explain any one of the tests in detail. | **07** |
| | **(b)** | What do you understand by Alkali aggregate reaction. Explain the factors promoting the Alkali aggregate reaction. | **07** |
| **Q.4** | **(a)** | State the type of cement you will use for each structure mentioned below:<br>1. Dams. 2. Under water constructions. 3. Marine Works 4. Road repair works | **04** |
| | **(b)** | How is the field testing of cement carried out. | **03** |
| | **(c)** | Enlist the various signs of deterioration/distress in concrete structures. Explain Permeability and porosity of concrete. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Define the below:<br>1. Setting time of cement 2. Heat of Hydration<br>3. Creep 4. Gel – space ratio | **04** |
| | **(b)** | Explain the repairing process using the Injection grouting technique. | **03** |
| | **(c)** | Explain Carbonation and Chloride ingress i.e Corrosion formation in concrete in detail. | **07** |
| **Q.5** | **(a)** | Enlist various data required to design a concrete mix. Explain importance of | **07** |

various factors affecting the concrete mix design method

**(b)** What is the water requirement for complete hydration of cement. What happens if the excess water than required is used. **07**

**OR**

**Q.5** **(a)** Write Short Notes on below **( any Two)**

1. Classification of aggregates 2. Curing methods of concrete 3. Grading of aggregates 4. Determination of Tensile strength of concrete. **04**

**(b)** State the difference between the following: (Any Three) **03**

1. Mortar and Concrete
2. 43 grade cement and Mix M20
3. Initial setting time and Final setting time of cement.
4. Segregation and Bleeding
5. Voids and Crack

**(b)** Explain various tests to assess the strength of aggregates. Explain briefly aggregate crushing value and aggregate Impact value **07**

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# GUJARAT TECHNOLOGICAL UNIVERSITY

## PDDC SEM-IV Examination-Nov-2011

**Subject code: X40602** **Date: 23/11/2011**

**Subject Name: Concrete Technology**

**Time: 2.30 pm -5.00 pm** **Total marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | |
|---|---|---|---|
| **Q.1** | **(a)** | Explain importance of Bogue's compounds of cement. | **07** |
| | **(b)** | Write procedure to test cement for following :<br>(i) consistency, (ii) soundness (iii) Setting time of cement | **07** |
| **Q.2** | **(a)** | How does the (i) fineness (ii) amount of gypsum affects the properties of cement? | **07** |
| | **(b)** | What do you know about<br>(i) Quick setting cement<br>(ii) Super sulphate cement<br>(iii) Oil well cement | **07** |
| | | **OR** | |
| | **(b)** | Explain effect of size, shape and texture of aggregate on concrete. | **07** |
| **Q.3** | **(a)** | Name three commonly used pozzolanic material used in concrete. Explain function of any one of them on workability, durability and strength of concrete. | **07** |
| | **(b)** | List various deleterious substances in concrete and explain their effect on concrete in brief. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Discuss various aspects of durability of concrete. | **07** |
| | **(b)** | What do you understand by workability of concrete? How will you measure it using Vee-Bee test? | **07** |
| **Q.4** | **(a)** | List various destructive, semi-destructive and non-destructive tests of concrete. Explain basic principle of any one non-destructive test. | **07** |
| | **(b)** | What is the shrinkage of concrete? Describe the factors affecting it. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Write steps of IS mix design method of concrete. | **07** |
| | **(b)** | How the weather conditions affect concreting? Explain precautions which are necessary during low temperature. | **07** |
| **Q.5** | | Write short note on following (any four) | **14** |
| | **(a)** | Causes of distress in concrete | **(b)** Ready mixed concrete |
| | **(c)** | Elasticity of concrete | **(d)** Light weight concrete |
| | **(e)** | Segregation in concrete | **(f)** Curing of concrete |
| | **(g)** | Plasticizers in concrete | **(h)** Carbonation of concrete |

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# GUJARAT TECHNOLOGICAL UNIVERSITY

**P.D.D.C. Sem - IV Examination June- 2011**

**Subject code: X40602**

**Subject Name: Concrete Technology**

**Date: 04/06/2011** **Time: 10.30 am – 01.00 pm**

**Total Marks: 70**

## Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

| | | | |
|---|---|---|---|
| **Q.1** | **(a)** | Explain hydration process of cement and write importance of Bogue's compounds. | **06** |
| | **(b)** | Write procedure to test cement for following : (i) Soundness test (iii) Setting time | **08** |
| **Q.2** | **(a)** | Explain function of aggregates in concrete. | **02** |
| | **(b)** | What do you understand by grading of aggregate? Name various types of grading and how does it affect the concrete? | **05** |
| | **(c)** | Describe effect of size, shape and texture of aggregate on concrete. | **07** |
| | | **OR** | |
| | **(c)** | What is super-plasticizer? How does it work in concrete? Describe the parameters which govern the dosage of super-plasticizer. | **07** |
| **Q.3** | **(a)** | Write the reasons of segregation and bleeding of concrete. | **04** |
| | **(b)** | Why curing of concrete is necessary? What are the guidelines for curing various structural elements? | **05** |
| | **(c)** | What do you understand by workability of concrete? Explain the factors affecting workability of concrete. | **05** |
| | | **OR** | |
| **Q3** | **(a)** | Why concrete shrinks? Name various types of concrete shrinkage. | **04** |
| | **(b)** | Comment on the effect of water cement ratio on concrete. Support by reasoning. | **05** |
| | **(c)** | Describe the science behind the Ultra-Sonic Pulse Velocity test. | **05** |
| **Q.4** | | Write data required and steps involved in mix design using (i) IS method (ii) ACI method | **14** |
| | | **OR** | |
| **Q.4** | **(a)** | What do you understand by durability of concrete? Explain phenomenon of carbonation of concrete. | **04** |
| | **(b)** | Explain the factors responsible for alkali-aggregate reaction. | **05** |
| | **(c)** | What are deleterious materials? How do they affect the concrete properties? | **05** |
| **Q.5** | | Explain briefly : **(any four)** | **14** |
| | **(a)** | Chloride attack on concrete (b) Mass concrete (c) Light weight concrete | |
| | **(d)** | Fiber reinforced concrete (e) Retarder (f) Sulphate resistant cement | |
| | | **OR** | |
| **Q.5** | **(a)** | Where pumped concrete is used? What precautions are required for pumping the concrete? | **04** |
| | **(b)** | How will you carry out concreting in summer in Rajasthan? | **05** |
| | **(c)** | Write the causes of distress in concrete of structural elements. | **05** |

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