**19CE3204 – CONCRETE TECHNOLOGY**

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| **Course Category** | Professional Core | **Credits:** | 3 |
| **Course Type**  | Theory | **Lecture - Tutorial - Practical**  | 3 - 0 - 0 |
| **Prerequisite**  | Building Materials & Construction | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks**  | 100 |

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| **Course Objectives** | 1. To classify various types of cement and additives.
2. To explain the various properties of aggregates.
3. To understand the behavior of fresh concrete and methods of curing.
4. To explain the properties of hardened concrete.
5. To assess the short term and long-term effects of concrete.
6. To understand the concept of mix design and special concretes.
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| **Course Outcomes** | CO1 | Identify various types of cement and additives. |
| CO2 | Determine the properties of aggregates used in concrete. |
| CO3 | Identify the properties of concrete in the fresh state and Methods of curing. |
| CO4 | Perform destructive and non-destructive tests on concrete. |
| CO5 | Understand the durability requirements of concrete. |
| CO6 | Design the concrete mix using various codes and apply various special concretes for their specific applications. |
| **Course****Content** | **UNIT– I****PORTLAND CEMENT:** Composition – Physical properties – Rapid Hardening Portland cement – Portland Blast Furnace Cement – Low heat Portland Cement – Sulphate resisting Portland cement – White Portland Cement – Coloured Portland Cement – High Alumina Cement – Super Sulphate Cement – Masonry Cement – Expansive Cements – Oil Well Cements.**ADDITIVES:** Classifications – Accelerators – Retarders – Plasticizers – Super Plasticizers – Water Proofers – Pigments – Air entraining agents – Pozzolans.**UNIT – II****CONCRETE AGGREGATES:** Classifications – Heavy aggregates – Normal weight aggregates – Strength and other mechanical properties – Moisture content and its effects – Deleterious substances – Alkali-Aggregate reaction – Thermal properties – Grading curves and Grading requirements – Gap-graded aggregate – Maximum aggregate size – Use of ‘Plums’ – Handling of aggregates.**UNIT – III****FRESH CONCRETE:** Workability – Factors affecting workability – Measurements of workability – Comparison of tests – Effect of time and temperature – Segregation – Bleeding – Mixing of concrete – Concrete mixers – Vibration of concrete – Types of vibrators – Ready mixed concrete – Pumped concrete –pre-packed concrete and vacuum processed concrete.**CURING OF CONCRETE:** Methods of curing – Maturity – Influence of temperature – Steam curing at atmospheric pressure – High pressure steam curing.**UNIT – IV****HARDENED CONCRETE:** Water/Cement ratio – Abram’s law – Gel space ratio – Effective water in mix – Nature of strength of concrete – Strength in tension and compression – Griffith’s hypothesis – Factors affecting strength – Relation between compression and tensile strength – Testing of Hardened concrete – Compression tests – Tension tests – Flexure tests – Splitting tests – Non-destructive testing methods.**UNIT – V****ELASTICITY, SHRINKAGE AND CREEP:** Modulus of elasticity – Factors affecting modulus of elasticity – Dynamic modulus of elasticity – Poisson’s ratio – Mechanism of shrinkage – Factors affecting shrinkage – Drying shrinkage – Plastic shrinkage – Carbonation shrinkage – Autogenous shrinkage – Moisture movement – Creep of concrete – Factors influencing creep – Relation between creep and time – Nature of creep – Effect of creep.**DURABILITY:** Permeability – Chemical attack of Concrete – Efflorescence – Air entrained concrete – Measurements – Effects – Thermal properties – Resistance of concrete to fire.**UNIT – VI****CONCRETE MIX DESIGN AND QUALITY CONTROL:** Basic consideration – Factors in the choice of properties – Method of calculation by absolute volume method. Simple example of mix design – Design of high strength mixes – ACI & IS methods of mix design.**SPECIAL CONCRETES:** Light weight concrete – Cellular concrete – No-fines concrete – High density concrete – Fiber reinforced concrete – Different types of fibers – Factors affecting properties of F.R.C – Applications of polymer concrete – Types of polymer concrete – Properties of polymer concrete – Applications – Self compacting concrete. |
| **Textbooks****and****References** | **TEXTBOOKS:**1. M.S. Shetty, *Concrete Technology Theory and Practice,* S Chand & Co Ltd., 8th Revised Edition, 2019.
2. Dr.R.P.Rethaliya, *Concrete Technology,* Charotar Publishing House, 2nd Edition, 2018.
3. V.N.Vazirani and S.P.Ratwani, *Concrete Technology,* Khanna Publishers, 6th Edition, 2016.

**REFERENCE BOOKS:**1. A.M.Neville, J.J.Brooks, *Concrete Technology,* Pearson. 2nd Edition, 2019, Concrete Manual by U.S. Bureau of Reclamation.
2. P.Kumar Mehta, Paulo J.M. Monteiro, *Concrete: Microstructure, Properties, and Materials,* McGraw Hill Education, 4th edition, 2017.
3. M.L.Gambhir, *Concrete Technology Theory and Practice,* McGraw Hill Education, 5th edition, 2017.
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**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | - | - | - | 1 | - | - | 1 | - | - | 1 | 1 |
| **CO2** | 1 | 1 | - | - | - | - | - | 1 | - | - | 1 | 1 |
| **CO3** | 1 | 1 | 1 | - | - | - | - | - | - | - | - | 1 |
| **CO4** | 2 | 1 | 1 | 2 | - | - | - | - | - | - | - | 2 |
| **CO5** | 1 | 1 | - | - | - | - | 1 | - | - | - | - | 1 |
| **CO6** | 3 | 3 | - | 1 | - | - | - | - | - | - | 1 | 2 |