

**FACULTY OF ENGINEERING**

**SYLLABUS AND COURSE STRUCTURE**

**B. TECH (CIVIL ENGINEERING)**

**ACADEMIC YEAR 2020-21**

**B. Tech. (CE) Program Educational Objective (PEO’s):**

A graduate of the Civil Engineering Program should:

**PEO-I**

Graduates of the Programme will contribute to the development of infrastructure that is sustainable.

**PEO-II**

Graduates of the Programme, as part of an organization or as Entrepreneurs, will continue to learn to harness evolving technologies.

**PEO-III**

Graduates of the Programme will be professional Civil Engineers with ethical and societal responsibility.

**Program Outcome (PO’s)**

A graduate of the Civil Engineering Program will demonstrate:

**PO1**: An ability to apply knowledge of mathematics, science, and civil engineering

**PO2**: An ability to design and conduct experiments, as well as to analyze and interpret data

**PO3**: An ability to design a civil engineering system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

**PO4**: An ability to function on multidisciplinary civil engineering teams

**PO 5**: An ability to identify, formulate, and solve civil engineering problems

**PO6**: An understanding of professional and ethical responsibility related to civil engineering practices

**PO7**: An ability to communicate effectively

**PO8**: The broad education necessary to understand the impact of civil engineering solutions in a global, economic, environmental, and societal context

**PO9**: A recognition of the need for, and an ability to engage in life-long learning

**PO10**: A knowledge of contemporary issues related to civil engineering

**PO11**: An ability to use the techniques, skills, and modern engineering tools necessary for civil engineering practices

**Program Specific Outcome:**

The B. Tech. Degree Programme in Civil Engineering is offered in the department with the following programme specific objectives:

**PSO1**: The Graduates of this Programme with proficiency in mathematics and physical sciences will excel in the core areas of civil engineering such as structural, environmental and water resources engineering.

**PSO2**: The graduates will plan, produce detailed drawings, write specification, and prepare cost estimates.

**PSO3**: The graduates will interact with stakeholders effectively and execute quality construction work applying necessary tools.

**CODE AND SUBJECT SCHEME FOR B.TECH. CIVIL**

**Semester III**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| BAS003D | Advanced Engineering Mathematics | 3 | 1 | 0 | 4 | F |
| BCI074A | Building Materials | 3 | 0 | 0 | 3 | C |
| BCI075A | Concrete Technology | 3 | 1 | 0 | 4 | C |
| BCI002A | Fluid Mechanics | 3 | 1 | 0 | 4 | C |
| BCI003A | Engineering Geology | 3 | 0 | 0 | 3 | S |
| BCI061A | Solid Mechanics I | 3 | 1 | 0 | 4 | C |
| BCI024B | Material Testing Lab | 0 | 0 | 2 | 2 | C |
| BCI005A | Engineering Geology Lab | 0 | 0 | 2 | 2 | S |
| BCI006B | Building Materials & Concrete Technology Lab | 0 | 0 | 2 | 2 | C |
| BCI076A | Building Drawing Lab | 0 | 0 | 2 | 2 | C |
|  | **TOTAL** | **18** | **4** | **8** | **30** |  |

**Semester IV**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| BAS005B | Numerical Methods, Optimization Techniques and Special Functions | 3 | 0 | 0 | 3 | F |
| BCI070A | Basic Construction Technology | 3 | 0 | 0 | 3 | C |
| BCI009B | Geotechnical Engineering I | 3 | 1 | 0 | 4 | C |
| BCI062A | Solid Mechanics II | 3 | 1 | 0 | 4 | C |
| BCI013C | Engineering Surveying I | 3 | 1 | 0 | 4 | C |
| BCI014B | Hydraulics & Hydraulic Machine | 3 | 1 | 0 | 4 | S |
| BCI071A | Geotechnical Engineering Lab I | 0 | 0 | 2 | 2 | C |
| BCI063B | Fluid Mechanics and Hydraulics Lab | 0 | 0 | 2 | 2 | C |
| BCI016C | Engineering Surveying Lab I | 0 | 0 | 2 | 2 | C |
| BCI065A | CAD Building Drawing Lab | 0 | 0 | 2 | 2 | S |
|  | **TOTAL** | **18** | **4** | **8** | **30** |  |

**Semester V**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| BCI018C | Geotechnical Engineering II | 3 | 1 | 0 | 4 | S |
| BCI019B | Engineering Surveying II | 3 | 1 | 0 | 4 | S |
| BCI012B | Theory of Structures I | 3 | 1 | 0 | 4 | C |
| BCI020A | Reinforced Cement Concrete I | 3 | 1 | 0 | 4 | C |
| BCI011B | Design of Steel Structures | 3 | 1 | 0 | 4 | C |
| BCI030A | Environmental Engineering I | 3 | 1 | 0 | 4 | C |
| BCI072A | Geotechnical Engineering Lab II | 0 | 0 | 2 | 2 | S |
| BCI023C | Engineering Surveying Lab II | 0 | 0 | 2 | 2 | S |
| BCI031B | STAAD Pro Lab | 0 | 0 | 2 | 2 | S |
|  | **TOTAL** | **18** | **6** | **6** | **30** |  |

**Semester VI**

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| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| BCI021B | Theory of Structures II | 3 | 1 | 0 | 4 | S |
| BCI028A | Irrigation and Hydrology | 3 | 1 | 0 | 4 | C |
| BCI029B | Transportation Engineering I | 3 | 1 | 0 | 4 | C |
| BCI041A | Environmental Engineering II | 3 | 1 | 0 | 4 | S |
|  | Program Elective – I | 3 | 1 | 0 | 4 | S |
|  | Program Elective – II | 3 | 0 | 0 | 3 | S |
|  | Open Elective | 3 | 0 | 0 | 3 | ID |
| BCI043B | Transportation Engineering Lab | 0 | 0 | 2 | 2 | C |
| BCI044B | Environmental Engineering Lab | 0 | 0 | 2 | 2 | S |
|  | **TOTAL** | **21** | **5** | **4** | **30** |  |

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| **Program Elective-I (any one of the following)** | |
| BCI026C - Advance Design of Steel Structures | BCI046B – Construction Project Management |

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| **Program Elective-II (any one of the following)** | | | |
| BCI079A | Infrastructure Management | BCI036B | Advanced Reinforced Cement Concrete |
| BCI037B | Foundation Engineering | BCI038A | Pre-Stressed Concrete |

**Semester VII**

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| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| BCI039A | Water Resource Engineering | 3 | 1 | 0 | 4 | C |
| BCI040B | Transportation Engineering II | 3 | 0 | 0 | 3 | S |
| BCI055A | Solid Waste Management | 3 | 0 | 0 | 3 | S |
| BCI077A | Quantity Surveying and Valuation | 3 | 0 | 0 | 3 | C |
|  | Program Elective – III | 3 | 0 | 0 | 3 | S |
| BCI073A | Project Work | 0 | 0 | 4 | 4 | C |
|  | **TOTAL** | **15** | **1** | **4** | **20** |  |

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| **Program Elective-III (any one of the following)** | | | |
| BCI078A | Ground Improvement Techniques | BCI080A | Earthquake Resistant Design |
| BCI027A | Building Maintenance and Repairs | BCI049A | Building Design |

**Semester VIII**

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| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| BCI050A | Industrial Project and Dissertation | 0 | 0 | 28 | 28 | C |
|  | **TOTAL** | **0** | **0** | **28** | **28** |  |

**Open Elective (Offered by the Department of Civil Engineering)**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** | **Semester** |
| **L** | **T** | **P** |
| BCI053A | Remote Sensing and GIS | 3 | 0 | 0 | 3 | ID | VII |
| BCI054A | Disaster Management | 3 | 0 | 0 | 3 | ID | VII |

**Semester III**

|  |  |  |
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| **L-T-P** | **BAS003D – Advanced Engineering Mathematics** | **Credits:4** |
| **3-1-0** |

**Objectives:**

* To understand the Laplace transform.
* To understand Analytic Functions and Cauchy Riemann equations.
* To understand Taylor Series, Laurent’s Series.
* To understand discrete random variables Sample space.
* To understand Descriptive Statistics.

**Unit 1**

LAPLACE TRANSFORM- Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficient with special reference to the wave and diffusion equations.

**Unit 2**

COMPLEX VARIABLES- Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy’s theorem. Cauchy’s integral formula.

**Unit 3**

COMPLEX VARIABLES -Taylor’s series Laurent’s series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.

**Unit 4**

Introduction & Discrete random variables Sample space, events, algebra of events, Bernoulli’s trials, Probability&Baye’s theorem. Random variable & their event space. Discrete & continuous distributions Probability distribution & probability densities: Binomial, Poisson and normal.

**Unit 5**

Descriptive Statistics—Mean, Mode and Median and standard deviation, Hypothesis testing.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Explain the Laplace Transform.

CO2: Understand Analytic Functions and Cauchy-Riemann equation.

CO3: Better utilization of Taylor Series and Laurent’s Series.

CO4: Define discrete random variables Sample space.

CO5: Calculate descriptive Statistics.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO 2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 |  | H |  |  |  |  | M | M |  |  |  | M | M |  |
| CO2 | H |  |  | H |  |  |  |  |  |  | M | M | H |  |
| CO3 |  |  | H |  |  | M |  |  | M |  |  |  |  | H |
| CO4 |  |  |  | M | H |  |  | L |  |  | M | L |  |  |
| CO5 |  |  | L |  |  |  | L |  | M |  |  | H | M |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Devor, *Probability and statistics for engineering and sciences*.Cengage learning 2011.
2. Mendenhall, *Introduction to probability and statistics.* Cengage learning 2012.

**Reference Book:**

1. Peebles,*Probability, Random Variables and Random.* Signal Principles, TMH 2002.
2. Bhat K. N. Hari *Probability Theory and Stochastic Processes for Engineers*, Pearson 2011.
3. Stark,*Probability and Random Processes with Application to Signal Processing, 3/e*, Pearson 2002.
4. Gaur and Srivastava. *Random Variables & Stochastic Processes*, Genius publications,

2003.

1. Ludeman.*Random Processes: Filtering, Estimation and Detection*,Wiley2002.

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| **L-T-P** | **BCI074A - Building Materials** | **Credits:3** |
| **3-0-0** |

**Objectives:**

* Building materials are to be studied from a different view point, that is, Right from manufacture.
* Use in construction at different stages and up to the finished project.
* Chemical formulation of material to know for weathering effects.
* Properties of building materials which are used for construction behavior

**Unit 1**

**Stones:** Source and types of stones, various standard test on building stones including compressivestrength, water absorption, durability, impact value, tensile strength. Identification, Selection criteria and uses of common building stones. Dressing of stones.

**Unit 2**

**Clay Products**: Manufacturing of Bricks. Types and properties of bricks and their determination as per IS code such as water absorption, compressive strength, effloresces, dimension and tolerance test. Types of Tiles, Standard tests for tiles as per IS code such as water absorption, tolerance, impact value, glazing.

Fly Ash: Properties, classification, use of fly-ash in manufacturing of bricks & cement.

**Unit 3**

**Cement & Lime:** Raw materials, chemical composition and manufacturing process of cement. Basic compounds (Bouge’s compounds) of cement and their role, types of cement. Setting and hardening of cement, physical properties of cement, various standard tests on Portland cements, as per IS code including consistency, setting time, fineness, soundness and strength.

**Lime**: Classification as per IS, Manufacturing process, properties, standard tests of lime. Use of lime in construction. Gypsum, properties and use, Plaster of Perris.

**Unit 4**

**Mortar and Plaster:** types of sand, bulking of sand, tests for sand, classification, mortar preparation methods**:** Functions and tests & their uses in various types pointing & plastering.

**Timber & Steel:** Definitions of related terms, classifications and properties, defects in wood, conversion of wood, seasoning, preservation, fire proofing, Plywood, fiber boards, Steel: properties, type’s mild steel and HYSD steel and their use, common tests on steel

Various types of paints and Varnishes; white wash and distempers and their application.

**UNIT 5**

**Environmental friendly Building material:** Concept of embodied energy of materials, energy used in transportation and construction process. Natural material like bamboo, rammed earth, stones, stabilized blocks; supplementary cementitious materials like blast furnace slag, silica fume, rice husk ash; building materials from agro and industrial wastes.

**Miscellaneous:** Properties, types and uses of glass, aluminum, Asbestos, G.I., plastics in construction.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: understand the properties of stones suitable for construction and testing procedure

CO2: understand the manufacturing,properties of raw materials and testing of bricks

CO3: understand about the ingredients and the type of cement

CO4: understand about the properties and application of mortar,plaster and steel in construction

CO5: understand the properties and application of environment friendly construction materials

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO 2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | H | H | H | L | H | M |  |  | H | H | H | H |
| CO2 | H | H | H | H | H | L | H | M |  | H | H | H | H | H |
| CO3 | H | H | M | M | H | L | H | M |  | H | H | H | H | M |
| CO4 | H | M | H | L | H | L | H | M |  | H | H | H | H |  |
| CO5 | H | H | M | H | H | L | H | M |  | M | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Illston,J.M.Spon E. *Construction Materials: Their nature &BehaviourAvenue*, New York, USA.2010
2. Ghambir,*Building Materials: Products, Properties and Systems.*Tata McGraw Hill, Delhi, 2005.

***Reference Book:***

1. Singh Prabin,*Building Materials,*S.K.Kataria& Sons. 2009.
2. DuggalS. K. *Building Materials* New Age International Publishers. 2009
3. CBRI and BMTPC Publications.2003

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| --- | --- | --- |
| **L-T-P** | **BCI075A – Concrete Technology** | **Credits:4** |
| **3-1-0** |

**Objectives:**

* Building materials are to be studied from a different view point, that is, Right from manufacture.
* Use in construction at different stages and up to the finished project.
* Chemical formulation of material to know for weathering effects.

**Unit 1**

**Ingredients of concrete:** Cement: hydration of cement and its basic compounds, structure of hydrated cement, C-S-H gel, and heat of hydration, gel-space ratio and its significance.

**Aggregates:** types, physical properties and standard methods for their determination.

**Concrete:** Grade of concrete, proportioning of ingredients, water content and its quality for concrete, water/cement ratio and its role, Properties of fresh concrete including workability, air content, Flow ability, Segregation, Bleeding and Viscosity etc. ‐Factors affecting, methods of determination.

**Unit 2:**

Properties of hardened concrete such as strengths, permeability, creep, shrinkage, factors influencing, Standard tests on fresh and hardened concrete as per IS code. Aggregate- cement interface, maturity concept.

**NDT:** Introduction and their importance. Application & use of Rebound Hammer, Ultra-sonic pulse velocity meter, Rebar & Cover meter, half-cell potential meter, corrosion resistivity meter, core sampling.

**Unit 3**

**Concrete Handling in Field:** Batching, mixing, placing and transportation of concrete, equipment’s for material handling, various methods their suitability and precautions. Compaction of concrete: methods & equipment’s. Curing of concrete: various methods their suitability. Durability of concrete.

**Unit 4**

Concrete mix deign (ACI, IS method), quality control for concrete.

**Admixture in concrete:** Chemical and mineral admixtures, their types and uses: water reducers, accelerator, retarders, water-proofing plasticizers, super plasticizers, air-entraining agents. Use of fly ash and silica fume in concrete, their properties and effect.

**Unit 5**

**Light Weight Concrete:** Classification of Light weight concrete, its advantage & disadvantages, principal behind light weight concrete and its salient properties and application.

**Green Concrete:** Introduction to green concrete, its advantages, limitation and application.

**Special types of concrete:** Introduction to high strength concrete, high performance concrete, sulphate resisting concrete, under water concreting, self-compacting concrete, pump able concrete: their salient properties and application.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: understand the ingredient of concrete and by products after heat of hydration

CO2: understand the properties of hardened concrete such as strength and durability

CO3: understand the various procedure associated with concrete casting such as batching, transporting and placing

CO4: understand the concrete mix design as per IS-10262 and admixtures used in concrete

CO5: understand the properties and application of special concrete such as high performance and self-compacting concrete

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | H | H | H | L | H | M |  |  | H | H | H | H |
| CO2 | H | H | H | H | H | L | H | M |  | H | H | H | H | H |
| CO3 | H | H | M | M | H | L | H | M |  | H | H | H | H | M |
| CO4 | H | M | H | L | H | L | H | M |  | H | H | H | H |  |
| CO5 | H | H | M | H | H | L | H | M |  | M | H | H | H | M |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Neville & Brooks,*Concrete Technology* Pearson Education.1987
2. MehtaP.K.*Concrete: Microstructure, Properties & Materials.* Tata McGraw Hill.1995
3. Shetty M.S. *Concrete Technology.*Chand& Co.2008

***Reference Book:***

1. Popovics,*Concrete materials* Standard Publishers.2012
2. PeterC.H.,*Chemistry of Cement and Concrete.*Elsevier Butterworth Heinemann.2003

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| --- | --- | --- |
| **L-T-P** | **BCI002A – Fluid Mechanics** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* To understand behavior of fluids under different conditions of flow and static properties.
* Several engineering operations and designs of equipment are based on fluid mechanics.

**Unit 1**

Introduction of fluid, Properties of fluids**:** Density, Specific volume, Specific gravity Viscosity, Compressibility, Surface Tension, Capillarity, Vapour Pressure; Cavitation, Classification of fluids: Newtonian and non-Newtonian fluids.

**Unit 2**

Principles of fluid statics: Pascal’s law, Hydrostatic law, Measurement of pressure by Manometers and mechanical gauges; Pressure on plane and curved surfaces.

Buoyancy: Total Pressure and Centre of pressure, Stability of immersed and floating bodies, Meta-centre, Meta-centric height.

**Unit 3**

Kinematics of flow and Equations of motion Continuity equation and Continuity equation in 3-D, Lagrangian and Euler equation of motion, Types of fluid Flows: Steady and Un-steady, Uniform and non-uniform, Laminar and turbulent flows, 1, 2 and 3-D flows; Stream lines, Path lines and Streak lines, Elementary explanation of Stream function and Velocity potential.

**Unit 4**

Bernoulli’s equation and its applications in flow measurement in pipes and open channels**:** Concept of control volume and control surface, Introduction to Navier-Stokes Equations, Pitot tube, Flow through orifices, Mouthpieces, Nozzles, Notches, Weirs, Free and Forced vortex motion. Introduction of boundary layer theory and Hydro-dynamically smooth and rough boundaries.

**Unit 5**

Introduction of Laminar and turbulent flow through pipes: Nature of turbulent flow in pipes, Equation for velocity distribution over smooth and rough surfaces, Major and Minor energy losses, Resistance coefficient and its variation, Hydraulic gradient and total energy lines, Flow in sudden expansion, contraction, bends, valves and siphons, Concept of equivalent length Branched pipes, Pipes in series and parallel.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Categorize solutions to fluids problems by their fundamental assumptions

CO2: Compute hydrostatic and hydrodynamic forces

CO3: List and explain the assumptions behind the classical equations of fluid dynamics

CO4: Identify and formulate the physical interpretation of the mathematical terms used in Solutions to

fluid dynamics problems

CO5: Analyze and design simple pipe systems

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Outcome** | **Program Outcome** | | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | L | M | | L | H | M |  | H | H | M | M | H | L | H |
| CO2 | H | M | H | | L | H | M |  | H | H | M | M | H | L | L |
| CO3 | H | H | H | | L | H | M |  | H | H | L | H | H | L | M |
| CO4 | H | H | H | | L | H | M |  | H | H | L | H | H | L | M |
| CO5 | H | H | H | | L | H | H |  | H | H | M | H | H | M | H |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Bansal, R.K. *Fluid mechanics and hydraulic machines*. Laxmi publications. New Delhi 2009
2. Modi& Seth.*Hydraulics and Fluid Mechanics Including Hydraulics Machines*Standard Book House, 2002
3. Arora, K.R. *Fluid Mechanics, Hydraulics and Hydraulic Machines*Standard PublishersDistributors, 01-Jan-2005

**Reference Book:**

1. Streeter, Wylie & Bedford: *Fluid Mechanics*,WCB/McGraw Hill, 1998
2. Natarajan, M.K.*Principles of Fluid Mechanics*,Oxford &Ibh Publishing Company Pvt Limited, 1994
3. Garde, R.J. *Fluid Mechanics Thorough Problems*,New age international (P)Limited publications 1997.

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| **L-T-P** | **BCI003A – Engineering Geology** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* All constructions whether workshops, powerhouses, multistoried buildings, dams and reservoirs, tunnels etc. have their design/construction source in geology.
* The foundations of structures have to be thoroughly investigated geologically for which engineering geology prepares the significant background**.**
* To study geological information at construction site for designing the foundation.

**Unit 1**

Introduction, Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Physical properties of minerals, susceptibility of minerals to alteration, Rock forming minerals, megascopic identification of common primary and secondary minerals.

**Unit 2**

Physical Geology- Weathering, Erosion and Denudation. Factors affecting weathering, Engineering consideration. Geological work natural agencies like wind, river, glacier, underground water.

**Unit3**

Petrology-Rock forming processes.

**Igneous** - Volcanic Phenomenon and different materials ejected by volcanoes. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Structures. Classification of Igneous rocks. Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Pegmatite. Engineering aspect to granite. Basic Igneous Rocks Like Gabbro, Dolerite, Basalt. Engineering aspect to Basalt.

**Sedimentary** - mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone.

**Metamorphic** - Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures and textures in metamorphic rocks. Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.

**Unit 4**

Concept of Rock Deformation and Tectonics. Dip and Strike. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints and Unconformity; Importance of structural elements in engineering operations.

**Unit 5**

Geological consideration for site of dam, tunnel, reservoir and bridge. Introduction of Remote Sensing and GIS.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand weathering process and mass movement

CO2: Distinguish geological formations

CO3: Identify geological structures and processes for rock mass quality

CO4: Identify subsurface information and groundwater potential sites through geophysical

investigations

CO5: Apply geological principles for mitigation of natural hazards and select sites for dams and

tunnels

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M | H |  | H | L |  | M | L |  | H | H |  | M |
| CO2 | H | M | H |  | H | M |  | M | L |  | H | H |  | M |
| CO3 | H | M | H |  | H | H |  | M | L |  | H | H |  | M |
| CO4 | H | M | H |  | H | H |  | M | L |  | H | H |  | M |
| CO5 | H | M | H |  | H | M |  | M | L |  | H | H |  | M |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Singh, P. *Engineering and General Geology*, 8th Edition, S K Kataria& Sons,New Delhi 2008.

***Reference Book:***

1. Kesavalu, *Text Book of Engineering Geology*, MacMillan India.
2. Duggal, S.K., Pandey, H.K. &Rawal, N. - *Engineering Geology*, McGraw Hill.2017

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| **L-T-P** | **BCI061A - Solid Mechanics - I** | **Credits: 4** |
| **3-1-0** |

**Objective:**

* To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.
* An ability to apply knowledge of basic mathematics, science and engineering

**Unit 1**

**Simple Stresses and Strains:** Concept of stress and strain in three dimensions and generalized Hooke’s law; Young’s modulus; Tension test of mild steel and other materials: true and apparent stress, ultimate strength, Yield stress and permissible stress; Stresses in prismatic &non-prismatic members and in composite members; Thermal stresses; Shear stress, Shear strain, Modulus of rigidity, Complementary shear stress; Poisson’s ratio, Volumetric strain, Bulk modulus, relation between elastic constants; Stresses in composite members, Compatibility condition

**Unit 2**

**Compound Stress:** Two dimensional stress system: stress resultant, principal planes and principal stresses, state of pure shear maximum shear stress, Mohr’s circle &it’s application.

**Moment of Inertia**: Polar and product moment of inertia, Principal axes and principal moment of inertia

**Unit 3**

**Columns:** Short and long columns, slenderness ratio, crushing and buckling of column, short column subjected to axial and eccentric loads; Euler’s theory and its limitation, concept of effective length of columns; Rankine& Secant formula.

**Membrane Analysis:** Stress and strain in thin cylindrical & spherical shells under internal pressures.

**Unit 4**

**Bending of Beams:** Types of supports, support reactions, determinate and indeterminate structures, static stability of plane structures.

Bending moment, Shear force and Axial thrust diagrams for statically determinate beams subjected o various types of loads and moments, Point of Contra- flexure, relation between load, SF and BM

**Unit 5**

**Theory of simple bending**: Distribution of bending and shear stresses for simple and composite sections

**Course Outcome:**

***At the end of this course, students will be able to:***

CO1: Understand the fundamental concepts of stress and strain and the relationship between both

through the strain-stress equations in order to solve problems for simple tri dimensional elastic

solids

CO2: Determine the principal stresses and strains in structural members

CO3: To obtain solutions to column buckling and plate problems

CO4: Describe the concepts and principles, and perform calculations, relative to the strength and

stability of structures and mechanical components

CO5: Solve problems relating to pure and non-uniform bending of beams and other simple structures

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  |  |  | H |  |  |  |  |  |  |  |  |  |
| CO2 | M |  |  |  | H |  |  |  |  |  |  |  |  |  |
| CO3 |  |  |  |  | H |  |  |  |  |  |  | M |  |  |
| CO4 |  |  | H |  | M |  |  |  |  |  |  |  |  |  |
| CO5 |  | M |  |  | H |  |  |  |  |  |  | L |  |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Bansal, R.K. *Strength of Materials*, Laxmi Publications, 2010
2. Punmia, B.C.*Strength of Materials & Mechanics of Structures:* Vol. I, II - Laxmi Publication,2002

***Reference Book:***

* + - 1. Popov, E.P. *Engineering Mechanics of Solids*, Pearson Education,201
      2. Ryder G.H. *Strength of Materials*, Macmillan and Co. Ltd,2002

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| **L-T-P** | **BCI024B – Material Testing Lab** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. Tensile strength of material with the help of Universal Testing Machine.
2. Compressive strength of material with the help of Universal Testing Machine.
3. Flexural strength of material with the help of Universal Testing Machine.
4. Shear strength of material with the help of Universal Testing Machine.
5. Bending tests on simply supported beam and Cantilever beam.
6. Torsion test
7. Hardness tests with Rockwell’s method
8. Hardness tests with Brinell’s method
9. Tests on closely coiled and open coiled springs

10. Compression test on wood or concrete

11. Charpy and Izod Impact test

12. Fatigue Test

**Course Outcome:**

***At the end of this course, students will be able to:***

CO1: Conduct tension test on steel, aluminum, copper and brass

CO2: Conduct compression tests on spring, wood and concrete

CO3: Conduct flexural and torsion test to determine elastic constants

CO4: Determine hardness of metals

CO5: Use of Universal Testing Machine

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 |  | H | M |  |  |  |  |  |  |  |  |  |  |  |
| CO2 |  | H | M |  |  |  |  |  | L |  |  |  |  |  |
| CO3 |  | H | M |  |  |  |  |  |  |  |  |  |  |  |
| CO4 | M | H | M |  |  |  |  |  |  |  |  |  |  |  |
| CO5 |  | L |  |  |  |  |  |  |  |  | H |  |  |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI005A – Engineering Geology Lab** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. Identification of Silicate Minerals
2. Identification of Non-Silicate Minerals
3. Study of physical properties of rock
4. Identification of Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff, and Basic Igneous rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte
5. Identification of Sedimentary rocks: Conglomerate, Breccia, Sandstone, Limestone and Shale
6. Identification of Metamorphic rocks: Marble, slate, Gneiss, Schist, Quartzite and Phyllite
7. Identification of physical features through diagram
8. Identification of geological discontinuities: Faults, joints, bedding planes, shear zone, unconformities etc
9. Identification of engineering geological features through diagram
10. Study of dip and strike
11. Plotting of plan and cross section profile on the ground including topographic features
12. Study of Geological maps.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Identify minerals

CO2: Measure strike and dip of the bedding planes

CO3: Interpret geological maps

CO4: Identify rocks

CO5: Identify geological features & discontinuities

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | H | M | M |  |  | M | M | M | H | H | M | M |
| CO2 | H | H | H | M | M |  |  | M | M | M | H | H | M | M |
| CO3 | H | H | H | M | M |  |  | M | M | M | H | H | M | M |
| CO4 | H | H | H | M | M |  |  | M | M | M | H | H | M | M |
| CO5 | H | H | H | M | M |  |  | M | M | M | H | H | M | M |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI006B – Building Materials and Concrete Technology Lab** | **Credits: 2** |
| **0-0-2** |

**Experiments**

**Cement**

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement.
5. Soundness & specific gravity of cement by Le-Chatelier’s apparatus.

**Fine Aggregate**

1. Sieve analysis of sand
2. To determine the specific gravity of fine aggregate.
3. Bulking of sand

**Bricks:**

1. Water absorption & Compressive strength

**Concrete**

1. Slump test & Compaction factor test
2. Flow table test
3. Compressive strength test

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: understand the basic test for materials and cement.

CO2: determination of various test of sand and concrete.

CO3: understand the basic test workability of the concrete.

CO4: understand of the basic test for fine and coarse aggregates.

CO5: understand of the basic test of compressive strength test of concrete.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO2 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO5 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |

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| **L-T-P** | **BCI076A - Building Drawing Lab** | **Credits: 2** |
| **0-0-2** |

1. Drawing of walls

i. Brick and Stone masonry

ii. Partition wall, cavity wall and cross section of external wall

2. Pointing, Arches, Lintels and Floors

3. Doors and Windows

4. Stairs, Cross section of Dog legged stairs

5. Roofs: Flat and Inclined (Steel)

6. Foundations for Masonry Structures and Framed Structures, Provision of Damp Proof Course

7. To plan and draw working drawing of a Residential building with following detail.

(a) Site plan

(b) Foundation plan

(c) Plan

(d) Two sectional elevations

(e) Front elevation

(f) Furniture plan

(g) Water supply and sanitary plan

(h) Electric fitting plan

8. To design and draw a Primary Health Center

9. To design and draw a Primary School

10. To design and draw a Post Office

11. To design and draw a Bank

12. To design and draw a Cinema Theatre

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand the basic knowledge of Drawing of walls.

CO2: Understand the basic knowledge of Drawing of Pointing, Arches, Lintels and Floors.

CO3: Understand the basic knowledge of Drawing of Doors and Windows.

CO4: Understand the basic knowledge of Drawing of Different types of building.

CO5: Understand the basic knowledge of Drawing of stairs, roof and foundation.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO2 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO5 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |

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**Semester IV**

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| **L-T-P** | **BAS005B – Numerical Methods, Optimization Techniques and Special Functions** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* Understand the solutions methods for nonlinear programming problems.
* Methods for Linear programming, transportation and assignment problem.
* Develop an understanding of Calculus of Variations

**Unit 1**

NUMERICAL ANALYSIS- Finite differences – Forward, Backward and Central differences. Newton’s forward and backward differences, interpolation formulae. Sterling’s formula, Lagrange’s interpolation formula.

**Unit 2**

NUMERICAL ANALYSIS- Integration-Trapezoidal rule, Simpson’s one third and three-eighth rules. Numerical solution of ordinary differential equations of first order - Picard’s method, Euler’s and modified Euler’s methods, Milne’s method and Runga-Kutta fourth order method, Differentiation

**Unit 3**

SPECIAL FUNCTIONS – Bessel’s functions of first and second kind, simple recurrence relations, orthogonal property of Bessel’s, Transformation, Generating functions, Legendre’s function of first kind. Simple recurrence relations, Orthogonal property, Generating function.

**Unit 4**

LINEAR PROGRAMMING PROBLEMS - Linear Programming(Graphicaland Simplex solution);Transportation and Assignment Method.

**Unit 5**

CALCULUS OF VARIATIONS - Functional, strong and weak variations simple variation problems, the Euler’s equation.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Explain the Finite differences.

CO2: Understand Milne’s method and Runga-Kutta fourth order method.

CO3: Better utilization of Bessel’s functions orthogonal property of Bessel’s, Transformation,

Generating functions, Legendre’s function of first kind.

CO4: DefineLinearProgramming (Graphicaland Simplex solution)Transportation and

Assignment Method.

CO5: Calculate Functional, strong and weak variations simple variation problems, the Euler’s

equation.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  |  |  |  |  |  |  | M | M |  | M | M |  |
| CO2 |  | H | H |  |  |  |  |  |  |  | M | M | M |  |
| CO3 |  |  | H |  | M |  | M |  |  |  |  |  | L | M |
| CO4 |  |  |  | M | H |  |  | L |  |  | M | M |  |  |
| CO5 | H | H |  |  | M | L |  |  |  |  |  | M |  |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. DattaK.B.*Mathematical methods of science & engineering.*Cengage learning*,*2012
2. O’neil peter *V.Advanced Engineering mathematics.*Cengage learning,2012

***Reference Book:***

1. Montgomery Douglas C*.Applied Statics & Probability.* John Wiley & Sons,2013
2. *VeerarajanT.Engineering Mathematics.*TMH,2011
3. *Jordan D. Mathematical Techniques.*Oxford ,2008
4. Sarangi K.C*. and others.Engineering Mathematics IV.*Genius publications,2011
5. Potter C.*Advance Engineering Mathematics.*Oxford ,2005
6. Greenberg K*. Advanced Engineering Mathematics.*Pearson,1998

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| **L-T-P** | **BCI070A – Basic Construction Technology** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* The objective of the course is to provide basic knowledge of Construction Technology and its application.
* To understand the safety aspects during construction of various structures.
* Helping to management of equipment and easy to construct any structure.

**Unit 1**

Building Requirements & Construction System: Building components, their functions and requirements, types of construction, load bearing construction and framed structure construction. Temporary structures: Types & methods of shoring, underpinning and scaffolding. Foundation& Site Preparation: Purpose, types of foundation, depth of foundation, Brick and Stone Masonry: Basic principle of sound masonry work, different types of bonds, relative merits merit and demerits of English, single Flemish and double Flemish bond. Comparison between stone and brick masonry. General principles, classification of stone masonry.

**Unit 2**

Damp Proofing: Causes of dampness, effects of dampness methods and material for damp proofing DPC treatment in buildings, methods and materials for anti-termite treatment.

Partition Wall: Types, purpose and use of partition wall. Stairs: Terms used requirements of good staircase, classification, construction details and suitability of different types of stairs.

**Unit 3**

Ground & Upper floors: Floor components and their junctions, selection of flooring and floor types, construction details of ground and upper floors, merits and demerits.

Roof and Roof Covering: Purposes, classification of roofs, terms used, types of pitched roofs, method of construction, roof covering materials for pitched roofs

**Unit 4**

Advance Construction Equipment: Different types of construction equipment viz. Earth moving equipment & their outputs, Dewatering equipment, Pumping equipment, Grouting equipment, Pile Driving equipment, Compaction equipment, Concreting equipment.

**Unit 5**

Equipment Management in Construction Projects: Forecasting equipment requirements, Output and capacity of equipment, Selection of equipment, Spare-parts management, Owning Costs, investment costs, depreciation, major repair cost, and Operation Cost & Its types. Investment Cost, Cost of Repairs, Overheads Cost accounting, Break-even point theory, Replacement of equipment.

Maintenance management: types of maintenance, breakdown maintenance, preventive maintenance & its functions.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Apply basic principles to develop stable, sustainable and cost-effective building and

Construction technology.

CO2: Classification of different structural components and their applications

CO3: Identify effective measures for floor components.

CO4: Study of advanced structural equipment

CO5: Identify the effective utilization of structural equipment

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO2 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO3 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO4 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO5 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Purifoy*.Construction Equipment & Management.*Tata McGraw Hill.

***Reference Book:***

1. Sarkar S.K.&Saraswati*.Construction Technology.*Oxford University Press,2008
2. Sharma.*Construction Equipment and its Management.*Prentice Hall of India (PHI).
3. Verma M.*Construction Equipment.*Metropolitan Book Co.,1979
4. Bindra& Arora.*Building Construction.*DahnpatRai& Sons,2018.
5. Moolchandani B.N.*Affordable Housing.* Indian Building Congress,Delhi.2014

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| **L-T-P** | **BCI009B - Geotechnical Engineering I** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* To get the knowledge about different types of soil and their origin.
* Study of different soil improvement techniques.
* Study of natural occurring phenomena in soil and variation of the properties of soil.
* To provide the knowledge of different soil structures and their properties.
* To get the experimental knowledge of soil parameters.

**Unit 1**

Introduction: Soil and soil-mass constituents, water content, specific gravity, void ratio, porosity, degree of saturation, air void and air content, unit weights, density index etc. Inter relationships of the above.

Index properties of soil and tests:Determination of index properties of soil: water content, specific gravity, particle size distribution, sieve and sedimentation analysis, consistency limits, void ratio and density index.

**Unit 2**

Plasticity Characteristics of Soil-Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits.

Soil Classification:Classification of soil for general engineering purposes: particle size, textural, H.R.B. Unified and I.S. Classification systems.

**Unit 3**

Clay mineralogy: Soil structure; single grained, honeycombed, flocculent, and dispersed, structure of composite soils, clay structure; basic structure, mineral structures, structures of Illite, Montmorillonite and kaolinite and their characteristics.

Permeability of soil:Soil water absorbed, capillary and free water, Darcy’s law of permeability of soil and its determination in laboratory. Field pumping out tests, factors affecting permeability, permeability of stratified soil masses.

**Unit 4:**

Stresses in soil mass: Total, effective and neutral pressure, calculation of stresses, influence of water table on effective stress, quicksand phenomenon.

Seepage Analysis: Seepage and Seepage Pressure, Laplace’s equation for seepage. Flow net and its construction. Uplift pressure, piping, phreatic line, Flow net through earth dam.

**Unit 5:**

Compaction of Soil-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control. Consolidation of Soil**-**Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, consolidation test results, basic definitions, Terzaghi’s theory of consolidation, final settlement of soil deposits, consolidation settlement: one- dimensional method, secondary consolidation.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Develop a basic understanding of the engineering properties of soil, and the use of such

properties in the analysis of selected geotechnical engineering problems.

CO2: Understanding of the fundamental behavior of soil and its relevance to civil engineering

operations and applications. Develop a understanding the behavior of soil in field conditions

CO3: Understanding of mineralogy of soil mass and its impacts on soil behavior. Ability to determine

and understand of permeability of soil in context of stability.

CO4: Estimation and analysis of developed stress in soil mass. Analysis of impacts and determination

of seepage pressure.

CO5: Develop a concept to adopt the best suitable technique for soil strength improvementtechniques

(Compaction Techniques).

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | H | L | H | H | H | H | H | M | H | M | H | H |
| CO2 | H | H | H | L | H | H | H | H | H | M | H | M | H | M |
| CO3 | H | H | H | L | H | H | H | H | H | H | H | H | H | M |
| CO4 | H | H | H | L | H | H | H | H | H | H | H | H | H | H |
| CO5 | H | H | H | L | H | H | H | H | H | M | H | M | H | H |

***Text Books:***

*1.*Punamia, B.C.*Soil Mechanics and Foundation Engineering.*Laxmi publication,2005.

***Reference Book:***

*1****.***MurthyV.N.S*. Soil Mechanics and Foundation Engineering.*CBS publishers,2011.

*2.*Singh A*.Modern Geotechnical Engineering.*IBI publs*.*

*3.*Venkataramaiah C. *Geotechnical Engineering.*New age international publishers.

*4.*Ranjan G. &Rao A.S.R*.Basic and Applied Soil Mechanics,*New age international publishers.

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| **L-T-P** | **BCI062A – Solid Mechanics II** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* Ability to analyze the various types of structures.
* To understand the deformations of structures under loading.
* To understand about the theory of vibration and torsion effects on the structures.

**Unit 1**

Deflection of Beams: Differential relation between load, shear force, bending moment, slope deflection. Slope & deflection in determinate beams using double integration method, Macaulay’s method, area moment method and conjugate beam method.

**Unit 2**

Analysis of prop cantilever structures, Analysis of Indeterminate Structure using Area moment method, Conjugate beam method Combined direct and bending stress, middle third rule, core of a section, gravity retaining wall

**Unit 3**

Fixed Beams and Continuous Beams: Analysis of fixed beams & continuous beams by three moments Theorem and Area moment method.

**Unit 4**

Torsion: Elementary concepts of torsion, shear stress in solid and hollow circular shafts, angle of twist, power transmitted by a shaft, combined bending and torsion;

**Springs**: Stiffness of springs, springs in series and parallel, laminated plate springs, leaf spring, close coiled helical springs, open coiled springs.

**Unit 5**

Vibrations: Elementary concepts of structural vibration, Mathematical models, basic elements of vibratory system. Degree of freedom. Equivalent Spring stiffness of springs in parallel and in series.

Simple Harmonic Motion: vector representation, characteristic, addition of harmonic motions, Angular oscillation.

Undamped free vibration of SDOF system: Newton’s law of motion, D'Alembert's principle, deriving equation of motions, solution of differential equation of motion, frequency & period of vibration, amplitude of motion; Introduction to damped and forced vibration.

**Course Outcome:**

***At the end of this course, students will be able to:***

CO1: Evaluate the slope and deflection of beams subjected to loads.

CO2: To solve for stresses and deflections of beams under unsymmetrical loading

CO3: Understand the fundamental concepts of fixed beam and continuous beam.

CO4: Solve problems relating to torsional deformation of bars and other simple tri-dimensional

structures

CO5: Analyze and design springs and thick cylinders

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | M |  |  |  | H |  |  |  |  |  |  | M |  |  |
| CO2 |  |  | H |  | M |  |  |  |  |  |  | M |  |  |
| CO3 | M |  | H |  | H |  |  |  |  |  |  |  |  |  |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  |  |  |
| CO5 | M |  |  |  | H |  |  |  |  |  |  |  |  |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Bansal, R.K. *Strength of Materials.*Laxmi publications.
2. Punmia, B.C*. Strength of Materials & Mechanics of Structures.*Vol. I, II Laxmi Publications.

***Reference Book:***

1. Popov E. P*. Engineering Mechanics of Solids,*Pearson Education.
2. Ryder G.H. *Strength of Materials.*Macmillan and Co. Ltd.
3. Norries& Wilbur *.Elementary Structural Analysis.*McGraw Hill
4. Laursen,H.I*..Structural Analysis.*McGraw Hill.

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| **L-T-P** | **BCI013C – Engineering Surveying I** | **Credits: 4** |
| **3-1-0** |

**Objective:**

* At the end of the course the student wills possess knowledge about Chain surveying, Compass surveying, Plane table surveying, Leveling, Theodolite surveying and Engineering surveys.

**Unit 1**

Definition - Principles - Classification - Field and office work - Scales - Conventional signs - Survey instruments, their care and adjustment - Ranging and chaining - Reciprocal ranging - Setting perpendiculars - well - conditioned triangles - Traversing - Plotting - Enlarging and reducing figures.

**Unit 2**

Prismatic compass - Surveyor’s compass - Bearing - Systems and conversions – Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of errors.

**Unit 3**

Level line - Horizontal line - Levels and Staves - Spirit level - Sensitiveness - Bench marks - Temporary and permanent adjustments - Fly and check leveling - Booking - Reduction - Curvature and refraction - Reciprocal leveling - Longitudinal and cross sections - Plotting - Calculation of areas and volumes.

**Unit 4**

Theodolite - Vernier and microptic - Description and uses - Temporary and permanent adjustments of Vernier transit - Horizontal angles - Vertical angles - Heights and distances - Traversing - Closing error and distribution - Gale’s tables - Omitted measurements.

**Unit 5**

Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs.

Plane table instruments and accessories - Merits and demerits - Methods - Radiation - Intersection - Resection – Traversing.

**Course outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand the working principles of survey instruments

CO2: Calculate angles and distances

CO3: Able to measure and layout elevations and relative heights between points

CO4: Able to measure horizontal and vertical angles.

CO5: Able to carry out profiling and grid leveling, for generation of profiles, contour maps.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | M |  | H |  | M |  |  | M | H |  | M | M | M |  |
| CO2 | H | H |  | M | H |  |  | M | H |  | H | H | H |  |
| CO3 | H | H |  | M | H |  |  | M | H |  | H | H | H |  |
| CO4 | H | H |  | M | H |  |  | M | H |  | H | H | H |  |
| CO5 | M | H |  | M | H |  |  | M | H |  | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text book:***

1. Punmia B.C. *Surveying* Vol. I & II.Laxmi publication.

***References book:***

## Arora K.R. *Surveying Vol. I & II.*[Standard Book House](https://www.sapnaonline.com/shop/Publisher/Standard%20Book%20House%20-%20Rajsons).

1. Cledenning& Oliver*.Surveying Instruments.*

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| **L-T-P** | **BCI014B – Hydraulics and Hydraulic Machine** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* The knowledge of this subject is necessary to study further hydraulics and hydraulic machinery.
* To understand the behavior for designing different hydraulic structures.

**Unit 1**

Introduction: Dimensional analysis, Rayleigh method, Buckingham theorem, applications of dimensional analysis to pipe Friction problems, Dynamical Similarity and Dimensional Homogeneity Model experiment, geometric, Kinematic and Dynamic similarity. Dimensionless numbers: Reynolds’s, Froude’s, Weber’s, Euler and Mach numbers. Distorted and undistorted river models, proper choice of scale ratios. Scale effect.

**Unit 2**

Laminar Flow: Relation between shear & pressure gradient, Flow between plates & pipes, Equation of velocity distribution and Pressure difference.

Turbulent Flow in pipes: Theories of Turbulence, Nikuradse’s Experiments, and Hydro-dynamically smooth and rough boundaries, Laminar, Sub-layer, Equations of velocity distribution and friction coefficient, Stanton Diagram, Moody’s diagram.

**Unit 3**

Flow through channels: Uniform, Non-Uniform and variable flow. Resistance equations of Chezy, Manning and Bazin, Section factor for uniform flow, Most Efficient rectangular, triangular and trapezoidal sections, Equations of gradually varied flow in Prismatic channels, Limitation of its applicability and assumption made in its derivation, Specific energy of flow, Critical depth in prismatic channels, Alternate depths. Rapid, critical and sub critical Flow Mild, steep and Critical Slopes.

**Unit 4**

Rapidly varied flow: Hydraulic jump or standing wave in rectangular channels, Conjugate or sequent depths Losses in jump, location of jump, Broad crested weirs for channel flow: Measurement, velocity distribution in open channels, parshall flume. Impact of free Jets: Impact of a jet on a flat or a curved vane, moving and stationary vane, flow over radial vanes.

**Unit 5**

Pumps and turbines: Volute and whirlpool chambers, Loses of head due to variation of discharge Monomeric and Hydraulic efficiencies, Description of single and multistage pumps. Specific speed, characteristic curves. Model Test. Reaction and Impulse turbines, specific speed, mixed flow turbines, Pelton wheel turbine, Francis turbine, propeller turbine and Kaplan turbine Efficiency, Characteristics of turbines. Basic principles of governing of turbines, Draft-tube, Selection of turbines, model tests.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Able to use of dimensions & model numbers

CO2: To understand the functioning of different types of laminar & turbulent flow.

CO3: Able to understand Flow through channels

CO4: Able to understand the impact of jet on vanes.

CO5: To understand the functioning of different types of pumps and turbines.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M | M |  | H | L |  | M |  |  | H | H | M |  |
| CO2 | H | M | M |  | H | L |  | M |  |  | H | H | M |  |
| CO3 | H | M | M |  | H | L |  | M |  |  | H | H | M |  |
| CO4 | H | M | M |  | H | L |  | M |  |  | H | H | M |  |
| CO5 | H | M | M |  | H | L |  | M |  |  | H | H | M |  |

H = Highly Related M = Medium L=Low

***Text book:***

1. Bansal N.*A Text Book of Fluid Mechanics and Hydraulic Machines.*Laxmi publication,2010.
2. Modi P.N.& Seth S.M. *Hydraulics and Fluid Mechanics.* Hydraulics Machines,Standard book house,2014.
3. Arora K.R.*Fluid Mechanics,Hydraulics And Hydraulic Machines.*Standard Publishers Distributors.

***Reference book:***

1. Ramamrutham, S.& Narayan, R. *Hydraulics, Fluid Mechanics and Fluid Machines.*Dhanpat Rai Pub Company,2006.

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| **L-T-P** | **BCI071A – Geotechnical Engineering Lab I** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. To determine the particle size distribution of a soil by sieve analysis.
2. To determine the water content of a soil sample by Oven drying method.
3. To determine the water content of a soil sample by pycnometer method.
4. To determine the specific gravity of a soil sample by pycnometer method.
5. To determine the liquid limit of a soil specimen by Casagrande’s apparatus.
6. To determine the liquid limit of a soil specimen by Cone penetrometer apparatus.
7. To determine the plastic limit of a soil specimen.
8. To determine the Shrinkage limit of a soil specimen.
9. To determine the field density of the soil by core-cutter.
10. To determine the dry density of the soil Sand replacement method.
11. To determine the compaction characteristics of a soil specimen by Standard proctor’s test/Modified Proctor’s test.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Develop a basic understanding of the engineering properties of soil, and the use of such

properties in the analysis of selected geotechnical engineering problems.

CO2: Experimentally determination of fundamental properties of soil to suit industrial need.

CO3: Experimentally able to understand and estimate plastic properties of soil using Casagrande’s

apparatus.

CO4: Estimation and analysis of various limits defined under plastic characteristics of soil.

CO5: Determine the compaction characteristics of a soil specimen by Standard proctor’s

test/Modified Proctor’s test.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | H | L | H | L | H | H | H | M | M | H | H | L |
| CO2 | H | H | H | L | H | L | H | H | H | M | M | H | H | L |
| CO3 | H | H | H | L | H | L | H | H | H | M | M | H | H | L |
| CO4 | H | H | H | L | H | L | H | H | H | M | M | H | H | L |
| CO5 | H | H | H | L | H | L | H | H | H | H | H | H | H | L |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI063B – Fluid Mechanics and Hydraulics Lab** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. Determination of friction
2. Hydraulic coefficient of an orifice/mouthpiece.
3. Impact of jet on vanes.
4. Performance test on centrifugal and reciprocating pump.
5. Performance test on Pelton wheel turbine, Francis turbine and Kaplan turbine.
6. To verify Bernoulli’s theorem.
7. To calibrate a Venturimeter and Orificemeter.
8. To determine Metacentric Height.
9. To determine velocity by Pitot tube.
10. To determine Cd of a V-notch.
11. Determination of losses in pipe fitting.
12. Determination of Reynolds no. for flowing water.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: understand Hydraulic coefficient

CO2: understand turbines.

CO3: understand Venturimeter and Orificemeter.

CO4: understand Pitot tube.

CO5: understand losses in pipe fitting.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | M |  | H | L |  | M |  |  | H | H | M |  |
| CO2 | H | H | M |  | H | L |  | M |  |  | H | H | M |  |
| CO3 | H | H | M |  | H | L |  | M |  |  | H | H | M |  |
| CO4 | H | H | M |  | H | L |  | M |  |  | H | H | M |  |
| CO5 | H | H | M |  | H | L |  | M |  |  | H | H | M |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI016C – Engineering Surveying Lab I** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. Locating various objects by chain and cross staff.
2. Determination of area of polygon by chain and cross staff.
3. To determine the magnetic bearing of a line by using surveyor's compass.
4. To determine the magnetic bearing of a line by using prismatic compass.
5. Determination of elevation of various points with tilting/dumpy level by collimation plane method.
6. Determination of elevation of various points with tilting/dumpy level by rise and fall method.
7. To determine the reduced level using Auto Level.
8. To measure the horizontal and vertical angles by Theodolite.
9. To carry out profile leveling and plot longitudinal and cross sections for road.
10. Locating given building by plane table surveying.
11. Three-point problem and two point problem in plane table surveying.
12. Study and use of mechanical planimeter

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: use conventional surveying tools such as chain/tape, compass, plane table, level in the field of

civil engineering applications such as structural plotting and highway profiling

CO2: apply the procedures involved in field work and to work as a surveying team

CO3: plan a survey appropriately with the skill to understand the surroundings

CO4: take accurate measurements, field booking, plotting and adjustment of errors can be understood

CO5: plot traverses / sides of building and determine the location of points present on field on a piece

of paper

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | H |  |  | M | H |  | M | H | H |  |
| CO2 | H | H |  | M | H |  |  | M | H |  | H | H | H |  |
| CO3 | H | H |  | M | H |  |  | M | H |  | H | H | H |  |
| CO4 | H | H |  | M | H |  |  | M | H |  | H | H | H |  |
| CO5 | M | H |  | M | H |  |  | M | H |  | H | H | H |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI065A- CAD Building Drawing Lab** | **Credits: 2** |
| **0-0-2** |

**Auto CAD 2D –**

1. Introduction to AutoCAD
2. Draw Commands
3. Drawing Aids
4. Edit Drawings
5. Text
6. Layers, Line Types, Colors
7. Polylines and Polygon
8. Crosshatching
9. Dimensioning
10. Draw Building Plan
11. Draw Building Section and Elevation
12. Plot and Print

**AutoCAD 3D –**

1. 3D Modeling Concepts in AutoCAD
2. 3D Co-ordinates Systems Viewpoint & UCS
3. Wireframe Modeling & Editing Solid, Mesh, Surface (Modeling& Editing ) Materials, Lights and Rendering Working with Images Import & Export

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Introduction to AutoCAD

CO2: Draw Commands, Drawing Aids, Edit Drawings.

CO3: Draw the plan, section and elevation of a building

CO4: Create, analyze and produce 2-D drawings of buildings in AUTO CAD environment.

CO5: Detailing building plans in CAD environment.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  |  |  |  | M |  |  |  |  | H |  |  |  |
| CO2 |  | M |  |  |  |  |  |  |  |  |  |  | H |  |
| CO3 |  | M |  |  |  |  |  |  |  |  |  |  | H |  |
| CO4 |  |  | L |  |  |  |  |  |  |  |  | L | H |  |
| CO5 |  |  | L |  |  |  |  |  |  |  |  | M | H |  |

H = Highly Related M = Medium L=Low

**Semester V**

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| **L-T-P** | **BCI018C - Geotechnical Engineering II** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* Engineering Emphasis is placed on the fundamental behavior of soil as it pertains to engineering problems
* Detailed study of fields tests which are useful to get the information about subsurface condition of soil.
* Estimation of pressure applied by retained soil on retaining structure.
* Study of different theories related to slope failure of soil.

**Unit 1**

Introduction: Basic definitions, Plastic characteristics of clay, Permeability of soil and its effect on properties of soil, compaction and consolidation of soil.

Shear Strength of soil -Principle planes parallel to the coordinate axes, Mohr’s circle,important characteristics of Mohr’s circle, Mohr-Coulomb theory, types of shear test: direct shear test, merits of direct shear test, triaxle compression tests, test behavior of UU, CU and CD tests, relation between major and minor principal stresses, unconfined compression test, vane shear test.

**Unit 2**

Site Investigations: Methods of explorations. Planning of Investigations, Depth of exploration, Number of boreholes, Undisturbed and Disturbed samples. Types of samplers and sampling, number and deposition of trail pits and borings, penetrometer tests, borehole logs, geophysical methods.

**Unit 3**

Lateral Earth Pressures Theories**-** Introduction: applications of earth pressure theories, different types of earth pressure at rest, active and passive pressure. Rankine’s Earth Pressure Theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure Planes for cohesion-less and cohesive soils. Coulomb’s Wedge Theory: Coulomb’s active pressure in cohesion-less soils, expression for active pressure, Coulomb’s passive earth pressure. Rebhann’s Construction for Active Pressure, Culmann’s graphical solutions for active soils, Wedge Method, passive pressure by friction circle method for cohesion-less and cohesive soils

**Unit 4**

Stability of slopes: Introduction , Basis of analysis, Different factors of safety, types of slope failures, stability of an infinite slope of cohesionless soils, Stability analysis of an infinite slope of cohesive soils, Wedge failure, Culmann’s method, Friction circle method, Stability charts, Swedish circle method, Stability of slope under steady seepage condition, Stability of slope under sudden during construction, Stability of slopes under construction, Bishop’s simplified method, Improving stability of slopes.

**Unit 5**

Soil Stabilization: Introduction, Mechanical Stabilization, Cement Stabilization, Lime Stabilization, Bituminous Stabilization, Chemical Stabilization, Chemical Stabilization, Thermal Stabilization, Electrical Stabilization, Stabilization by Grouting, Stabilization by Geotextile and fabric, Reinforced earth.

Basics of Geotechnical Earthquake Engineering: Seismic zones in India, Magnitude and intensity of earthquakes, Effect of ground motion on structures, General principles of earthquake resistant design, seismic coefficient and seismic forces, Hazards due to earthquakes, Liquefaction phenomenon, factor affecting liquefaction and methods of prevention of it.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: This subject develops a understanding about site investigation and knowledge about different

pressure theories.

CO2: Develop the knowledge how to avoid the slope failure in soil and different analysis methods.

CO3: This subject provides the basic concept related to earthquake and its effect on soil behavior.

CO4: Understand soil exploration methods

CO5: techniques of the stabilization of the soils

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L | H |  | L |  | M | H | H |  | L |
| CO2 | H |  | M |  |  | H |  | H |  |  |  | H |  | M |
| CO3 | H |  | L |  |  | H |  | H |  | M |  | H |  | M |
| CO4 | H |  | H |  |  | H |  | M |  | M |  | H |  | M |
| CO5 | H |  | H |  |  | M |  | H |  | M |  | H |  | H |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Punmia, B.C.  *Soil Mechanics and Foundation Engineering,*.New Delhi, India. Laxmi Publications,2017

***Reference Book:***

1. Murthy, V.N.S. *Soil Mechanics and Foundation Engineering,*New Delhi, India: CBS, *2009*
2. Singh, Alam. *Modern Geotechnical Engineering.* New Delhi, India: CBS Publishers,2009
3. Venkataramaiah, C. *Geotechnical Engineering.* New Delhi, India: New Age International,2018
4. Ranjan, G. & Rao, A.S.R. *Basic and Applied Soil Mechanics.* New Delhi, India: New Age International Pvt Ltd,2016

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| **L-T-P** | **BCI019B – Engineering Surveying II** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.
* Ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
* More efficient, more accurate and fast surveying reducing time consumption.

**Unit 1**

Trigonometric Levelling: Methods of trigonometric levelling, direct method and reciprocal method, axis Signal corrections, Determination of difference in elevations of points.

**Unit 2**

Curve Surveying: Elements of circular (Simple, compound and reverse) curves, transition curves, degrees of curves, Methods of setting out circular and transition curves.

**Unit 3**

Triangulation: Merits and demerits of traversing, triangulation and trilateration. Grades of triangulation, Strength of figure, field procedure of triangulation. Reconnaissance and selection of triangulation stations. Inter-visibility of stations and calculation of the heights of towers. Equipment needed for base line measurement, corrections to base line. Satellite station and base line extension.

**Unit 4**

Errors in Surveying: Classification of errors in surveying. The probability curve, its equation and properties, theory of least squares, weight, most probable valve, probable errors, standard errors. Normal equation correlates.

Adjustment of Triangulation Figures: Adjustment of levels. Adjustment of triangulations figures, Braced quadrilateral Triangle with central, station. Approximate and method of least squares for figure adjustment, Trilateration.

**Unit 5**

Field Astronomy: Definitions of terminology used in Astronomy, Co-ordinate Systems. Relationships between different Coordinate systems. Astronomical Triangle, Napier’s Rule. Different methods of determination of Azimuth. Electronic distance measurement and use of Total station.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Plan a survey for applications such as road alignment and height of the building

CO2: Set out curves, buildings, culverts and tunnels

CO3: Carry out a geodetic survey, taking accurate measurements using instruments and adjusting the

traverse

CO4: Apply mathematical adjustment of accidental errors involved in surveying measurements

CO5: Invoke advanced surveying techniques over conventional methods in the field of civil

engineering and knowledge about field astronomy.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | L | H |  | M |  |  | M | H |  | M | M | M |  |
| CO2 | H | H |  | M | H |  |  | M | H |  | H | H | H |  |
| CO3 | H | H |  | M | H |  |  | M | H | L | H | H | H |  |
| CO4 | H | H |  | M | H |  |  | M | H | L | H | H | H |  |
| CO5 | H | H |  | M | H |  |  | M | H | L | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Punmia, B.C. *Surveying And Leveling Vol I, Ii, &Iii.* New Delhi, India:  Laxmi Publications,2016
2. Arora, K.R. *Surveying, Vol I, II &III,2016.* New Delhi India: Standard Book House Since,1960

***Reference Book:***

1. Basak,N.N. *Surveying and Levelling, Tata McGraw Hill.* Noida India: Tata McGraw-Hill Education Pvt. Ltd,2014
2. Agor,R. *Surveying.* New Delhi India: *Khanna Publishers,2002*
3. Lo, C.P. & Yeung, A.K.W. *Concepts and Techniques of GIS, Prentice Hall. India:* Upper Saddle River, NJ : Pearson Prentice Hall,2007
4. Kang-tsungChang *Introduction to GIS. Tata McGraw Hill.* New Delhi India: Tata McGraw-Hill Education Pvt. Ltd,2007
5. Rao, K.A. *Remote sensing and GIS.* New Delhi India:   *BS Publications,2007*

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| **L-T-P** | **BCI012B – Theory of Structures I** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* Ability to analyze the various types of structures.
* To understand the deformations of structures under loading.
* To study the different methods to analyze the structures.
* To introduce portal method, cantilever method & factor method for analysis of Analysis of multistory frames.

**Unit 1**

Introduction to Indeterminate structures, Degrees of freedom per node, Static and Kinematic indeterminacy (i.e. for beams, frames & portal with & without sway etc.), Releases in structures, Maxwell’s reciprocal theorem and Betti’s theorem.

**Unit 2**

Slope deflection method: derivation of the slope-deflection equation – analysis of statically indeterminate beams subjected to applied loads - analysis of statically indeterminate beams subjected to uneven support settlement.

Moment distribution method: Analysis of structures using Moment distribution method applied to continuous beams and portal frames with and without inclined members.

**Unit 3**

Column analogy method: fixed end moments for a beam with constant moment of inertia – stiffness and carryover factor to beam with constant moment of inertia – fixed end moments for a beam with variable moment of inertia – stiffness and carryover factor to beam with variable moment of inertia.

Kani’s Method: Analysis of beams and frames with & without sway by Kani’s method.

**Unit 4**

Unit load method & their applications: deflection of determinate beams and frames, analysis of determinate and redundant frames up to two degree of redundancy, lack of fit in redundant frames.

Introduction to Energy Methods: Strain energy for gradually applied, suddenly applied and impact loads, Strain energy due to axial loads, bending, shear and torsion; Castiglione’s theorems & their applications in analysis of determinate and redundant frames up to two degrees of redundancy and trussed beams; Stresses due to temperature & lack of fit in redundant frames; deflection of determinate beams, frames using energy methods

**Unit 5**

Approximate methods for lateral loads: Analysis of multi-storey frames by portal method, cantilever method & factor method. Analysis of determinate space trusses by tension coefficient method.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Ability to identify determinate, indeterminate, stable and unstable structures.

CO2: Ability to determine forces and deflections in indeterminate trusses, beams and frames.

CO3: Able to understand the concept of different methods to analyze the structures.

CO4: Ability to understand the concept of energy methods, stresses due to temperature variation.

CO5: Analyze structures for gravity loads and lateral loads for multistory building frames.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | L | L | M | H | L | L | H | H | M | H | L | M |
| CO2 | H | H | M | L | M | H | L | M | H | H | H | H | L | M |
| CO3 | H | H | M | L | M | H | L | M | H | H | H | H | L | M |
| CO4 | H | H | M | L | M | H | L | M | H | H | H | H | L | M |
| CO5 | H | H | M | L | M | H | L | M | H | H | H | H | H | M |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Punmia, B.C*. - Theory of Structures.* New Delhi India:Laxmi Publication2017
2. Bhavikatti, S.S. *-* Structural Analysis Volume – I, 3rd edition.  Uttar Pradesh India:Vikas Publishers,2013
3. R.S. Khurmi - *Theory of Structures.* New Delhi India:S Chand Publication*,*2000
4. S.Ramamrutham,R Narayan. *Theory of Structures.* New Delhi India:DhanpatRai Publication,2014

***Reference Book:***

1. Menon, D. *Structural Analysis Volume* – I. New Delhi India: Narosa Publication,2010
2. Reddy, C.S. *Basic Structural Analysis.*Uttar Pradesh India: Tata McGraw Hill,2017
3. Timoshenko & Young. *Theory of Structures.* Uttar Pradesh India: Tata McGraw Hill,1965
4. Wang, C.K. *Intermediate Structural Analysis.* Uttar Pradesh India: McGraw Hill,1982
5. Norries& Wilbur. *Elementary Structural Analysis.* Uttar Pradesh India: McGraw Hill,2012
6. Laursen, H.I.*Structural Analysis.*Uttar Pradesh India: McGraw Hill,1988

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| **L-T-P** | **BCI020A – Reinforced Cement Concrete I** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* Study of design Philosophies.
* Analysis and design of structural members such as beam, slab, column, footing etc.

**Unit 1**

Objective and fundamental concepts of design of RC members, Types and function of reinforcement. Introduction to various related IS codes. Design Philosophies: Working stress, ultimate strength and limit states of design. Analysis and Design of singly reinforced rectangular beam section for flexure using Working Stress Method and Limit State Method.

**Unit 2**

Analysis and design of singly reinforced, flanged beams and doubly reinforced rectangular beams for flexure using Limit State Method. Limit state of serviceability for deflection, control of deflection as per codal provisions of empirical coefficients.

**Unit 3**

Limit state of collapse in shear: analysis and design of prismatic sections for shear using LSM.

Limit state of collapse in bond: concept of bond stress, anchorage length and development length, curtailment of reinforcement as per codal provisions.

**Unit 4**

Analysis and design of one way and two way slabs using LSM and Flat slab using direct design method as per code, Detailing of reinforcement.

**Unit 5**

Columns: Short and long columns, their structural behavior. Analysis and design of axially loaded short columns, using LSM. Analysis of uniaxial eccentrically loaded short columns. Introduction to Pu-Mu interaction curves and their use for eccentrically loaded columns.

Design of Column Footings: Analysis and design of isolated column footing and combined footing for two columns (without central beam) for axial loads using LSM.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand the concept of shear and shear reinforcement

CO2: Ability to analyze and design of beams.

CO3: Ability to analyze and design of columns.

CO4: Ability to analyze and design of slab.

CO5: Ability to analyze and design of footings.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO2 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO5 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text book:***

1. Varghese, P.C. *Limit State Design of Reinforced Concrete.* New Delhi India: Prentice Hall of India Pvt. Ltd.,2008
2. *IS:456-2000*
3. Dr.B C Punmia, *B C PunmiaDesign of Reinforced Concrete.*New Delhi India: Laxmi Publication Ltd,2008
4. NeelamSharma.New Delhi India: S.K. Kataria& Sons

***Reference Book:***

1. Nilson, A.H. *Design of Concrete Structures, McGraw Hill Companies Inc.* NewYork, NY Columbus, McGraw Hill Companies Inc,2009
2. Pilla, S.U. & Menon, D. *Reinforced Concrete Design3edition.* Noida,Uttar Pradesh India: Tata McGraw Hill Publishing,2017
3. Syal & Goel *Reinforced concrete structures Reprint Edition. New* Delhi India:S Chand,2007

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| **L-T-P** | **BCI011B – Design of Steel Structures** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* To know how to design and use the different types of steel structural elements.
* To know about different design concepts for different types of steel structures.

**Unit 1**

**Connections**: Types of bolts, load transfer mechanism, prying action. Design of bolted and welded connections under axial and eccentric loadings.

**Unit 2**

**Tension Members:** Design strength in gross section yielding, net section rupture and block shear. Design of axially loaded tension members.

**Unit 3**

Design of laterally supported and unsupported beam.

**Unit 4**

Columns and Bases- Design of columns under axial loads using single or multiple rolled steel sections, design of lacing and battens, columns subjected to axial load and bending, design of slab and Gusseted base.

**Unit 5**

Plastic analysis of steel structures, fundamentals, and static and mechanism method of analysis, bending of beams of rectangular and I sections beams, shape factor. Classification of Cross Sections: As per IS 800-2007 Plastic, compact, semi compact, slender sections, their characteristics including moment rotation.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: An understanding of the basic principles of reliability based design on steel structures.

CO2: Able to design of bolt and weld connections

CO3: Able to design of tension members

CO4: Able to design of beams and beam columns

CO5: Able to design of column bases and compression members

CO6: To understand plastic design method in steel structures and classification of section.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | L |  |  |  | H |  |  | M | H |  | H | L | L |  |
| CO2 | H |  | M |  | H | L |  | M |  |  | H | H | M |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | M | H | H |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO5 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO6 | H |  | L |  | H | L |  | M | H |  | M | H | M |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Negi, L. *Design of Steel Structures 2 edition. New* Delhi India: Tata McGraw Hill,2017
2. Duggal, SK. *Limit State Design of Steel Structures 2 edition.* New York: Tata McGraw-Hill Education, 2017

***Reference Books:***

*1.* Shah, V.L.& Gore, V. *Limit State Design of Steel Structures IS: 800-2007,*Pune,Maharashta India: Structures Publications, 2010.

*2.* Bhavikatti, S.S. *Design of Steel Structures.*New Delhi India: I.K. International Publishing House Limited, 2010

*3.* Subramanian, N. *Design of Steel Structures.United* Kingdom: Oxford University Press, 2010

*4.* Relevant Codes IS: *800-2007*

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| **L-T-P** | **BCI030A – Environmental Engineering I** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* Demonstrate the importance of interdisciplinary nature of environmental and health risk

assessment.

* To study the Aesthetics of metropolitans.
* Facilitates to plan urban area’s removing the environmental issues.

**Unit 1**

Water supply and quantity**:** Introduction, Water demands and domestic use, variation in demands; population forecasting by various methods using logistic curve method; per capita supply, basic needs and factors affecting consumption; design period. Sources of water: Kinds of water sources and their characteristics, collection of surface and ground water; quality of surface and ground waters; factors governing the selection of a source of water supply.

Quality of water: Introduction, Common impurities in water and their effect, quality of source, water analysis, physical examination, chemical examination, micro-organism in water, microbiological examination of water, bacterial effect on quality of water, common water borne diseases, standards of purified water

**Unit 2**

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control; water hammer and its control measures.

**Unit 3**

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, concept of service and balancing reservoirs, capacity of distribution reservoirs; general design guidelines for distribution system, Hardy - Cross method, Newton - Raphson method and equivalent pipe method of pipe network analysis; rural water supply distribution system.

**Unit 4**

Purification of water supplies: Introduction, coarse and fine screens, theory of sedimentation, sedimentation tanks, tube settlers, analysis of flocculent settling, coagulation, constituents of coagulation plant, determination of optimum coagulant quantity, coagulation sediment process, theory of filtration, filter materials, types of filters and their classification, slow sand filters, rapid gravity filters, design of filtering media, hydraulics of sand gravity filters, pressure filters, other filters

**Unit 5**

Disinfection, softening and miscellaneous treatments: Minor methods of disinfection, chlorination, methods of removing temporary hardness and permanent hardness, removal of colors, odors and tastes from water, Desalination, arsenic contamination and its removal, removal of iron and manganese, packaged natural mineral water, BIS standards for packaged drinking water.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Able to design a water supply scheme for a particular section of community.

CO2: To know the different water treatment technologies.

CO3: Basic knowledge of storage and transmission.

CO4: Basic knowledge of distribution system.

CO5: Able to understand Purification of water supplies

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | L | L |  | H |  |  | M | H | L |  |
| CO2 | H |  | M |  | L | L |  | H |  |  | M | H | L |  |
| CO3 | H |  | M |  | L | L |  | H |  |  | M | H | L |  |
| CO4 | H |  | M |  | L | L |  | H |  |  | M | H | L |  |
| CO5 | H |  | M |  | L | L |  | H |  |  | M | H | L |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Garg, S.K. *Water Supply Engineering (Environmental Engineering Vol. – I).*New Delhi India: Khanna Publisher,2017

***References Books:***

1. Peavy, Rowe &Tchobanoglous. *Environmental Engineering First edition*. Noida UtterPradesh India:McGraw Hill Education,2017
2. Metcalf & Eddy. *Wastewater Engineering.*Noida UtterPradesh India: McGraw Hill Education,2002
3. Garg, S.K. *Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).*Jaipur Rajasthan India:Schand,1979
4. Manual on Water Supply and Treatment.*C. P. H. E. E. O. Government of India,* New Delhi India: Ministry of Urban Development,2009
5. Manual on Sewerage and Sewage Treatment. *C. P. H. E. E. O., Government of India,* New Delhi India: Ministry of Urban Development,2009

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| **L-T-P** | **BCI072A – Geotechnical Engineering Lab II** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. To determine the differential free swell index of soil.
2. To determine the particle size distribution of a soil by hydrometer analysis.
3. To determine the shear parameters of a sandy soil specimen by direct shear test.
4. To determine the CBR of soil.
5. To determine the compressibility parameters of soil by consolidation test.
6. To determine the swelling pressure of soil.
7. To determine the permeability of a soil sample using Constant Head permeability test method.
8. To determine the permeability of a soil sample using Variable Head permeability test method.
9. To determine the shear strength of soil sample by tri-axial test apparatus.
10. To determine the Unconfined Compression Strength of a soil sample.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Determine index properties of soils

CO2: Classify soils

CO3: Determine engineering properties of soils

CO4: Determine the permeability of the soil

CO5: Determine the shear and compression parameters of the soil

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M | M | H | H | H | M | M | M | H | H | H | H | H |
| CO2 | H | M | M | H | H | H | M | M | M | H | H | H | H | M |
| CO3 | H | M | M | H | H | H | L | M | H | H | H | H | H | H |
| CO4 | H | H | M | H | H | L | L | M | L | H | H | H | H | M |
| CO5 | H | H | M | H | H | L | H | M | H | L | H | H | H | M |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI023C – Engineering Surveying Lab II** | **Credits: 2** |
| **0-0-2** |

**Experiment**

1. Determination of elevation of point by trigonometric levelling (same vertical plane)
2. Determination of elevation of point by trigonometric levelling (different vertical plane)
3. To shift the R.L. of known point by double leveling.
4. To measure and adjust the angles of a braced quadrilateral.
5. Setting out a simple circular curve by offset from chord method
6. Setting out simple circular curve by Rankine’s method.
7. To prepare a contour map by indirect contouring.
8. Collection of field data like point data, line data and area data by using GPS receiver.
9. Image interpretation and GIS lab
10. Demonstration of Total Station
11. Survey Camp

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Use the theodolite along with chain/tape, compass on the field

CO2: Apply geometric and trigonometric principles of basic surveying calculations

CO3: Plan a survey, taking accurate measurements, field booking, plotting and adjustment of errors

CO4: Apply field procedures in basic types of surveys, as part of a surveying team

CO5: Employ drawing techniques in the development of a topographic map

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | L | H |  | M |  |  | M | H |  | M | H | M |  |
| CO2 | H | H | L | M | H |  |  | M | H | L | H | H | H |  |
| CO3 | H | H |  | M | H |  | L | M | H | L | H | H | H |  |
| CO4 | H | H | L | M | H |  | L | M | H | L | H | H | H |  |
| CO5 | H | H |  | M | H |  |  | M | H | L | H | H | H |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI031B – STAAD Pro Lab** | **Credits: 2** |
| **0-0-2** |

**Experiment**

Design of Concrete Structures as per all major international codes

1. Design of Concrete Beam
2. Design of Cantilever Beam
3. Design of Concrete Column
4. Design of Concrete Slab
5. Design of Concrete Footing
6. Design a G+2 building
7. Numerical and Graphical Design Outputs with complete reinforcement details.
8. IS 456-2000 for RCC design implemented
9. RC detailer as per IS 456-2000 has been implemented which has given a new dimension to RCC design never witnessed in STAAD before

**Course Outcome:**

***At the end of this course, students will be able to:***

CO1: Design of Concrete Beam using STAAD Pro

CO2: Design of Concrete Column using STAAD Pro

CO3: Design of Concrete footing using STAAD Pro

CO4: Design of Concrete G+2 building using STAAD Pro.

CO5: IS 456-2000 for RCC design implemented.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM**

**OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M |  |  |  |  |  |  |  |  | L | H |  |  |
| CO2 | H | M |  |  |  |  |  |  |  |  | L | H |  |  |
| CO3 | H | M |  |  |  |  |  |  |  |  | L | H |  |  |
| CO4 | H | M |  |  |  |  |  |  |  |  | L | H |  |  |
| CO5 | H | M |  |  |  |  |  |  |  |  | L |  |  |  |

H = Highly Related M = Medium L=Low

**Semester VI**

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| **L-T-P** | **BCI021B – Theory of Structures II** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* Ability to analyze the various types of structures.
* To understand the deformations of structures under loading.
* To study the different methods to analyze the structures.

**Unit 1**

Influence line diagram and rolling load: ILD for beams & frames, Muller-Breslau principle and its application for drawing ILD, Rolling load, maximum stress resultants in a member/section, absolute maximum stress resultant in a structure.

**Unit 2**

Arches: analysis of three hinged two hinged and fixed type parabolic arches with supports at the same level and at different levels.

**Unit 3**

Cable and Suspension bridges: Analysis of cables with concentrated and continuous loading, analysis of two and three hinged stiffening girder.

**Unit 4**

Unsymmetrical bending: Definition, location of NA, computation of stresses and deflection, shear center and its location, Theories of Failures.

**Unit 5**

Introduction to matrix method, Force displacement relation, flexibility and stiffness coefficients, relation between flexibility and stiffness matrices, system approach of flexibility method and stiffness method, coordinate transformation matrix, rotation matrix, element and global stiffness matrix for pin jointed structures and beam element in 2D only.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Ability to identify determinate, indeterminate, stable and unstable structures.

CO2: Ability to determine forces and deflections in determinate arches and cable.

CO3: Formulate Equilibrium and compatibility equations for structural members.

CO4: Analyze structures for gravity loads, moving loads and lateral loads

CO5: Analyze one dimensional and two dimensional structures using matrix methods of structural

analysis

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  |  |  | H |  |  |  |  |  |  |  |  |  |
| CO2 |  |  |  |  | H |  |  |  |  |  |  | H |  |  |
| CO3 |  |  |  |  | H |  |  |  |  | L |  |  |  |  |
| CO4 |  |  |  |  | H |  |  |  |  |  |  | M |  |  |
| CO5 |  |  |  |  | H |  |  |  |  |  |  | L |  |  |

H = Highly Related M = Medium L=Low

***Text Books:***

1. Punmia, B.C. *- Theory of Structures, ,* 13th edition, *Laxmi Publication,* 2017*.*
2. Bhavikatti, S.S. *- Structural Analysis Volume – I*, 4th edition, Vikas Publishers,2010

***Reference Book:***

1. Menon, D.-*Structural Analysis* Narosa Publishing House, Reprint 2016
2. Hibbeler R.C, *Structural Analysis*, Prentice Hall; 7th edition, 2009.
3. Pandit& Gupta.- *Structural Analysis A Matrix Approach*, Tata Mc Graw Hill Publication,2008

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| **L-T-P** | **BCI028A – Irrigation and Hydrology** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* The objective of the course is to build on the student's background in hydrology and irrigation an understanding of the engineering of water resource systems in general and urban hydrologic systems in particular.
* To introducing the irrigation, different terms and definitions.

**Unit 1**

**Introduction:** Definitions, functions and advantages of irrigation, present status of irrigation in India, classification for agriculture, soil moisture and crop water relations, Irrigation water quality. Consumptive use of water, principal Indian crop seasons and water requirements, multiple cropping, hybrid crops, water harvesting and conservation.

**Unit 2**

**Canal Irrigation:** Types of canals, parts of canal irrigation system, channel alignment, assessment of water requirements, estimation of channel losses, design of channels, regime and semi theoretical approaches (Kennedy’s Theory, Lacey’s Theory), cross section of channels, silt control in canals.

**Water Distribution System:** Rotational delivery (Warabandi, JamaBandi,KhasraBandi, Sajra Sheets), continuous delivery and delivery on demand, Role of command area development authority, Functions and organizational structures.

**Unit 3**

**Distribution of Canal Water:** System of regulation and control, outlets, assessment of canal revenue.

**Hydraulics of Alluvial Rivers:**Critical tractive force, regimes of flow, resistance relationship for natural streams, bed load, suspended load and total equations, different stages of rivers, meandering, aggradations, andDegradation, river training & bank protection works.

**Unit 4**

**Water Logging:** Causes, preventive and curative measures, drainage of irrigated lands, saline and alkaline lands, types of channels lining and design of lined channel.

**Well Irrigation:** Open wells and tube wells, types of tube wells, duty of tube well water.

**Unit 5**

**Hydrology:** Definition, Hydrologic cycle, Application to Engineering problems, measurement of rainfall, rain gauge, peak flow, flood frequency method, catchment area formulae, Flood hydrograph, Rainfall analysis,

Infiltration, Run off, Unit hydrograph and its determination, Estimation of runoff.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Theoretical knowledge of fundamentals, classification and function of irrigation systems in

relation with crop production.

CO2: Design and classification canal and channel for irrigation purpose using various methods and

knowledge of water distribution.

CO3: Theoretical knowledge of canal water distribution and its hydraulic characteristics for alluvial

rivers.

CO4: Theoretical knowledge of water logging, its impacts, causes and prevention

CO5: Theoretical knowledge of hydrological aspects, classification and measurement of precipitation

with help of various engineering methods.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM**

**OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO  11 | PSO1 | PSO2 | PSO3 |
| CO1 | L | L | H | L | L | H | H | H | H | M | L | M | H | H |
| CO2 | H | L | H | L | H | H | H | H | H | M | H | M | L | M |
| CO3 | H | L | H | M | H | H | H | H | H | H | M | H | L | M |
| CO4 | L | L | H | L | H | H | H | H | H | H | L | H | L | H |
| CO5 | H | L | H | H | H | H | H | H | H | M | M | M | L | H |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Basak, N. N*. - Irrigation Engineering ,*1st editionMcGraw Hill Education Publication*.* 2017
2. Arora, K.R. *- Irrigation Water Power and Water Resource Engineering,* Standard Publisher distributors ,2010

**Reference Book:**

1. Garg, S.K. *- Irrigation Engineering & Hydraulic Structures,* Khanna Publishers,2017
2. Modi, P.N. - *Irrigation Engineering & Hydraulic Structures,*S.K. Kataria& Sons; Reprint 2013 edition (2013)
3. Zimmerman, J.D. *- Irrigation,* 99th edition John Wiley & Sons; 99th edition (1 September 1966)

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| **L-T-P** | **BCI029B – Transportation Engineering I** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* Ability to mathematically develop and interpret design standards for horizontal and vertical geometry and super elevation.
* Ability to apply standards to design of alignments when considering topography and environmental concerns.
* Providing faster system of transport to avoid traffic jams in urban areas.

**Unit 1**

Introduction: Importance and Role of Transportation Systems, Technological and Operating Characteristics of Transportation Systems, Components of transportation Systems, Transportation Coordination, Transportation Modes and their comparison. Highway Planning: Highway Planning Process, specifically in India, Transport or Highway related Agencies in India. Classification of Roads and Road Development Plans, Road Patterns, Controlling Factors and Surveys for Highway Alignment.

**Unit 2**

Highway Materials and Construction: Desirable Properties, Testing Procedures, Standards and standard values relating to Soil, Stone Aggregates, Bitumen and Tar, fly-ash/pond-ash. Methods of constructing different types of roads viz. Earth roads, Stabilized roads, WBM roads, fly ash embankments, Bituminous roads and Concrete roads. Specific features of rural roads.

**Unit 3**

Highway Geometric Design: Cross Sectional Elements, camber, Sight Distances - definition and analysis of SSD and OSD, Design of Horizontal Alignment – Super elevation, extra widening, transition curves. Design of Vertical Alignment – Gradients, Vertical curves.

**Unit 4**

Elementary Traffic Engineering: Significance of different Traffic Engineering Studies viz. Speed, Volume, O & D, Parking and Accident’s Study. Importance and types of Traffic Signs, Signals, Road Markings and Road Intersections.

**Unit 5**

Structural design of Highway Pavements: Design of Flexible Pavements by G. I. and CBR methods. Design of Rigid Pavements by Westergaard and modified methods.

**Course Outcomes**:

***At the end of this course, students will be able to:***

CO1: Plan highway networks

CO2: Understand the principles of construction and maintenance of highways

CO3: Design highway geometrics.

CO4: Design Intersections and prepare traffic management plans

CO5: Design flexible and rigid pavements.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM**

**OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | M | L | L | M | M |  |  | L | H |  | M | M | M |  |
| CO2 | L | H | L | L | L |  |  | L | H | L | H | L | M |  |
| CO3 | H | M | H | M | H |  |  | H | H | L | H | H | H |  |
| CO4 | H | H | H | H | H |  |  | H | H | L | H | H | H |  |
| CO5 | H | H | H | H | H |  |  | H | M | L | H | H | M |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Kadiyali, L.R. &Lal,N.B. *- Principles and practice of highway engineering,* Khanna Publications, 2005
2. Mannering, F.L., S.K. Khanna & C.E.G. Justo *– Highway Engineering,* Nem Chand & Bros; 10th Edition 2015
3. *Rao, G.V. – Principal of Transportation & Highway Engineering.*

***Reference Books:***

1. Morlok, E.R. *- An Introduction to Transportation Engineering and Planning,* McGraw Hill, NY, 1978
2. Hay, W.W. *- Introduction to transportation Engineering,* John Wiley & Sons, NY, 1988.
3. Papacostas, C.S*. - Fundamentals of transportation Engineering,* Prentice Hall of India, 1987*.*
4. Chakroborty, P*. - Principles Of Transportation Engineering,* , PHI Learning, 1st edition,2009
5. Washburn, S.S.&Kilareski, W.P. *- Principles of Highway Engineering and Traffic Analysis,* , John Wiley4th Edition,

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| **L-T-P** | **BCI041A – Environment Engineering II** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* To study the characteristics of wastewater.
* To study sewage treated techniques.
* To making sure that the treated water is purified enough to be disposed off.

**Unit 1**

**Wastewater characteristics:** Introduction: Beneficial uses of water and quality requirements, standards. Concepts of water and wastewater quality: physical, chemical and bacteriological examination of water and wastewater, Water borne diseases and their control, Wastewater characteristics: Temperature, pH, colour and odor, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. Objectives of treatment: Water and wastewater treatment, unit operations and processes and flow sheets.

**Unit 2**

Sedimentation: Determination of settling velocity, efficiency of ideal sedimentation tank, short circuiting; different classes of settling; design of primary and secondary settling tanks; removal efficiency for discrete and flocculent settling. Coagulation: Mechanisms of coagulation, coagulants and their reactions, coagulant aids; design of flocculates and clariflocculators.

**Unit 3**

Filtration: Theory of filtration; hydraulics of filtration; Carman - Kozeny and other equations; slow sand, rapid sand and pressure filters, backwashing; brief introduction to other filters; design of filters. Disinfection: Requirements of an ideal disinfectant; kinetics of disinfection, various disinfectants, chlorination and practices of chlorination. Water softening and ion exchange: calculation of dose of chemicals, Adsorption.

**Unit 4**

Wastewater Treatment: Preliminary, primary, secondary and tertiary treatment processes. Primary Treatment: Screens, grit chamber and their design, sedimentation and chemical treatment to be given. Secondary Treatment: Theory of organic matter removal; activated sludge process, design of different units and modifications, extended aeration systems; trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, R.B.C. etc.

**Unit 5**

Anaerobic digestion of sludge: Design of low and high rate anaerobic digesters and septic tank. Basic concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and upflow anaerobic sludge blanket (UASB) reactor, Disposal of wastewater on land and in water bodies, Introduction to Duckweed pond, vermiculture and root zone technologies and other emerging technologies for wastewater treatment.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understanding different theory of filtration.

CO2: Understanding anaerobic digestion of sludge of wastewater.

CO3: Understanding different theory of Sedimentation.

CO4: Understand the characteristics of wastewater. .

CO5: Able to understand Wastewater Treatment**.**

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO2 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO3 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO4 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO5 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |

H = Highly Related M = Medium L=Low

***Text book:***

1. Metcalf & Eddy *- Wastewater Engineering*,McGraw-Hill Higher Education; 4 edition, 2002.

***Reference Book:***

1. Garg, S.K*. - Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).* Khanna, 37th edition,1979
2. *Manual on Water Supply and Treatment, C. P. H. E. E. O*., Ministry of Urban Development, Government of India, New Delhi
3. *Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O.,* Ministry of Urban Development, Government of India, New Delhi

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| **L-T-P** | **BCI043B – Transportation Engineering Lab** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. Aggregate impact test
2. To determine fineness modulus of a given sample of coarse aggregate.
3. Los angles abrasion test
4. Aggregate crushing value test
5. Standard tar viscometer test
6. Specific gravity and water absorption test
7. To determine the elongation index for given sample of aggregate.
8. To determine the flakiness index & angularity number of given sample of aggregate.
9. Ductility test
10. To determine the softening point for give sample of bitumen.
11. To determine penetration value of bitumen.
12. Marshal stability test
13. Float test

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Characterize the pavement materials

CO2: Perform quality control tests on pavements and pavement materials

CO3: Develop Job mix for various types of bituminous constructions such as WMM,

SDBC, BC, DBM and BM etc.

CO4: Prepare the testing reports related to highway engineering works.

CO5: Monitor and maintain road pavements.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | L | L | L | M | L |  |  | L | H |  | M | L | L |  |
| CO2 | M | H | L | L | M |  |  | L | H | L | H | M | M |  |
| CO3 | H | M | M | M | H |  |  | H | M | L | H | H | H |  |
| CO4 | M | H | H | H | M |  |  | H | H | L | H | M | M |  |
| CO5 | M | H | H | H | M |  |  | H | M | L | H | M | L |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **BCI044B – Environmental Engineering Lab** | **Credits: 2** |
| **0-0-2** |

**Experiments**

1. To determine the pH of the given sample of water & sewage.
2. To determine the turbidity of the given sample of water &wastewater.
3. To determine the Total Solids of the given sample of water & sewage.
4. To determine the Total Dissolved Solids of the given sample of water & sewage.
5. To find out conductivity of the given water sample.
6. Determination of the iron and fluoride content in drinking water.
7. Determination of BOD & COD of waste water.
8. To find out chloride of the given water sample.
9. To determine alkalinity of the given water sample.
10. To determine hardness of the given water sample.
11. To determine the optimum dose of alum by Jar test.
12. Determine the dissolved oxygen in water by winkler method.
13. Determine the color and odor of a given sample of water
14. To find out Total Settle able Solids of the given sewage sample.
15. To determine Total Suspended Solids of the given sewage sample.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understanding different theory of filtration.

CO2: Understanding anaerobic digestion of sludge of wastewater

CO3: Understanding anaerobic digestion of disposal of waste water.

CO4: Would be able to explain the different aspects of quality of water.

CO5: Able to understand Wastewater Treatment

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO2 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO3 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO4 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |
| CO5 | H |  | M |  | L | L |  | H |  |  | M | H | M |  |

H = Highly Related M = Medium L=Low

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| **Program Elective-I (any one of the following)** | |
| BCI026C - Advance Design of Steel Structures | BCI046B – Construction Project Management |

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| **L-T-P** | **BCI026C – Advance Design of Steel Structures** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* This course covers the behavior and design of advanced components used in steel structures.

**Unit 1**

Design of beams & columns with axial and eccentric loading.

**Unit 2**

Gantry Girder - Loads acting on gantry girder. Design of gantry girder.

**Unit 3**

Design of plate girder: Design of welded and bolted sections. Connections for flange plate to flange angles and flange angles to web, etc. Design of welded connections. Web and flange splicing. Horizontal, Intermediate and Bearing stiffeners. Curtailment of plates. Shear strength determination by post critical and tension field action methods. End panel design options and procedure as per IS 800.

**Unit 4**

Bridges: Classification, Loadings, Standard loading for railway bridges, Design of Deck type plate-girder bridges, design of its bracings and frames.

Design of through type truss girder bridges including stringer design, cross girder design, main truss members, portal and sway bracings etc.

**Unit 5**

Steel tanks and stacks - Loads acting on tanks including wind and earthquake. Design of circular tanks with conical bottom, supporting ring beam, staging for circular tanks. Design of rectangular steel tanks. Design of foundation for columns.

***Outcomes:***

***At the end of this course, students will be able to:***

CO1: design Beam column with eccentric loading

CO2: design steel gantry girders

CO3: design plate girder

CO4: design the steel bridge for railways

CO5: design Steel tanks and foundation for columns

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO2 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO5 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Negi, L.S. *- Design of Steel Structures,* Tata McGraw Hill, New Delhi 2nd edition,1997
2. Bhavikatti, S.S. *– Design of steel structures*I K International Publishing House Pvt. Ltd; 5th Revised edition edition,2017
3. Duggal, S.K*.-Limit state design of Steel Structures.* McGraw Hill Education; 2nd edition 2017.

***Reference Book:***

1. Kazimi, S.M. A. & Jindal, R.S*. - Design of Steel Structures*, Prentice Hall of India. 1990
2. Ramchandran*- Design of Steel Structures, Vol I & II,*Scientific Publishers Journals Dept, 2011)
3. Subramaniam, N, *Design Of Steel Structures Limit States Method*, 2nd edition,Oxford University Press,2016,
4. *Relevant Codes IS: 800-2007*

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| **L-T-P** | **BCI046B – Construction Project Management** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* To develop skills in the management and control of construction operations.
* To study the techniques of planning resources and executing them.
* To predict the probability of completion of project and in less time.

**Unit 1**

Construction- Unique features of construction, construction project, types and features, phases of a project, agencies involved and their methods of execution.

**Unit 2**

Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break -down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data

**Unit 3**

Techniques of planning- Bar charts, Networks: basic terminology, types of precedence relationships: finish to start, start to start, finish to finish, start to finish, preparation of CPM networks: activity on link and activity on node representation, analysis of single relationship (finish to start) networks, computation of float values, critical and semi-critical paths, calendaring networks.

**Unit 4**

Resource scheduling- bar chart, line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothing and levelling.

**Unit 5**

PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Ability to ensure that construction projects are completed on-time and within budget.

CO2: Able to apply different techniques for planning.

CO3: Able to apply different method for planning and Construction.

CO4: Able to apply PERT for predicting probability and time of completion of project.

CO5: Able to apply different techniques for scheduling.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | H | L |  | M |  |  | H | H | M |  |
| CO2 | H |  | M |  | H | L |  | M |  |  | H | H | M |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | H | H | M |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | M |  |
| CO5 | H |  | M |  | H | L |  | M |  |  | H | H | M |  |

H = Highly Related M = Medium L=Low

***Text Book:***

* 1. George R., Sidney L. *Total construction project management.* New York, USA: McGraw Hill Publication, 2013.

***Reference Book:***

1. Keoki S. S., Richard H.C. *Construction Project Management*: A guide to field construction management.

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| **Program Elective-II (any one of the following)** | | | |
| BCI079A | Infrastructure Management | BCI036B | Advanced Reinforced Cement Concrete |
| BCI037B | Foundation Engineering | BCI038A | Pre-Stressed Concrete |

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| **L-T-P** | **BCI079A - Infrastructure Management** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

After successful completion of the course, student will be able to

* Comprehend concept of infrastructure, infrastructure economics, policies and regulations.
* Identify and analyse issues related to infrastructure projects.
* Recommend appropriate infrastructure management plan.

**Unit 1**

**Introduction and Infrastructure scenario:** Types, role, need and scenario of infrastructure, infrastructure crisis.

**Unit 2**

**Urban Infrastructure:** Concept of urbanization and economic development, scenario of municipal infrastructure, models of urban governance, municipal finances, major municipal reforms, legislations pertaining to urban infrastructure.

**Rural Infrastructure:** Overview, concept of rural infrastructure planning, state of rural infrastructure, growth, rural characteristics, strategies to improve infrastructure in rural areas.

**Unit 3**

**Private Involvement in Infrastructure:** Overview, benefits, problems and challenges of infrastructure privatization.

**Unit 4**

**Infrastructure Economics and Finance:** Principles of finance, infrastructure economics, developing financial models for infrastructure, introduction to project finance.

**Infrastructure Risk Management:** Risks in infrastructure, quantitative risk analysis, qualitative risk management, risk management strategies.

**Unit 5**

**Infrastructure Maintenance:** Introduction, need and requirement and preventive techniques for maintenance, recycling techniques.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Able to understand the scenario of infrastructure.

CO2: To know the planning of rural and urban infrastructure.

CO3: Able to understand the involvement of private sector.

CO4: Basic knowledge of economics, finance and risk associated with infrastructure project.

CO5: Able to understand infrastructure maintenance.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | M |  | M |  |  |  |  | L | L |  |  | L |  |  |
| CO2 | M |  | M |  |  |  |  | L | L |  |  | L |  |  |
| CO3 | M |  | M |  |  |  |  | L | L |  |  | L |  |  |
| CO4 | M |  | M |  |  |  |  | L | L |  |  | L |  |  |
| CO5 | M |  | M |  |  |  |  | L | L |  |  | L |  |  |

H = Highly Related M = Medium L=Low

***Text & References Books:***

1. Chandra P. *Projects: Planning, Analysis, Selection, Financing, Implementation, and Review*, New York, USA: Tata McGraw-Hill, 2017.

2. Goodman S., Hastak M. *Infrastructure Planning Handbook: Planning, Engineering, and Economics*, New York, USA: Tata McGraw-Hill, 2014.

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| **L-T-P** | **BCI036B – Advanced Reinforced Cement Concrete** | **Credits: 3** |
| **3-0-0** |

**Objective:**

* Design of various structural members.

**Unit 1**

**Elements of Prestressed Concrete:** Principles and systems, material properties, losses of prestress, I.S. specifications, analysis and design of rectangular and T sections for flexure and shear.

**Unit 2**

Torsion: Analysis and Design of beams for torsion as per code method.

Continuous and Curved Beams: Analysis and Design of continuous beams using coefficients (IS Code), concept of moment redistribution. Analysis and design of beams curved in plan.

**Unit 3**

Circular Domes: Analysis and design of Circular domes with u.d.l. and concentrated load at crown.

Water Tanks and Towers: Water Tanks and Water Towers-design of rectangular, circular and Intze type tanks, column brace type staging.

**Unit 4**

Yield Line Theory: Introduction to Yield line concept, Application of Y.L.T. to slabs with simple support conditions.

Retaining walls: Analysis and design of Cantilever Retaining Walls: Introduction to counterfort and buttress type retaining walls, their structural behavior and stability analysis.

**Unit 5**

Culverts and Bridges: Analysis and Design of superstructure of slab culverts and T-bridge for I.R.C. loading.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand the concept of Prestressed concrete

CO2: Ability to analyze and design of torsion reinforcement.

CO3: Ability to analyze and design of Circular domes & Water Tank.

CO4: Ability to analyze and design of Retaining wall.

CO5: Ability to analyze and design of Culverts & Bridges.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO2 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO5 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text book:***

1. Punmia, B.C., Jain, A.K.& Jain, A.K*. - RCC Designs (Reinforced Concrete Design),* , Lakshmi Publishers,10th Edition 2006
2. *IS:456-2000*

***Reference Book:***

1. Victor, J *Essentials Of Bridge Engineering*, Oxford &Ibh, 6th edition, 2016
2. Krishna Raju N, *Design of Bridges*, South Asia Books; 2nd edition,1988.
3. Varghese P.C. *Advanced reinforced structure design* Prentice Hall India Learning Private Limited; 2nd edition (2005)
4. Krishna Raju N, *Advanced reinforced Concrete design*CBS; 3rd edition ,2005.

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| **L-T-P** | **BCI037B – Foundation Engineering** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To understand the suitability of different type of foundation on the basis of soil type.
* Methods to determine the load carrying capacity of soil.
* To understand the design of shallow, pile and well foundations.
* Study of different types loading on soil and calculation of stresses due to such loadings.

**Unit 1**

Bearing Capacity of Shallow Foundation: Definitions of ultimate bearing capacity,gross, net and safe pressures, allowable bearing pressure, types of shallow foundations modes of failures. Bearing capacity theories: Rankine’s approach, Prandtl’s approach and Terzaghi’s approach, concept behind derivation of equation, general bearing capacity equation, bearing capacity equations for square and circular footings, factors influencing bearing capacity, performance of footings in different soils, Vesic’s chart, ultimate bearing capacity in case of local shear failure. Plate load test and its applications and estimation of settlements, bearing capacity based on Standard Penetration Test.

**Unit 2**

Design of Shallow foundation: Types of shallow foundation, Footing size and loading parameters, principle of design of footing, different types of method of design of strip, spread, combined footing and raft footing.

**Unit 3**

Axially Loaded Pile Foundations: Introduction to pile foundations, necessity ofpile foundation, classification of piles, construction methods of bored piles, concrete bored piles, driven cast in-situ piles. Pile capacity based on static analysis, piles in sand, piles in clay, dynamic methods and their limitations, in- situ penetration tests and pile load test as per IS 2911 specifications, negative skin friction. Pile groups ultimate capacity of groups, settlement of pile groups in sand and in clay as per IS 2911 and critical depth method.

**Unit 4**

Well foundation: Introduction, Shapes of wells and components parts, Depth of well foundation and and bearing capacity, forces acting on well foundation, well curb, cutting edge, steining and bottom plug, well sinking.

Machine Foundation: Introduction, Types of machine foundation, Basic definitions, Degree of freedom of a block foundation, General criteria for design of machine foundation, free and forced vibrations, vibration of machine foundation.

**Unit 5**

Foundation on Difficult Soils: Collapsible soil; identification, Collapse settlement: foundation design. Sanitary land fills settlement of sanitary land fill.

Expansive soils: Behaviour of expansive soil, foundation practices, underreamed piles. Methods of finding out load carrying capacity of under reamed piles in clayey and sandy soil. Provision of IS 2911 Part III-1980 for design of under-reamed pile foundations.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Analysis of shallow foundation and pile foundation.

CO2: Basic idea about machine foundation.

CO3: Use of well foundation in water front structure.

CO4: Understand soil exploration methods

CO5: Analysis of expensive soil

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | M | M | H | L |  | M |  |  | H | H | H |  |
| CO2 | H | H | M | M | H | L |  | M |  |  | H | H | H |  |
| CO3 | H | H | M | M | H | L |  | M |  |  | H | H | H |  |
| CO4 | H | H | M | M | H | L |  | M |  |  | H | H | H |  |
| CO5 | H | H | M | M | H | L |  | M |  |  | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text Books:***

1. Punmia, B.C*. - Soil Mechanics and Foundation Engineering,*Laxmi Publications; 16th edition ,2017.
2. K.R. Arora- *Soil Mechanics And Foundation Engineering* Standard Publisher Dist.,2009

***Reference Books***

1. Murthy, V.N.S. *- Soil Mechanics and Foundation Engineering,* CBS; 1st edition, 2009
2. Budhu M, *Soil Mechanics and Foundations,* Wiley, 2016.
3. Ranjan, G. & Rao, A.S.R*. - Basic and Applied Soil Mechanics,* New Age International Pvt Ltd; 3rd edition,2016

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| **L-T-P** | **BCI038A – Pre-Stressed Concrete** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* Understand the general mechanical behavior of prestressed concrete.
* Analyze and design prestressed concrete flexural members.

**Unit 1**

General principles of prestressed concrete: classification and types, stages of loading, advantages of prestressed concrete over reinforced concrete, partial prestressing, design codes for prestressed concrete.

Materials: Strength requirements of concrete, strain characteristics of concrete, steels for prestressing, steel wires, steel strands, steel bars, fiberglass tendons, grouts.

**Unit 2**

Prestressing systems and end anchorages: pretensioning system and end anchorages, tensioning methods in post tensioning, post tensioning anchorages utilizing wedge action, post tensioning anchorages for wires, post tensioning anchorages for bars.

Loss of prestress: Significance, Lump sum estimate, elastic shortening of concrete, time dependent losses, loss due to creep of concrete, loss due to shrinkage of concrete, loss due to steel relaxation, loss due to anchorage take up, loss or gain due to bending of members, practical considerations for frictional loss, theoretical considerations for frictional loss, total amount of losses elongation of tendons.

**Unit 3**

Analysis of sections for flexure: Stresses in concrete due to prestress, stresses in concrete due to loads, stresses in steel due to loads, discussion on moment curvature relationship of a prestressed concrete beam.

Design of sections for flexure: Preliminary design, general concepts of elastic design, elastic design with no tension in concrete, elastic design allowing tension, elastic design allowing and considering tension, ultimate design, arrangement of steel and prestressing in stages

**Unit 4**

Limit state design of prestressed concrete sections: strength and serviceability limits state, crack widths in prestressed members, design of section for flexure, design of section for shear and torsion, design of member for bond, design of member for bearings.

**Unit 5**

Design of pretensioned and post tensioned flexural beam: dimensioning of flexural members, estimation of self weight of beam, design of pretensioned beam, design of post tensioned beam, design of partially prestressed beam.

**Course Outcome:**

***At the end of this course, students will be able to:***

CO1: Prestressing methods, principles and concepts are essential for the basic concept of the subject.

analysis of prestress and the resultant stresses using different concepts

CO2: Determination of losses in concrete & Anchorage zone stresses in end block can be brought out

using IS method

CO3: Determination of shear strength and ultimate shear resistance capacity as per IS code

CO4: Design of prestressed concrete section, stresses at transfer, service load, limit state of collapse in

flexure and shear

CO5: Design of pretensioned and post tensioned flexural beam.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | L | M | H | H |  | L |  |  | M | L | H | L |  |
| CO2 | H | M | H | H | L |  | L |  |  | M | M | H | M |  |
| CO3 | H | M | H | H | M |  | L |  |  | M | L | H | M | L |
| CO4 | H | H | H | H | L |  | L |  |  | H | M | H | H | L |
| CO5 | H | M | H | H | M |  | L |  |  | M | M | H | M | L |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Raju, N.K*. - Prestressed concrete,* Tata McGraw Hill Publishing Company Limited, New Delhi India.
2. *IS:1343-2012*

***Reference Book:***

1. Lin, T.Y. & Burns, N.H*. - Design of prestressed concrete structures,* John Wiley & Sons, New York.
2. Edward G.N,*Prestressed Concrete: A Fundamental ApproachPrentice Hall;* 5th edition, 2005.

**Semester VII**

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| **L-T-P** | **BCI039A – Water Resource Engineering** | **Credits: 4** |
| **3-1-0** |

**Objectives:**

* To understand the design of different types of regulatory works and diversion headwork.
* To incorporate analytical abilities into the planning and design of water resource systems.
* To understand the design of different types of dams.

**Unit 1**

Regulation of works: Falls, Classification of falls, Design of falls, Distributary head regulator and cross-head regulator, Escape, bed bars.

Cross-Drainage Structure: Necessity of Cross-drainage structures, their types and selection, comparative merits and demerits, design of various types of cross-drainage structure-aqueducts, siphon aqueduct, super passage siphon, level crossing and other types.

**Unit 2**

Diversion Head works: Design for surface and subsurface flows, Bligh’s and Khosla’s methods. Selection of site and layout, different parts of diversion head works, types of weirs and barrages, design of weirs on permeable foundation, silt excluders and different types of silt ejectors. Energy dissipation.

**Unit 3**

Embankment Dams: Suitable sites, causes of failures, stability and seepage analysis, flownet, slope stability analysis, precautions of piping, principles of design of earth dams.

Gravity Dams: Force acting on a gravity dam, stability requirements, Instrumentation.

**Unit 4**

Spillways: Spillway capacity, flood routing through spillways, different types of spillways and gates, energy dissipation below spillways.

Hydro Power Plant: General features of hydroelectric schemes, elements of power house structure, selection of turbines, draft tube and setting of turbine, cavitation.

**Unit 5**

Reservoirs: Evaluation of impact of water projects on river regimes and environment. Reservoir sedimentation and watershed management.

Optimization: Introduction to optimization techniques and system approach. Introduction to G.I.S. and Computer aided irrigation design.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Design and analysis of flow regulation work, and cross drainage work and classification.

CO2: Design and analysis of diversion head work and its classification.

CO3: Design and analysis of embankment and gravity dam in context of site selection, stability and

instrumentation.

CO4: Design and assessment of water power projects, various structural components.

CO5: Analysis and understanding of reservoirs impacts, relevance in context of environment using

optimization techniques.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M | H | L | H | H | L | H | H | M | M | H | H | H |
| CO2 | H | M | H | L | H | H | L | H | H | M | M | H | H | H |
| CO3 | H | M | H | L | H |  | L | H | H | M | M | H | H | H |
| CO4 | H | M | H | L | H | H | L | H | H | M | M | H | H | H |
| CO5 | M | L | H | H | L | H | L | H | H | M | M | M | M | H |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Basak, N.N. *Irrigation engineering (water resources engineering).* New York USA: McGraw Hill Education Publication, 2017.
2. Arora, K.R.*Irrigation Water Power and Water Resource Engineering*; NaiSarak, Delhi,India:Standard Publisher, 2010.

***Reference Book:***

1. Asawa, G.L. *Irrigation Engineering*. DariyaGanj New Delhi, India:Wiley Easternpublication, 2011.
2. Garg, S.K. *Irrigation Engineering & Hydraulic Structures,*NaiSarak Delhi, India:Khanna Publishers, 2017.

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| **L-T-P** | **BCI040B– Transportation Engineering II** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* Students should be able to relate their understanding of the railroad industry, history, and principal components.
* Finding out the traffic load analyzing them and designing transportation systems.
* To overcome the traffic problems in peak hours.

**Unit 1**

Introduction and Permanent Way Components: Types and Selection of Gauges, Selection of Alignment, Ideal Permanent Ways and Cross-sections in different conditions, Drainage, Salient Features and types of Components viz. Rails, Sleepers, Ballast, Rail Fastenings. Study of Specific Aspects: Coning of Wheels, Creep, Wear, failures in Rails, Rail Joints, Length of Rail, Sleeper Density and Spacing, Stations, Yards and Sidings, Turntable, Signalling.

**Unit 2**

Points and Crossings: Types of Turnouts, Points or Switches, layout Plans of different types of Crossings, Design calculations of turnouts. Railway Systems Specific to Urban Movements: Surface railways (suburban railway system of Mumbai, Chennai and Delhi), Underground system (Metro of Kolkata/ Delhi), Elevated Systems (as Proposed for Jaipur, Delhi, Mumbai), Light Rail System (MRTS, Thane). Recent developments in Railway Networking.

**Unit 3**

Geometric Design: Gradient and Grade Compensation, Superelevation and cant, cant deficiency, Types of Curves, Transition curves, their designs, Widening of Gauges.

**Unit 4**

Airport Engineering: Introduction: Requirements to Airport Planning, Airport Classifications, Factors in Airport Site Selection, Airport Size, Obstructions, Zoning. Planning and Design of Airport: Requirements of Airport, Planning of Terminal Area, and different Layouts, Location of Gates, Types of Runway patterns, Runway Layout, Runway Length, Geometric Design of Runways, Layout of Taxiways, Geometric Standards, Exit or Turnaround Taxiways, Apron and Hangers.

**Unit 5**

Airport Pavement Design: Factors Affecting Pavement Design, Design methods of Flexible Pavements, Design methods of Rigid Pavements.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand the importance of railway infrastructure planning and Design fundamental.

CO2: Identify the factors governing design of railway infrastructures

CO3: Design and analyze the railway track system

CO4: Describe the different components of airport and aircrafts

CO5: Design flexible and rigid pavements

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | L | L | L | M | L |  |  | L | H |  | M | L | L |  |
| CO2 | M | H | L | M | M |  |  | L | H | L | M | M | M |  |
| CO3 | H | M | L | M | H |  |  | H | H | L | H | H | H |  |
| CO4 | H | H | H | H | M |  |  | H | H | L | H | M | M |  |
| CO5 | H | H | H | H | M |  |  | H | M | L | H | H | L |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Saxena, S.C. & Arora, S.P.*A Course of Railway Engineering.*Daryaganj New Delhi, India: DhanpatRai publication, 2010.
2. Khanna, Arora. *Airport Planning & Design.* Civil Lines Roorkee, India:Nemchand Bros, 2015.

***Reference Book:***

1. Agarwal, M. M. *Indian Railway Track*,Shahdara, Delhi, India: Sachdeva Press,2018.
2. Bindra, S.P.*Docks and Harbour Engineering,*DaryaganjNew Delhi, India:DhanpatRai, 2012.

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| **L-T-P** | **BCI055A – Solid Waste Management** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To provide the student with a working knowledge of all unit operations involved in solid waste management.
* To identify the hazardous wastes, their transportation and disposal.
* To predict the sources and types of solid wastes.

**Unit 1**

Solid Wastes: sources, types, composition, physical, chemical, and biological properties of solid wastes/ sources and types of hazardous and infectious wastes in municipal solid wastes.

**Unit 2**

Solid waste generation and collection, Handling, Storage, Processing, Transportation.

**Unit 3**

Disposal of Solid waste, materials separation and processing, thermal conversion, biological and chemical conversion, recycling of material in municipal solid wastes, Land-filling, Composting, gas generation, closure of land-fills.

**Unit 4**

Hazardous Wastes–Fundamentals, fate, and Transport of contaminants, Toxicology origin, quantity and quality parameters. Biomedical / infectious Waste: Composition, Collection, Handling and Disposal. Legal aspects of Hazardous Waste Management: Collection, Conveyance, Treatment and Disposal

**Unit 5**

Hazardous Waste Management Practices: Environmental Audits, Pollution Prevention Treatment and Disposal Methods; Physicochemical processes, Biological Methods, Stabilization & Solidification, Thermal Methods, Land Disposal. Site Remediation- Site and Subsurface Characterization, Remedial Technologies.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Study of physical, chemical, and biological properties of solid wastes

CO2: Analysis of solid waste generation and collection

CO3: Disposal of Solid waste, materials

CO4: Study of hazardous Wastes

CO5: Ability to explain the various aspects of solid waste management

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | L | M | H | L |  | L |  | H | L |  | H | H | H | H |
| CO2 | L | M | H | L |  | L |  | H | L |  | H | H | H | H |
| CO3 | L | M | H | L |  | L |  | H | L |  | H | H | H | H |
| CO4 | L | L | H | L |  | L |  | H | L |  | H | H | H | H |
| CO5 | L | L | H | L |  | L |  | H | L |  | H | H | H | H |

H = Highly Related M = Medium L=Low

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***Text Book:***

1. Singh J.,Ramanathan*A. L.* Solid Waste Management: *Present and Future Challenges.*Dariyaganj New Delhi India: I. K. International Pvt Ltd, 2010.

***Reference Books:***

1. Techobanglous T.*Integrated Solid Waste Management*, New York U.S.A: McGraw Hill Education, 2017.

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| **L-T-P** | **BCI077A – Quantity Surveying and Valuation** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To produce civil engineering students who have strong foundation in estimation of quantities required for roads and buildings
* To familiarize with the knowledge of preparing bar bending schedules and valuation of buildings.

**Unit 1**

**Introduction:** Purpose and importance of estimates, principles of estimating. Methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet; bill of quantities. Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

**Unit 2**

**Rate Analysis:** Task for average artisan, various factors involved in the rate of an item, material and labor requirement for various trades; preparation for rates of important items of work. Current schedule of rates. (C.S.R.)

**Unit 3**

**Estimates:** Preparing detailed estimates of various types of buildings, R.C.C. works, earth work calculations for roads and estimating of culverts, Services for building such as water supply, drainage and electrification.

**Unit 4**

**Cost of Works:** Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building.

**Unit 5**

**Valuation:** Purposes, depreciation, sinking fund, scrap value, year’s purchase, gross and net income, dual rate interest, methods of valuation, rent fixation of buildings**.**

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: To identify and differentiate the types of estimates

CO2: To prepare rate analysis and identify the main sources of current and forecast labour rates and

CO3: To prepare detailed estimates of roads and buildings

CO4: To quantify the various items of constructions and estimation of overhead costs

CO5: Ability to prepare valuation of the buildings

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | L | H | L | M | H | H |  |  | M | L | M | H |  |
| CO2 | H | M | H | L | H | H | H |  |  | M | H | M | H |  |
| CO3 | H | M | H | M | H | H | H |  |  | H | M | H | H |  |
| CO4 | L | L | H | L | H | L | H |  |  | H | L | H | M |  |
| CO5 | H | L | H | H | H | H | H |  |  | M | M | M | L |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Dutta B.N. *Estimating & costing,* UBS Publishers' Distributors Pvt Ltd; 28th Revised Edition edition (2016)

***Reference Book:***

1. ChakrobortyM., *Estimating Costing Specification & Valuation in Civil Engg.* Bhakti Vedanta, Book Trust, Delhi,2016
2. Rangwala S.C.  *Quantity Surveying and Valuation,* Charotar Publishing House.

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| **Program Elective-III (any one of the following)** | | | |
| BCI078A | Ground Improvement Techniques | BCI080A | Earthquake Resistant Design |
| BCI027A | Building Maintenance and Repairs | BCI049A | Building Design |

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| **L-T-P** | **BCI078A – Ground Improvement Techniques** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To identify ground conditions and suggest method of improvement
* Understand the principles of soil reinforcement and confinement in engineering constructions

**Unit 1**

**Introduction:** Formation of soil, major soil types, collapsible soil, expansive soil, reclaimed soil, sanitary land fill, ground improvements; objective, potential.

**General principles of compaction:** Mechanics, field procedure, quality control in field.

**Unit 2**

**Ground Improvement in Granular soil:** In-place densification by (a) Vibro floatation (b) Compaction piles in sand (c) Vibro compaction piles (d) Dynamic compaction (e) Blasting

**Unit 3**

**Ground improvement in cohesive soil:** Preloading with or without vertical drains. Compressibility vertical and radial consolidation, Rate of consolidation, Preloading methods. Types of drains, Design of vertical drains,Construction techniques.

**Stone column:** Function, Design principles, load carrying capacity, construction techniques, settlement of stone column foundation.

**Unit 4**

**Ground Improvement by Grouting & Soil Reinforcement:** Grouting in soil: Types of grout, desirable characteristics, Grouting pressure, Grouting methods. Soil Reinforcement – Mechanism, Types of reinforcing elements,Reinforcement- Soil interaction, Reinforced soil application beneath roads, foundation and retaining walls

**Unit 5**

**Soil Stabilization:**

**Lime Stabilization** – Base Exchange mechanism, Pozzolonic reaction, limesoil interaction, lime columns, Design of foundation on lime column.

**Cement Stabilization**-Mechanism, amount, Age and curing.

**Fly Ash-Lime stabilization and Soil bitumen stabilization**

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand the properties of different types of soil

CO2: Know to methods of densification of soil

CO3: Understand the consolidation process

CO4: Design of stone column foundation

CO5: Know about the grouting & soil reinforcement

CO6: Understand the mechanism of stabilization

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M | M | M | H |  |  | M | M |  | H | M | L |  |
| CO2 | H | M | M | L | H |  |  | M | M |  | H | M | L |  |
| CO3 | H | M | M | L | H |  |  | M | M |  | H | M | L |  |
| CO4 | H | M | M | M | H |  |  | M | M |  | H | M | L |  |
| CO5 | H | M | M | M | H |  |  | M | M |  | H | M | L |  |
| CO6 | H | M | M | L | H |  |  | M | M |  | H | M | L |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Raj P.*Ground Improvement Techniques.* Noida UP, India: Tata McGraw Hills, 2013.
2. Gulhati, Dutta. *Text book of Geostatic Engineering.*Noida UP, India: Tata McGraw Hills, 2015.

***Reference Book:***

* + - 1. Singh, A. *Soil Engineering in Theory and Practice.* Dariyaganj, Delhi, India: CBS Publisher & Distributors Pvt. Ltd., 2017.

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| **L-T-P** | **BCI080A – Earthquake Resistant Design** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* Understand phenomenon, causes and effects of earthquake.
* Apply concepts of dynamics to earthquake problems.
* Design earthquake resistant RCC structures using Codal provisions.
* Design earthquake resistant masonry structures.

**Unit 1**

**Seismology:** Causes of earthquakes and seismic waves, magnitude, intensity and energy release, plate tectonics, types of earthquakes, related IS codes.

**Unit 2**

**Characterization of Ground Motion:** Measurement of earthquake ground motion, seismic instruments, strong ground motion parameters.

**Unit 3**

**Effect of Damping:** Types of damping and their form, Logarithmic Decrement.

**Unit 4**

**Forced vibration of Single Degree of Freedom System:** Equation of motion, harmonic force excitation, Dynamic Magnification Factor, Resonance, system excited at base, Transmissibility of force/motion. Free vibration of Multi-Degree of Freedom System.

**Unit 5**

**Earthquake resistant design of buildings, Ductile Detailing.**

**Earthquake resistant design for masonry structures.**

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Able to understand the basic of seismology.

CO2: To know the measurements, equipment and parameters related to seismology.

CO3: Able to understand the effect of damping.

CO4: Basic knowledge of dynamics of seismic.

CO5: Able to design earthquake resistant buildings.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | M | L | L | M | M |  |  | L | H |  | M | M | M |  |
| CO2 | L | H | L | L | L |  |  | L | H | L | H | L | M |  |
| CO3 | H | M | H | M | H |  |  | H | H | L | H | H | H |  |
| CO4 | H | H | H | H | H |  |  | H | H | L | H | H | H |  |
| CO5 | H | H | H | H | H |  |  | H | M | L | H | H | M |  |

H = Highly Related M = Medium L=Low

***Text & References Books:***

1. Chopra A. K. *Dynamics of Structures,* Pearson Education Asia Pte.

2. Kramer S. L. *Geotechnical Earthquake Engineering,* Pearson Education Asia Pte..

3. Duggal S. K. *Earthquake Resistant Design of Structures*, OXFORD University Press.

4. IS CODES: IS:456, IS:1893, IS:4326, IS:18935, IS:13920

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| **L-T-P** | **BCI027A – Building Maintenance and Repairs** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* This course covers the awareness about the maintenance and repairs of the different types of structures
* To study the different types of methods used for the Maintenance and Repairs.

**Unit 1**

General- quality assurance for concrete construction as built concrete property strength, permeability, thermal properties and cracking.

**Unit 2**

Influence on Serviceability and Durability-Effects due to climate, Temperature,Chemicals, Wear and Erosion, Design and Construction errors, Corrosion Mechanism,Effects of Cover thickness and Cracking, Methods of Corrosion protection, Corrosion Inhibitors, Corrosion Resistant Steels, Coatings, Cathodic Protection.

**Unit 3**

Maintenance and Repair Strategies-Definitions-Maintenance, repair and rehabilitation, Facets of Maintenance, Importance of Maintenance, Preventive Measures on Various Aspects, Inspection, Assessment Procedure for Evaluating for Damaged Structures,Causes of Deterioration, Testing Techniques.

**Unit 4**

Materials for Repair-Special Concretes and Mortar, Concrete chemicals, Special Elements for accelerated strength gain, Expansive cement, Polymer Concrete, Sulphur Infiltrated Concrete, Ferro Cement, Fiber Reinforced Concrete.

**Unit 5**

Techniques for Repair-Rust Eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and shotcrete, Epoxy Injection, Mortar Repairs for cracks, shoring and underpinning.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: An understanding of the different techniques for repairs

CO2: An understanding of the background of Importance of Maintenance

CO3: Classification of different structural components and their applications

CO4: Identify effective measures for floor components.

CO5: Study of advanced structural equipment

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM**

**OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| **Course Outcome** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO2 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO3 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO4 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |
| CO5 | L | M | M | L | H | L |  | M |  |  | H | H | H | L |

H = Highly Related M = Medium L=Low

***Text Book:***

1. Campbell, D.A., Roper, H. *Concrete Structures – Materials, Maintenance and Repair*, UK: Longman Scientific and Technical,1991.
2. Allen, R.T., Edwards, S.C. *Repair of Concrete Structures*, UK: Blakie and Sons, 1987.

***Reference Book:***

1. Shetty, M.S. *Concrete Technology -Theory and Practice.* Ram Nagar, New Delhi India:S. Chand, 2015.
2. Kumar, A.R. *Training Course Notes on Damage Assessment and Repair in Low Cost Housing*, RHDC - NBO, Anna University, 1992*.*

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| **L-T-P** | **BCI049A – Building Design** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To understand the loads design for different types of structural system in buildings
* To understand the design of masonry buildings and framed buildings.

**Unit 1**

**Design Loads:** Design loads for different types of buildings. (IS-875 part 1 & 2). Load distribution & concept of load flow to different structural components.

**Structural Systems:** Assumption of integrity aspect ratios & over turning resistance, strength & stiffness of buildings, symmetry and Asymmetry in building forms, Vertical and lateral load resting elements, shear walls, framed tubes and various multistory configurations.

**Unit 2**

**Lateral loads:** Wind loads & calculation of wind load on structures (IS: 875-Part 3).

**Unit 3**

**Lateral loads:** Earthquake loads & calculations of earthquake loads on buildings masonry & framed structures. (IS: 1893 – Part 1).

**Unit 4**

**Masonry and Framed Buildings:** Design of masonry buildings and framed buildings, Earthquake resistant construction of buildings, and various provisions as per IS codes; IS-4326, IS-13827, IS-13828, IS-13920, IS-13935.

**Unit 5**

**Mass Housing:** Prefabricated construction for mass housing.

**Special Roofs:** Introduction to folded plates, cylindrical shells, north-light shell roofs, grid and ribbed floors.

**Course Outcomes:**

***At the end of this course, students will be able to:***

CO1: Understand about the design loads on buildings

CO2: Analysis of wind loads acts on buildings.

CO3: Analysis of earthquake load on buildings.

CO4: Understand about the provision of different codes

CO5: Basic idea about mass housing and special roofs.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | **Program Outcome** | | | | | | | | | | | **Program Specific Outcome** | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H | H | M | M | M | L | M | M | M | H | H | H | H |
| CO2 | H | H | H | M | M | M | L | M | M | M | H | H | H | H |
| CO3 | H | H | H | M | M | M | L | M | M | M | H | H | H | H |
| CO4 | H | H | H | M | M | M | L | M | M | M | H | H | H | H |
| CO5 | H | H | H | M | M | M | L | M | M | M | H | H | H | H |

H = Highly Related M = Medium L=Low

***Relevant Codes:***

*IS : 875, Part I, II and III.*

*IS : 1893*

*IS : 4326*

*IS : 13920*

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| **L-T-P** | **BCI073A – Project Work** | **Credits: 4** |
| **0-0-4** |

**Semester VIII**

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| **L-T-P** | **BCI050A – Industrial Project and Dissertation** | **Credits: 28** |
| **0-0-28** |