

**School of Engineering**

**Department of Civil Engineering**

**Course Structure and Syllabi**

**Academic Programmes**

**April, 2018**

**JECRC UNIVERSITY**

**Department of Civil Engineering**

**Minutes of the meeting of the Board of Studies**

1. Minutes of the meeting of board of studies held on 26thApril, 2018 at 11.00 A.M. in the conference hall of Engineering block JECRC University, Jaipur.
2. The following members attended the meeting.
3. Mr. Rakesh Kumar Verma (Chairperson)
4. Prof. (Dr.) Ram Rattan (Director, School of Engineering)
5. Mr. Anirudh Sharma (Member)
6. Mr. RamvilasMeena(Member)
7. Dr. Gunwant Sharma (Associate Professor, MNIT, Jaipur)
8. Dr. J.K. Jain(Associate Professor, MNIT, Jaipur)
9. Mr. Rakesh Kumar Verma, Head, Department of Civil Engineering, greeted all the members and briefly apprised about the working agenda of the meeting listed below:
10. Constitution of research and practice oriented syllabus.
11. To discuss logical sequencing of the syllabus.
12. Modification of syllabus.
13. Introduction of the new syllabus.
14. The complete curricula of B.Tech. were discussed and finalized considering all academic aspects and significant contents in continuity. A judicious combination of engineering practice and research inputs was aimed for practical development of upcoming engineers, sufficient theory and satisfactory practical were kept in mind.
15. M. Tech. (Structural Engineering) curricula were considered and finalized with respect to prevailing circumstances and technical and academic requirements. The research part was duly given weightage and adopted as such.
16. The syllabi are revised by the faculty members on the basis of suggestions given by alumni, industrial and subject experts.
17. The syllabi are highly focused on employability & skill development and all the courses adopted have full relevance.
18. B. Tech. & M. Tech program has Choice based credit system and elective course system respectively.
19. The detailed contents of the syllabi are enclosed as a part of these minutes.
20. The following emerged from the discussions and course structure of the B.Tech. (CE) as follows:-

a) For the batch inducted in 2018, some new subjects has been added as per requirement of industry requirements.

b) For the batch inducted in 2018, the syllabus mentioned above will be adopted from 3rdsemester.

c) New added subjects are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Subject Name** | **Credit** | **Semester** |
| 1. | Advanced Engineering Mathematics | 4 | 3rd |
| 2. | Building Materials | 3 | 3rd |
| 3. | Concrete Technology | 4 | 3rd |
| 4. | Building Drawing Lab | 2 | 3rd |
| 5. | Numerical Methods, Optimization Techniques and Special Functions | 3 | 4th |
| 6. | Quantity Surveying and Valuation | 3 | 6th |
| 7. | Ground Improvement Techniques | 3 | 7th |

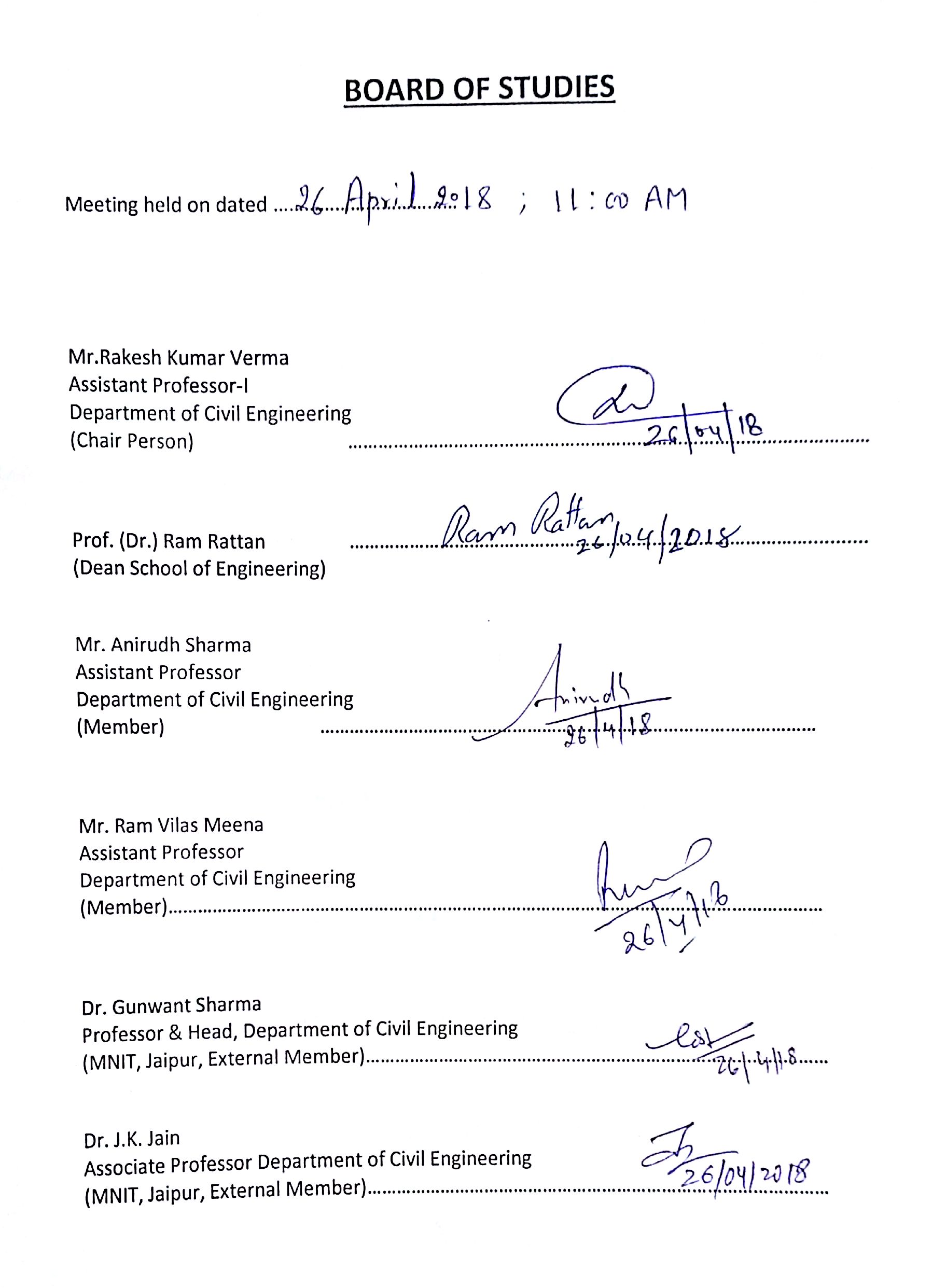
1. The following emerged from the discussions and course structure of the B.Tech (CE) has been revised as follows:-

For the batch Inducted in Third Semester in 2018, following changes made to rationalize the syllabus

1. Subject **Multivariate Analysis, Linear Algebraand Special Function(BAS003A)** with 3 credit is removed from 3rd semester.
2. Subject **Building Materials & Concrete Technology (BCI001B)** with 3 credit is removed from 3rd semester.
3. Subject **Engineering Materials (BES018A)** with 3 credit is removed from 3rd semester.
4. Subject **Professional Skills-III Communication Skills-III (BHS010A)** with 3 credit is removed from 3rd semester.
5. Subject **Professional Skills-III Aptitude-III (BHS003A)** with 4 credit is removed from 3rd semester.
6. Subject **Energy Studies (BMC009A)** with 3 credit is removed from 3rd semester.
7. Subject **Complex Analysis (BAS005A)** with 2 credit is removed from 4th semester.
8. Subject **Professional Skills-IV (BHS004A)** with 6 credit is removed from 4th semester.
9. Subject **Seminar (BCI017A)** with 1 credit is removed from 4th semester.
10. Subject **CAD Building Drawing Lab(BCI065A)** with 2 credit is shifted from 5th semester to 4th semester.
11. Subject **Design of Steel Structures (BCI011B)** with 4 credit is shifted from 4th semester to 5th semester.
12. Subject **Optimization and calculus of variations(BAS004A)** with 2 credit is removed from 5th semester.
13. Subject **Professional Skills-V (BHS005A)** with 6 credit is removed from 5th semester.
14. Subject **Seminar (BCI025A)** with 1 credit is removed from 5th semester.
15. Subject **Program Elective-I**with 3 credit is removed from 5th semester.
16. Subject **Open Elective**with 3 credit is removed from 5th semester.
17. Subject **Advanced Design of Steel Structures(BCI026B)** with 3 credit is shifted from 5th semester to 6th semester.
18. Subject **Environmental Engineering I (BCI030A)** with 3 credit is shifted from 6th semester to 5th semester.
19. Subject **STAAD Pro Lab (BCI031B)** with 2 credit is shifted from 7th semester to 5th semester.
20. Subject **Quantity Surveying and Valuation Lab (BCI033A)** with 3 credit is removed from 6th semester.
21. Subject **Professional Skills-VI (BHS006A)** with 6 credit is removed from 6th semester.
22. Subject **Seminar (BCI034A)** with 1 credit is removed from 6th semester.
23. Subject **Program Elective-II & III**with 3 credit is replaced by **Program Elective-I** in 6th semester.
24. Subject **Open Elective**with 3 credit is removed from 6th semester.
25. Subject **Basic Simulation Laboratory(BEE024A)** with 2 credit is shifted from 6th semester to 7th semester.
26. Subject **Environmental Engineering II (BCI041B)** with 3 credit is shifted from 7th semester to 6th semester.
27. Subject **Environmental Engineering Lab(BCI044B)** with 2 credit is shifted from 7th semester to 6th semester.
28. Subject **Probability and Statistics (BAS006A)** with 2 credit is removed from 7th semester.
29. Subject **Professional Skills-VII (BHS007A)** with 6 credit is removed from 7th semester.
30. Subject **Seminar (BCI045A)** with 1 credit is removed from 7th semester.
31. Subject **Program Elective-IV & V**with 3 credit is replaced by **Program Elective-II** in 7th semester.
32. The following emerged from the discussions and course structure of the B.Tech (CE) has been revised as follows:-

For the batch Inducted in Third Semester in 2018, following changes made to rationalize the syllabus & credits:-

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.No.** | **Subject Name** | **Credit** | **Semester** | **Remarks** |
| 1. | Geotechnical Engineering I | 4 | 4th | Tutorial added |
| 2. | Engineering Surveying I | 4 | 4th | Tutorial added |
| 3. | Hydraulics & Hydraulic Machine | 4 | 4th | Tutorial added |
| 4. | Engineering Surveying Lab I | 2 | 4th | Contact Hours reduced |
| 5. | Geotechnical Engineering II | 4 | 5th | Tutorial added |
| 6. | Engineering Surveying II | 4 | 5th | Tutorial added |
| 7. | Engineering Surveying Lab II | 2 | 5th | Contact Hours reduced |
| 8. | Transportation Engineering I | 4 | 6th | Tutorial added |
| 9. | Advance Design of Steel Structures | 4 | 6th | Tutorial added |
| 10. | Construction Project Management | 4 | 7th | Tutorial added |
| 11. | Project Work | 6 | 7th | Contact Hours increased |





**SCHOOL OF ENGINEERING**

**SYLLABUS AND COURSE STRUCTURE**

**B. TECH (CIVIL ENGINEERING)**

**ACADEMIC YEAR 2018-19**

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

**Semester III**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| L | T | P |
| BAS00 A | 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** |  |
| **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** |  |
| **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**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| **L** | **T** | **P** |
| BCI021B | Theory of Structures II | 3 | 1 | 0 | 4 | S |
| BCI028A | Irrigation and Hydrology | 3 | 1 | 0 | 4 | C |
| BCI029A | Transportation Engineering I | 3 | 1 | 0 | 4 | C |
| BCI026C | Advance Design of Steel Structures | 3 | 1 | 0 | 4 | S |
| BCI041A | Environmental Engineering II | 3 | 1 | 0 | 4 | S |
| BCI077A | Quantity Surveying and Valuation | 3 | 0 | 0 | 3 | C |
|  | Program Elective – I | 3 | 0 | 0 | 3 | S |
| BCI043B | Transportation Engineering Lab | 0 | 0 | 2 | 2 | C |
| BCI044B | Environmental Engineering Lab | 0 | 0 | 2 | 2 | S |
|  | **TOTAL** | **21** | **5** | **4** | **30** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Program Elective-I (any one of the following)** | | | |
| BCI035A | Rural Water Supply and Sanitation | BCI036B | Advanced Reinforced Cement Concrete |
| BCI037A | Foundation Engineering | BCI038A | Prestressed Concrete |

**Semester VII**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| **L** | **T** | **P** |
| BCI039A | Water Resource Engineering | 3 | 1 | 0 | 4 | C |
| BCI040B | Transportation Engineering II | 3 | 0 | 0 | 3 | S |
| BCI046B | Construction Project Management | 3 | 1 | 0 | 4 | S |
| BCI055A | Solid Waste Management | 3 | 0 | 0 | 3 | S |
|  | Program Elective – II | 3 | 0 | 0 | 3 | S |
|  | Open Elective | 3 | 0 | 0 | 3 | ID |
| BEE024A | Basic Simulation Laboratory | 0 | 0 | 2 | 2 | S |
| BCI073B | Project Work | 0 | 0 | 6 | 6 | C |
|  | **TOTAL** | **18** | **2** | **8** | **28** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Program Elective-II (any one of the following)** | | | |
| BCI078A | Ground Improvement Techniques | BCI048A | Traffic Engineering |
| BCI027A | Building Maintenance and Repairs | BCI049A | Building Design |

**Semester VIII**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| **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)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  | **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**

|  |  |  |
| --- | --- | --- |
| **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-efficients 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:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | 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. *Probability, Random Variables And Random Signal Principles, Peebles, TMH 2002*
2. *Probability Theory and Stochastic Processes for Engineers, Bhat, Pearson 2011*
3. *Probability and Random Processes with Application to Signal Processing, 3/e, Stark,*

*Pearson 2002*

1. *Random Variables & Stochastic Processes, Gaur and Srivastava, Genius publications*

*2003*

1. *Random Processes: Filtering, Estimation and Detection, Ludeman, Wiley 2002 8 An Introduction to Probability Theory & Its App., Feller, Wiley 1969*

|  |  |  |
| --- | --- | --- |
| **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, Plywoods, 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:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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. *Construction Materials: Their nature &Behavior by J.M. Illston; E& FN Spon*
2. *Building Materials: Products, Properties and Systems by Ghambir, Tata McGraw Hill, Delhi.*

***Reference Book:***

1. *Building Materials by Prabinsingh; S.K.Kataria& Sons.*
2. *Building Materials by S. K. Duggal; New Age International Publishers.*
3. *CBRI and BMTPC Publications.*

|  |  |  |
| --- | --- | --- |
| **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 formaterial 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, pumpable 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. *Concrete Technology by Neville & Brooks, Pearson Education.*
2. *Concrete: Microstructure, Properties & Materials by Mehta P.K, Tata McGraw Hill.*
3. *Concrete Technology by M.S.Shetty, S.Chand& Co.*

***Reference Book:***

1. *Concrete materials by Popovics, Standard Publishers.*
2. *Chemistry of Cement and Concrete by Peter C.Hewlett, Elsevier Butterworth Heinemann.*

|  |  |  |
| --- | --- | --- |
| **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: Analyse 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.*
2. *Modi& Seth – Hydraulics and Fluid Mechanics Including Hydraulics Machines*
3. *Arora, K.R. -Fluid Mechanics, Hydraulics And Hydraulic Machines*

***Reference Book:***

1. *Streeter, Wylie & Bedford: Fluid Mechanics*
2. *Natarajan, M.K. - Principles of Fluid Mechanics*
3. *Garde, R.J. - Fluid Mechanics Thorough Problems*

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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*

***Reference Book:***

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

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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

**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

throughthe 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*
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*

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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 |  |

H = Highly Related M = Medium L=Low

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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 |  |

H = Highly Related M = Medium L=Low

**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. Stirling’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 mathod, Euler’s and modified Euler’s methods, Miline’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 Miline’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: DefineLinear Programming (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. *Datta – Mathematical methods of science & engineering, Cengage learning 2012*
2. *O’neil – Advanced Engineering mathematics, Cengage learning 2007*

***Reference Book:***

1. *Applied Statics & Probability, Montgomery, Wiley 2013*
2. *Engineering Mathematics, T Veerarajan, TMH 2011*
3. *Mathematical Techniques, Jordan, Oxford 2002*
4. *Engineering Mathematics IV, K.C. Sarangi and others, Genius publications 2011*
5. *Advance Engineering Mathematics, Potter, Oxford 2005*
6. *Advanced Engineering Mathematics, 2/e, Greenberg 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: Termsused 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. *Construction Equipment & Management by R.L. Purifoy, Tata McGraw Hill.*

***Reference Book:***

1. *Construction Technology by Subir K. Sarkar &SubhajitSaraswati, Oxford University Press*
2. *Construction Equipment and its Management by S.C.Sharma, Prentice Hall of India (PHI).*
3. *Construction Equipment by Mahesh Verma, Metropolitan Book Co.*
4. *Building Construction by Bindra& Arora; DahnpatRai& Sons*
5. “*Affordable Housing”, Published by Indian Building Congress, Delhi.*

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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, Montmorilinite 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

propertiesin the analysis of selected geotechnical engineering problems.

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

operationsand 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 andunderstand 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 improvement

techniques (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*

***Reference Book:***

*1****.****Murthy, V.N.S. - Soil Mechanics and Foundation Engineering*

*2.Singh, A. - Modern Geotechnical Engineering*

*3.Venkataramaiah, C. - Geotechnical Engineering*

*4.Ranjan, G. &Rao, A.S.R. - Basic and Applied Soil Mechanics*

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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.*

***References book:***

1. *Arora, K.R. - Surveying Vol. I & II.*
2. *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, Mannring 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, parshallflume.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 Manometric 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, R. K. - A Text Book of Fluid Mechanics and Hydraulic Machines.*
2. *Modi& Seth – Hydraulics and Fluid Mechanics Including Hydraulics Machines*
3. *Arora, K.R. -Fluid Mechanics, Hydraulics And Hydraulic Machines*

***Reference book:***

1. *Ramamrutham, S.& Narayan, R. - Hydraulics, Fluid Mechanics and Fluid Machines.*

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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

propertiesin 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/ModifiedProctor’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

ofpaper

**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, triaxial compression tests, test behaviour 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 pressuretheories, 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*

***Reference Book:***

1. *Murthy, V.N.S. - Soil Mechanics and Foundation Engineering*
2. *Singh, Alam - Modern Geotechnical Engineering*
3. *Venkataramaiah, C. - Geotechnical Engineering*
4. *Ranjan, G. & Rao, A.S.R. - Basic and Applied Soil Mechanics*

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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, Laxmi Publication.*
2. *Arora, K.R. – Surveying, Vol I, II & III, Rajsons Publication*

***Reference Book:***

1. *Basak, N.N. - Surveying and Levelling, Tata McGraw Hill.*
2. *Agor, R. - Surveying, Khanna Publishers.*
3. *Lo, C.P. & Yeung, A.K.W. - Concepts and Techniques of GIS, Prentice Hall, India.*
4. *Kang-tsung Chang - Introduction to GIS, Tata McGraw Hill.*
5. *Rao, K.A. - Remote sensing and GIS, BS Publications.*

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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 degree 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, Laxmi Publication.*
2. *Bhavikatti, S.S. -* Structural Analysis Volume – I, 3rd edition, Vikas Publishers.
3. *R.*S. Khurmi - *Theory of Structures, S Chand Publication*
4. *S. Ramamrutham, R Narayan - Theory of Structures, DhanpatRai Publication*

***Reference Book:***

1. *Menon, D. -* Structural Analysis Volume – I, Narosa Publication
2. *Reddy, C.S. -* Basic Structural Analysis, Tata McGraw Hill
3. *Timoshenko & Young -* Theory of Structures, Tata McGraw Hill
4. *Wang, C.K. -* Intermediate Structural Analysis, McGraw Hill
5. *Norries& Wilbur -* Elementary Structural Analysis, McGraw Hill
6. *Laursen, H.I. -*  Structural Analysis, McGraw Hill

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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, Prentice Hall of India Pvt. Ltd., New Delhi.*
2. *IS:456-2000*
3. *Dr. B C Punmia,Laxmi Publication Ltd.*
4. *NeelamSharma,S.K. Kataria& Sons*

***Reference Book:***

1. *Nilson, A.H: Design of Concrete Structures, McGraw Hill Companies Inc.*
2. *Pillai, S.U. &Menon, D. - Reinforced Concrete Design, Tata McGraw Hill Publishing*
3. *Syal&Goel - Reinforced concrete structures – S Chand*

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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, Tata McGraw Hill, New Delhi*
2. *Duggal, SK - Limit State Design of Steel Structures, Tata McGraw-Hill Education*

***Reference Books:***

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

*2. Bhavikatti, S.S. - Design of Steel Structures,I.K. International Publishing House Limited, 2010*

*3. Subramanian, N. - Design of Steel Structures, 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)*

***References Books:***

1. *Peavy, Rowe &Tchobanoglous - Environmental Engineering*
2. *Metcalf & Eddy - Wastewater Engineering*
3. *Garg, S.K. - Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).*
4. *Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi*
5. *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** | **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, Laxmi Publication.*
2. *Bhavikatti, S.S. -* Structural Analysis Volume – I, 3rd edition, Vikas Publishers.

**Reference Book:**

1. *R.*S. Khurmi - *Theory of Structures, S Chand Publication*
2. *S. Ramamrutham, R Narayan - Theory of Structures, DhanpatRai Publication*

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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, and

Degradation, 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:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 and, McGraw Hill Education Publication.*
2. *Arora, K.R. - Irrigation Water Power and Water Resource Engineering, Standard Publisher*

***Reference Book:***

1. *Asawa, G.L. - Irrigation Engineering, Wiley Eastern*
2. *Garg, S.K. - Irrigation Engineering & Hydraulic Structures, Khanna Publishers*
3. *Modi, P.N. - Irrigation Engineering & Hydraulic Structures*
4. *Zimmerman, J.D. - Irrigation, John Wiley & Sons*
5. *Varshney, Gupta & Gupta - Theory and Design of Irrigation Structures, Nem Chand & Bros.*

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| **L-T-P** | **BCI029A – 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. *S.K. Khanna & C.E.G. Justo – Highway Engineering*
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, 1970*
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*
5. *Mannering, F.L., Washburn, S.S.&Kilareski, W.P. - Principles of Highway Engineering and Traffic Analysis, 4th Edition, , John Wiley*

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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 beam column 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: Types of bridges, 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
2. *Bhavikatti, S.S. –* Design of steel structures
3. *Duggal, S.K.-*Limit state design of Steel Structures*.*

**Reference Book:**

1. *Kazimi, S.M. A. & Jindal, R.S. -* Design of Steel Structures, Prentice Hall of India.
2. *Krishnamachar, B.S.& Sinha, A. -* Design of Steel Structures
3. *Ramchandran -* Design of Steel Structures, Vol I & II,
4. *Dayaratnam -* Design of Steel Structures.
5. *Breslar, Lin &Scalzi -* Design of Steel Structures.
6. *Relevant Codes IS: 800-2007*

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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 odour, 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 flocculators 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*

***Reference Book:***

1. *Garg, S.K. - Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).*
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** | **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. *Estimating & costing by B.N. Dutta, UBS Publishers & Distributors.*

***Reference Book:***

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

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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)** | | | |
| BCI035A | Rural Water Supply and Sanitation | BCI036B | Advanced Reinforced Cement Concrete |
| BCI037A | Foundation Engineering | BCI038A | Prestressed Concrete |

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| **L-T-P** | **BCI035A – Rural Water Supply and Sanitation** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To study the water supply system in rural area.
* To study the quality of water and communicable diseases.
* To study the rural sanitation system.

**Unit 1**

General:Importance of village community in India, Condition of Indian villages with special regard to economics, social and health aspects.

Sources of water:Traditional sources of water in rural areas. Different types of wells, sanitary aspects in well construction, pumps used for village wells, Hand pump Technology, its operation and maintenance. Water harvesting techniques.

**Unit 2**

Quality of water:Estimation of total water requirement including cattle water demand, quality of water needed for village community, water quality surveillance, standards of water quality.

Communicable Diseases:Diseases and immunity, Source of communicable diseases, Mode of transfer, Control of communicable diseases, Guinea worm Eradication.

**Unit 3**

Water Treatment:Slow sand filter, horizontal roughing filter and their combination. Disinfection of rural water sources, Fluoride and its removal.

Schemes of Rural water supply:Different Schemes of Rural water supply in Rajasthan, Their Design and project formulation including the programmes and standards laid by Govt. of India and Govt. of Rajasthan.

**Unit 4**

Milk and Food sanitation:Essentials of dairy farm and cattle shed sanitation, Tests for milk and dairy products, food epidemics, food poisoning, Botulism.

Fly and Mosquito control:Life cycle of flies and mosquitoes, various methods of flies and mosquito control.

**Unit 5**

Rural Sanitation:Village latrines, VIP latrines, pour flush latrines, materials, construction and cost of the latrines, Pollution aspects and pollution travel from latrines. Storm water and sludge problems. Septic tank, soak pit, small bore sewer system; its design and construction. Animal waste, method of composting, Biogas, collection and disposal of wastes.

Community Awareness and user participation:Planning of communication support in rural supply and sanitation projects.

**Course Outcomes:**

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

CO1: Student could be able to understand about rural sanitation.

CO2: Student could be able to understand water treatment and different schemes of rural water supply

in Rajasthan.

CO3: Understand the new technology used for water supply & its quality.

CO4: Understand about the communicable Diseases.

CO5: Able to understand about the Fly and Mosquito control

**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/Reference books:***

*1. Low cost on site sanitation option, Hoffman &Heijno Occasional Nov.1981 paper No.*

*2. 21, P.O. Box 5500 2280 HM Rijswijk, the Netherlands offices, J.C. Mokeniaan, 5*

*3. Rijswijk ( the Hague ). Wagner, E.G. and Lanoik, J.N. water supply for rural areas and small*

*communities, Geneva: W.H.O.1959.*

*4. Manual of water supply and treatment, 3rd edition, CPHEEO, GOI, New Delhi.*

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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), 10th Edition, Lakshmi Publishers, 2006*
2. *IS:456-2000*

***Reference Book:***

1. *Ram Chandra - Design of steel structures, Standard Book House, Delhi.*
2. *Dayaratnam - Design of Steel Structures – S Chand*
3. *Negi, L.S. - Design of steel structures, Tata McGraw Hill.*
4. *Raz, W.A. - Structural design of steel, New Age International (P) Ltd, New Delhi.*

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| **L-T-P** | **BCI037A – 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*
2. *K.R. Arora- Soil Mechanics And Foundation Engineering*

***Reference Books***

1. *Murthy, V.N.S. - Soil Mechanics and Foundation Engineering*
2. *Singh, A. - Modern Geotechnical Engineering*
3. *Venkataramaiah, C. - Geotechnical Engineering*
4. *Ranjan, G. & Rao, A.S.R. - Basic and Applied Soil Mechanics*

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| **L-T-P** | **BCI038A – Prestressed 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. *Jain &Jaikrishna: Plain and Reinforced Concrete Vol. I.*

**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 headworks.
* 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 and, McGraw Hill Education Publication.*
2. *Arora, K.R. - Irrigation Water Power and Water Resource Engineering, Standard Publisher*

***Reference Book:***

1. *Asawa, G.L. - Irrigation Engineering, Wiley Eastern*
2. *Garg, S.K. - Irrigation Engineering & Hydraulic Structures, Khanna Publishers*
3. *Modi, P.N. - Irrigation Engineering & Hydraulic Structures*
4. *Zimmerman, J.D. - Irrigation, John Wiley & Sons*
5. *Varshney, Gupta & Gupta - Theory and Design of Irrigation Structures, Nem Chand & Bros.*

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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

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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, DhanpatRai, New Delhi*
2. *Khanna & Arora - Airport Planning & Design, Nemchand Bros, Roorkee*

***Reference Book:***

1. *Horonjeff&Mcklerey - Planning & Design of Airport*
2. *Quinn, A.D. - Design and Construction of Ports and Marine Structures.*
3. *Agarwal, M. M. - Indian Railway Track, Sachdeva Press, New Delhi*
4. *Bindra, S.P. - Docks and Harbor Engineering, DhanpatRai, New Delhi*
5. *Shrinivasan, R. - Harbor Dock and Tunnel Engineering*

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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 Ritz and Sidney Levy: Total construction project management: McGraw Hill Publications.*

***Reference Book:***

1. *S.Keoki Sears and Richard H.Clough: Construction Project Management: A guide to field construction management.*

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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. *A D Bhide: Solid waste management in developing countries, Nagpur Publications.*

***Reference Books:***

1. *Techobanglous, Thiesen and Vigil: Integrated Solid Waste Management, McGraw Hill, N.Y.*
2. *Lagrega, Buckingham and Evans: Hazardous Waste Management, McGraw Hill, N.Y.*

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| **L-T-P** | **BEE024A – Basic Simulation Lab** | **Credits: 2** |
| **0-0-2** |

**Experiments may be carried out using MATLAB/ SCILAB**

1. Creating a One-Dimensional Array (Row / Column Vector) Exercise – Creating a vector of even whole numbers between 31 and 75; Creating a Two-Dimensional Array (Matrix of given size) and (A). Performing Arithmetic Operations - Addition, Subtraction, Multiplication and Exponentiation. (B). Obtaining Modified Matrix - Inverse, Transpose, with Appended and Deleted Elements;

2. Performing Matrix Manipulations - Concatenating, Indexing, Sorting, Shifting, Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis; Creating Arrays X & Y of given size (1 x N) and Performing

(A) Relational Operations - >, <, ==, <=, >=, ~=

(B) Logical Operations - ~, &, |, XOR

3. Generating a set of Commands on a given Vector (Example: X = [1 8 3 9 0 1]) to

(A) Add up the values of the elements (Check with **sum**)

(B) Compute the Running Sum (Check with **sum**), where Running Sum for element j = the sum of the elements from 1 to j, inclusive.

(C) Compute the Sine of the given X-values (should be a vector).

Also, Generating a Random Sequence using **rand() / randn()** functions and plotting them.

4. Evaluating a given expression and rounding it to the nearest integer value using Round, Floor, Ceil and Fix functions; Also, generating and Plots of

(A) Trigonometric Functions - sin(t), cos(t), tan(t), sec(t), cosec(t) and cot(t) for a given duration ‘t’.

(B) Logarithmic and other Functions – log(A), log10(A), Square root of A, Real nth root of A.

5. Write a MATLAB program to generate an exponential Sequence.



6. Write a MatLab program to generate the signal corrupted by the noise resulting the signal.

Also down sample the corrupted signal

7. Creating a vector X with elements, Xn= (-1)n+1/(2n-1) and Adding up 100 elements of the vector, X; And, plotting the functions, x, x3, ex and exp(x2) over the interval 0 < x < 4 (by choosing appropriate mesh values for x to obtain smooth curves), on

(A) A Rectangular Plot

(B) A Semi log Plot

(C) A log-log Plot

8. Generating a Sinusoidal Signal of a given frequency (say, 100Hz) and Plotting with Graphical Enhancements - Titling, Labelling, Adding Text, Adding Legends, Adding New Plots to Existing Plot, Printing Text in Greek Letters, Plotting as Multiple and Sub- Plots; Also, Making Non-Choppy and Smooth Plot of the functions,

9.To Plot the following Functions:

h(n)={4rn cos[pi\*n(1+r)/m]+m sin[pi\*n(1-r)/m]}/[1-4rn/m)^2]\*pi\*nm

h (0)=(1/m)+(r/(m \* 4/pi -1))

h (|m/4|)=(-r/m)\*[(2\*cos{(pi/4\*r)\*(1+4)}-cos{pi\*(1-r)/4\*r}]

Given: - m=4, r=0.1

10. Creating A Structure, An Array of Structures and Writing Commands to Access Elements of the created Structure and Array of Structures; Also, Solving First Order Ordinary Differential Equation using Built-in Functions; And, Creating an M x N Array of Random Numbers using **rand** and setting any value that is and any value that is by moving through the Array, Element by Element.

11. Write a MatLab/SciLab program to generate a Fibonacci series up-to 20.

12. Write a MatLab/SciLab program to check whether a number is prime or not.

13. Write a MatLab/SciLab program to convert a decimal number to binary.

14. Generating normal and integer random numbers and plotting them; Also, Writing a Script (which keeps running until no number is provided to convert) that asks for Temperature in degrees Fahrenheit and Computes the Equivalent Temperature in degrees Celsius. [Hint: Function **is empty** is useful]

15. Writing brief Scripts starting each Script with a request for input (using input) to Evaluate the function using if-else statement, where

Exercise: Testing the Scripts written using

(A)

(B)

Also, Creating a Graphical User Interface (GUI); And, Curve Fitting using

(A) Straight line Fit

(B) Least Squares Fit

16.Interpolation based on following Schemes (A) Linear (B) Cubic (C) Spline Also, Generating the first Ten Fibonacci numbers according to the relation

with , and computing the ratio for the first Fibonacci numbers.

**Course Outcomes:**

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

CO1: Knowledge of mathematics in problem solving.

CO2: Knowledge of simulation in civil engineering field.

**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 |  |

H = Highly Related M = Medium L=Low

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| **Program Elective-II (any one of the following)** | | | |
| BCI078A | Ground Improvement Techniques | BCI048A | Traffic Engineering |
| 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**

**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:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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. *Ground Improvement Techniques by Purushottam Raj, Tata McGraw Hills, Delhi.*

***Reference Book:***

1. *Text book of Geostatic Engineering by Gulhati& Dutta, Tata McGraw Hills, Delhi.*
2. *Principles of Foundation Engg by B.M. Das, Thomson, Books/Cole.*
3. *Foundation Design Manual by N.V Nayak, DhanpatRai and Sons.*
4. *Soil Engineering in Theory and Practice Vol. III by Alam Singh CBS Publishers*

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| **L-T-P** | **BCI048A – Traffic Engineering** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To study role of traffic engineer and traffic characteristics.
* Introduction of traffic noise and air pollution and remedial measures.
* To analysis the design of intersections

**Unit 1**

**Introduction:** Role of traffic engineer, vehicle, highway and traffic factors. Traffic characteristics, vehicular road users. Introduction of traffic noise and air pollution and remedial measures.

**Unit 2**

**Traffic flow:** Interrupted and Un-interrupted Traffic Flow, Highway capacity: Urban, rural and intersection, Capacity of transit system, Traffic flow theory: Car Following and Queuing Theory.

**Unit 3**

**Traffic Studies:** Traffic volume studies, speeds studies, Speed and Delay Studies,Origin and Destination studies, Accident studies, capacity studies, parking studies.

**Unit 4**

**Traffic Control:** regulations and other operational controls, Traffic Signal andmarking, street lighting, Traffic Safety: Barricades, delineators.

**Unit 5**

**Design of Intersections:** Canalizing islands, Design of Rotaries, Intersection and Terminal Design, Parking facilities.

**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**

**OUTCOMESAND 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. *Introduction to Transportation Engineering: William w. Hay.*
2. *Introduction to Transportation Engineering planning - E.K. Mortak*

***Reference Book:***

1. *Metropolitan Transportation planning – J.w. Dickey.*
2. *Traffic Engineering, L.R. Kadiyali*
3. *Transportation Engineering, Khisty&Lall*

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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,Longman Scientific and Technical UK, 1991.*
2. *Allen, R.T. & Edwards, S.C. - Repair of Concrete Structures,Blakie and Sons, UK, 1987.*

***Reference Book:***

1. *Shetty, M.S. - Concrete Technology -Theory and Practice, S. Chand, New Delhi, 1992.*
2. *Santhakumar, A.R. - Training Course Notes on Damage Assessment and Repair in Low Cost Housing,RHDC - NBO, Anna University, 1992.*
3. *Raikar, R.N. - Learning from Failures – Deficiencies in Design,Construction and Service -R & D Centre (SDCPL), RaikarBhavan, Mumbai, 1987.*

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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.

**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** | **BCI073B – Project Work** | **Credits: 6** |
| **0-0-6** |

**Semester VIII**

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

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

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

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

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  | **Semester** |
| **L** | **T** | **P** |
| BCI057A | Special Data Analysis and Applications | 3 | 0 | 0 | 3 | ID |  |

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| **L-T-P** | **BCI053A – Remote Sensing and GIS** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To study the fundamental concepts of geographic information systems
* To study the fundamentals of remotely sensed data and its integration with geographic information systems

**Unit 1:**

Basic concepts of GIS- Information systems, spatial and non-spatial information, geographical concepts and terminology, advantages of GIS, basic components of GIS, commercially available GIS hardware and software, organization of data in GIS.

**Unit 2:**

GIS data- Field data, statistical data, Maps, aerial photographs, satellite data, points, lines and areas features, vector and raster data, advantages and disadvantages, data entry through keyboard, digitizers and scanners, digital data, pre-processing of data- rectification and registration, interpolation techniques.

**Unit 3:**

Data management- DBMS, various data models, run-length encoding, quadtrees, data analysis-data layers, analysis of spatial and non-spatial data, data overlay and modelling, data processing: raster based and vector based, data presentation –hardcopy devices, softcopy devices.

**Unit 4:**

Remote sensing and GIS integration- Principles of electromagnetic remote sensing, imaging characteristics of remote sensing systems, extraction of metric and descriptive information from remotely sensed images, integration of remote sensing and GIS.

**Unit 5:**

Applications of GIS- Map revision, land use, agriculture, forestry, archaeology, municipal geology, water resources, soil erosion, land suitability analysis, change detection

**Course Outcomes:**

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

CO1: Understanding of basic concepts and components of GIS.

CO2: Theoretical knowledge of different types of data and their collection.

CO3: Theoretical & practical knowledge of DBMS with data handling and processing techniques.

CO4: Basic understanding of integration of remote sensing and GIS.

CO5: Theoretical knowledge of various applications of GIS in relation with different engineering and

nonengineering disciples.

**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 | H | L | H | L | L |
| CO2 | L | L | H | H | H | H | H | H | H | H | L | H | L | L |
| CO3 | L | H | H | H | H | H | H | H | H | H | L | H | L | L |
| CO4 | L | H | H | H | H | H | H | H | H | H | L | H | L | L |
| CO5 | L | L | H | L | H | H | H | H | H | H | L | H | L | L |

H= Highly Related M = Medium L=Low

***Text/Reference Books:***

1. *Lo C P, Yeung A K W: Concepts and Techniques of Geographic Information Systems, Prentice Hall. India.*
2. *Kang-tsung Chang: Introduction to Geographic Information Systems, Tata McGraw Hill*

|  |  |  |
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| **L-T-P** | **BCI054A – Disaster Management** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To increase skills and abilities for implementing the Disaster Risk Reduction(DRR)Strategy.
* To develop skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
* To identify Disaster risk reduction and disaster management cycle.

**Unit 1**

Introduction: Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation.

**Unit 2**

Disasters: Disasters classification; natural disasters (floods, drought, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

**Unit 3**

Disaster Impacts: Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

**Unit 4**

Disaster Risk Reduction (DRR)Disaster management cycle–its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

**Unit 5**

Disasters, Environment and Development- Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental-friendly recovery; reconstruction and development methods.

**Course Outcomes:**

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

CO1: Basic understanding of disaster phenomena and influencing factors to disaster. .

CO2: Understanding different causes of disaster, classification and influencing factors. .

CO3: assessment of impacts of disaster in different aspects related to environment, economical,

political context.

CO4: Understanding and analysis of role of government in pre and post disaster management events,

meeting different disaster management phases.

CO5: Evaluation and understanding of impacts on environment and development of country, to

sustain in extreme conditions.

**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 | L | L | H | H | L | H | M | L | M | H | H |
| CO2 | L | L | L | L | L | H | H | H | H | M | L | M | L | M |
| CO3 | L | L | L | L | L | H | H | H | H | M | L | H | L | M |
| CO4 | L | L | L | M | L | H | H | H | H | M | L | H | L | H |
| CO5 | L | L | L | M | L | H | H | H | H | M | L | M | L | H |

H = Highly Related M = Medium L=Low

***Text book:***

1. *Singh B.K.: 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.*

***Reference Book:***

1. *http://ndma.gov.in/ (Home page of National Disaster Management Authority).*
2. *http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).*
3. *Pradeep Sahni: 2004, Disaster Risk Reduction in South Asia, Prentice Hall. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.*

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| --- | --- | --- |
| **L-T-P** | **BCI057A – Special Data Analysis and Applications** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To study the fundamental concepts of spatial data and its importance
* To study the fundamentals of data acquisition, its management and integration with geographic information systems

**Unit 1**

Basic concepts of GIS- Information systems, spatial and non-spatial information,geographical concepts and terminology, advantages of GIS, basic components of GIS,commercially available GIS hardware and software, organization of data in GIS.

**Unit 2**

GIS data- Field data, statistical data, Maps, aerial photographs, satellite data,points, lines and areas features, vector and raster data, advantages and disadvantages, dataentry through keyboard, digitizers and scanners, digital data, pre-processing of data rectification and registration, interpolation techniques.

**Unit 3**

Data management- DBMS, various data models, run-length encoding, quadtrees,data analysis-data layers, analysis of spatial and non-spatial data, data overlay and modelling,data processing: raster based and vector based, data presentation –hardcopy devices, softcopydevices.

**Unit 4**

Remote sensing and GIS integration- Principles of electromagnetic remotesensing, imaging characteristics of remote sensing systems, extraction of metric anddescriptive information from remotely sensed images, integration of remote sensing and GIS.

**Unit 5**

Applications of GIS- Map revision, land use, agriculture, forestry, archaeology,municipal geology, water resources, soil erosion, land suitability analysis, change detection

**Course Outcomes:**

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

CO1: Understanding of basic concepts and components of GIS.

CO2: Theoretical knowledge of different types of data and their collection.

CO3: Theoretical & practical knowledge of DBMS with data handling and processing techniques.

CO4: Basic understanding of integration of remote sensing and GIS.

CO5: Theoretical knowledge of various applications of GIS in relation with different engineering and

non engineering disciples.

**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 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 |
| CO1 | L | L | H | L | L | H | H | H | H | H | L | H | L | L |
| CO2 | L | L | H | H | H | H | H | H | H | H | L | H | L | L |
| CO3 | L | H | H | H | H | H | H | H | H | H | L | H | L | L |
| CO4 | L | H | H | H | H | H | H | H | H | H | L | H | L | L |
| CO5 | L | L | H | L | H | H | H | H | H | H | L | H | L | L |

H = Highly Related M = Medium L=Low

***Text/Reference Books:*** *1. Lo C P, Yeung A K W: Concepts and Techniques of Geographic Information Systems, Prentice Hall. India.  
2. Kang-tsung Chang: Introduction to Geographic Information Systems, Tata McGraw* Hill



**SCHOOL OF ENGINEERING**

**SYLLABUS AND COURSE STRUCTURE**

**M. TECH (STRUCTURAL ENGINEERING)**

**ACADEMIC YEAR 2018-19**

**M. Tech. (Structural Engineering)**

**Code & Subject Scheme**

**Semester I**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| **L** | **T** | **P** |
| MCI024A | Structural Dynamics | 4 | 0 | 0 | 4 | C |
| MCI025A | Concrete Technology and Special Concretes | 4 | 0 | 0 | 4 | C |
| MCI026A | Design of Plates and Shells | 4 | 0 | 0 | 4 | C |
| MCI027A | Bridge Engineering | 4 | 0 | 0 | 4 | C |
| MCI028A | Structural Engineering Laboratory | 0 | 0 | 2 | 2 | C |
| MCI029A | Advanced Concrete Lab | 0 | 0 | 2 | 2 | C |
| MCI007A | Seminar | 0 | 0 | 2 | 2 | C |
|  | **Total** | **16** | **0** | **6** | **22** |  |
|  |  |  |  |  |  |  |

**Semester II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| **L** | **T** | **P** |
| MES001A | Research Methodology | 3 | 0 | 0 | 3 | F |
| MCI030A | Advanced Design of Steel Structures | 4 | 0 | 0 | 4 | C |
| MCI031A | Prestressed Concrete Design | 4 | 0 | 0 | 4 | C |
| MCI032A | Theory of Elasticity and Plasticity | 4 | 0 | 0 | 4 | C |
| MCI033A | Design Lab (SAP 2000) | 0 | 0 | 2 | 2 | C |
| MCI034A | Finite element Lab (MATLAB) | 0 | 0 | 2 | 2 | C |
| MES002A | Advanced Excel Lab\*\* | 0 | 0 | 1 | 1 | F |
| MCI013A | Seminar | 0 | 0 | 2 | 2 | C |
|  | **Total** | **15** | **0** | **7** | **22** |  |

**\*\*** Quantitative Techniques & Computer Applications Lab on ERP

**Semester III**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| **L** | **T** | **P** |
| MCI035A | Plastic analysis and design | 4 | 0 | 0 | 4 | C |
| MCI036A | Neo Construction Materials | 4 | 0 | 0 | 4 | C |
|  | Elective-I | 4 | 0 | 0 | 4 | S |
|  | Elective-II | 4 | 0 | 0 | 4 | S |
| MCI016A | Dissertation Part – I | 0 | 0 | 12 | 12 | C |
|  | **Total** | **16** | **0** | **12** | **28** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Elective Subjects (one from each group)** | | | |
| **Elective I** | | **Elective II** | |
| MCI037A | Stability of structures | MCI039A | Repair and Rehabilitation of Structures |
| MCI038A | Earthquake Resistant design | MCI040A | Advanced Foundation Design |
| MCI022A | Soil structure interaction | MCI041A | Design of Tall Buildings |

**Semester IV**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** |  |
| **L** | **T** | **P** |
| MCI023A | Dissertation Part – II | 0 | 0 | 28 | 28 | C |
|  | **Total** | **0** | **0** | **28** | **28** |  |

**Semester-I**

|  |  |  |
| --- | --- | --- |
| **L-T-P** | **MCI024A – Structural Dynamics** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* Learn how to model discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems.
* Apply the methods learned to a realistic engineering vibration problem and write a report on the results.

**Unit1**

Dynamics of Structures: Objectives and importance. Types of dynamic loads, Dynamic degree of freedom, Mathematical modelling, Damping and stiffness, Torsional stiffness, Equivalent stiffness, Free and forced vibrations

**Unit 2**

Single Degree of Freedom (SDOF) Systems: Undamped free vibrations, formulation of differential equation of motion: Newton’s law of motion, D’Alembert’s principle and energy approach. Natural frequency. Vibration response.

**Unit 3**

Single Degree of Freedom (SDOF) Systems: damped free vibrations, critically damped, under damped & over damped systems, formulation of differential equation of motion: Natural frequency. Vibration response.

**Unit 4**

Forced vibration response of SDOF damped and undamped systems to harmonic loading, rotating and reciprocating unbalance, support motion and impulsive type forcing function. Vibration isolation and transmissibility. Seismic Instruments.

**Unit 5**

Forced vibration response of SDOF damped and undamped systems to harmonic loading, rotating and reciprocating unbalance, support motion and impulsive type forcing function. Vibration isolation and transmissibility. Seismic Instruments.

**Course Outcomes:**

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

CO1: Understood various type degree of freedom systems in structures.

CO2: Understood orthogonal relationship of principle modes Rayleigh's principle and its

Application.

CO3: Gained knowledge about application of structural dynamics to civil engineering

Problems.

**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 |  | L | L |  |  | M |  | L | M | H | M |  |
| CO2 | H | H |  | L | L |  |  | M |  | L | M | H | M |  |
| CO3 | H | H | H | H | H |  |  | M |  | L | M | H | M |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. *“Dynamics of Structures: Applications to Earthquake Engineering” by A. K. Chopra*

***Reference Book:***

1. *“Dynamics of Structures” by R.W. Clough and J. Penzien*
2. *Fundamentals of Structural Dynamics, 2nd Edition, by* [*Roy R. Craig*](http://as.wiley.com/WileyCDA/Section/id-302477.html?query=Roy+R.+Craig)*,* [*Andrew J. Kurdila*](http://as.wiley.com/WileyCDA/Section/id-302477.html?query=Andrew+J.+Kurdila)

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| **L-T-P** | **MCI025A – Concrete Technology and Special Concretes** | **Credits: 4** |
| **4-0-0** |

**Objectives**

* To familiarize with the fundamentals of concrete
* To study the different concreting methods
* To understand the basic concepts of special concretes, types, properties and their applications
* To study the application of different concretes

**Unit 1**

Characteristics of concrete and mix design: Properties of fresh and hardened concrete - strength, elastic properties, creep and shrinkage – variability of concrete strength - quality control – Principles of concrete mix design, methods of concrete mix design - High Strength Concrete Mix Design - Super - Plasticizers - Principles involved in mix design of high performance concrete with fly ash or GGBS replacements.

**Unit 2**

Concreting methods: Process of manufacturing of concrete-methods of transportation-placing and curing - extreme weather concreting - special concreting methods – vacuum dewatering - under water technology-special form work-Ready mix Concrete.

**Unit 3**

Polymer and fibre concretes: Polymer concrete-Types, Properties and Applications - Blended cement concretes-Fibre-reinforced Concrete-Different types of metallic and non metallicfibres - Types, Properties and Applications, Slurry-infiltrated fibre reinforced concrete.

**Unit 4**

Ferrocement, low and high density concretes: Ferrocement and its applications, Light Weight concrete -concrete - Roller compacted concrete - Types, Properties and Applications.

**Unit 5**

Other concretes: Bacterial concrete - Born again concrete (Recycled Aggregate concrete) Electric concrete (Smart concrete) description - applications. Performance concrete-Production and applications-Self compacting concrete - Reactive powder concrete - Description, Properties and Applications.

**Course Outcomes:**

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

CO1: Ability to design concrete mix of different grade.

CO2: Knowledge about properties of concrete.

CO3: Knowledge about various NDT techniques.

CO4: Knowledge about durability 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 | PO 10 | PO 11 | 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 |  |
| 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 |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. *Fintel, "Hand book of Concrete EnssiVannostrand", CBS Publishers &Distributors, 2004*

***Reference Book:***

1. *Metha P.K. and Monterio P.J.M. "Concrete-Structures", Properties andMaterials, 3rd Edition, McGraw Hill Professional, 2006.*
2. *M.S. Shetty, "Concrete Technology" S.Chand and Company Ltd, Delhi,2000.*
3. *Neville.A.M. "Properties of Concrete", Pitman Publishing Limited,London, 1990*

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| **L-T-P** | **MCI026A – Design of Plates and Shells** | **Credits: 4** |
| **4-0-0** |

**Objectives**

* Study the behaviour and design of shells, folded plates, space frames

**Unit 1**

Plate equation in cartesian and polar coordinates for isotropic plates - Analysis of rectangular and circular plates with different boundary conditions and loadings

**Unit 2**

Design and analysis of plates by various method, Orthotropic plates - Plates on elastic foundation.

**Unit 3**

Classification of shells - Membrane and bending theory for singly curved and doubly curved shells - Various approximations - Design of cylindrical shells, HP shells, conoids

**Unit 4**

Design and Analysis of folded plates by various approximate method

**Unit 5**

Design of diaphragms - Detailing of reinforcements for shells Framework for shells and folded plates.

**Course Outcomes:**

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

CO1: Ability to know about Plate equation and behaviour of thin plates in Cartesian, polar and skew

coordinates.

CO2: Understand Isotropic and orthotropic plates, bending and twisting of plates; Numerical

solutions.

CO3: Ability to learn Shell behaviour, shell surfaces and characteristics, equilibrium equations in

curvilinear coordinates, force displacement relations.

CO4: Ability to understand Membrane analysis of shells of revolution and cylindrical shells under

different loads.

CO5:Able to design plate and shell structure for different kind of loading and different kind of

support condition.

**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 | H | M | M | L |  | M |  | L | H | L |  |
| CO2 | H | H | M | H | M | M | L |  | M |  | L | H | L |  |
| CO3 | H | H | L | H | H | M | L |  | M |  | L | H | L |  |
| CO4 | H | H | L | H | H | M | L |  | M |  | L | H | L |  |
| CO5 | H | H | L | H | H | M | L |  | M |  | L | H | L |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. *Billington.D.P, “Thin Shell Concrete Structures”, McGraw Hill Book Co.,New York, 1982.*

***Reference Book:***

*1. Santhakumar.A.R and Senthil.R, “Proceedings of International Conference onSpace Structures”, Anna University, Chennai, 1997.*

*2. Subramanian.N ,”Principles of Space Structures”, Wheeler Publishing Co.1999.*

*3. Ramasamy, G.S., “Design and Construction of Concrete Shells Roofs”, CBSPublishers, 1986.*

*4. ASCE Manual No.31, “Design of Cylindrical Shells”.*

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| **L-T-P** | **MCI027A – Bridge Engineering** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* To study the loads, forces on bridges and design of several types of bridges

**Unit 1**

Introduction - Classification and components of bridges, historical perspective, layout and planning, investigations for Bridges, choice of type of the bridges, conceptual bridge design, bridge aesthetics. Bridge appurtenances.

**Unit 2**

Loads on bridges - loading standards for highway and railway bridges (IRC, IRS) Analysis and design of RC and PSC bridge decks: slab culvert bridges, slab and beam bridges, load distribution in slabs and beams, bowstring girder bridges, behaviour of skew bridge decks.

**Unit 3**

Behaviour, analysis and design of RC and PSC box girder bridge decks. Behaviour, analysis and design of steel bridge decks: girder bridges, truss bridges, arch bridges, composite construction.

**Unit 4**

Design of bearings, substructure and foundations - piers and abutments of different types, shallow and deep foundations-design and constructional aspects.

**Unit 5**

Modern methods of construction of concrete, steel and composite bridges, their impact on analysis and design. Introduction to analysis and design of long span bridges: suspension.

**Course Outcomes:**

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

CO1: Knowledge about the Types of Bridges, choice of bridge type.

CO2: Criteria for selection of bridge site, economic span, bridge loadings, slab bridges, effect of

skew.

CO3: Study about load distribution theories for multi beam bridges.

CO4: Design of R.C. T beam bridges, behaviour and structural action of box Girder Bridge.

CO5: Design of bridge bearings, inspection and maintenance procedures, rehabilitation of 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 | L | L | H | L |  |  | M | M |  |  |  |  | L |  |
| CO2 | L | H | H | L |  | H | M | M | H | M | H | L | L |  |
| CO3 | M | H | H | H | M | L | L |  |  | M | H | H | H |  |
| CO4 | H | H | H | H | M | M | L |  | M | H | H | H | H | M |
| CO5 | H | H | H | H | M | M | L |  | M | H | H | H | H | M |

H = Highly Related M = Medium L=Low

***Text Book:***

*1. Swami Saran, “Analysis and Design of Substructures”, Oxford & IBH Publishing Co., 1996.*

***Reference Book:***

*1. J.E. Long, “Bearings in Structural Engineering”, Newnes Butterworth & Co., 1974.*

*2. R.E. Rowe, “Concrete Bridge Design”, 1st Edition, Elsevier Science and Technology, 1962.*

*3. L.G. Hendry and A.W. Jaeger, “The Analysis of Grid Frameworks and Related Structures”, Chatto&Windus, 1958.*

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| **L-T-P** | **MCI028A – Structural Engineering Lab** | **Credits: 2** |
| **0-0-2** |

**List of Experiments:**

1. Fabrication, casting and testing of simply supported reinforced concrete beam for strength and deflection behaviour.

2. Testing of simply supported steel beam for strength and deflection behaviour.

3. Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading.

4. Dynamic testing of cantilever steel beam

a. To determine the damping coefficients from free vibrations.

b. To evaluate the mode shapes.

5. Static cyclic testing of single bay two storied steel frames and evaluate

a. Drift of the frame.

b. Stiffness of the frame.

c. Energy dissipation capacity of the frame.

6. Determination of in-situ strength and quality of concrete using

i) Rebound hammer and

ii) Ultrasonic Pulse Velocity Tester

**Course Outcomes:**

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

CO1: Gain the knowledge on concept of NDT.

CO2: Analyze the deflection behaviour of different type of structures.

CO3: Analyze different characteristics of a structure for dynamic loadings.

CO4: Understand Dynamic testing of cantilever steel beam.

CO5: Understand Static cyclic testing of single bay two storey steel frames and evaluate

**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 | H | H |  |
| CO2 | H |  | H |  | H |  |  | M | H |  | H | H | H |  |
| CO3 | H |  | H |  | H |  |  | M | H |  | H | H | H |  |
| CO4 | H |  | H |  | H |  |  | M |  |  | H | H | H |  |
| CO5 | H |  | H |  | H |  |  | M | H |  | H | H | H |  |

H = Highly Related M = Medium L=Low

|  |  |  |
| --- | --- | --- |
| **L-T-P** | **MCI029A – Advanced Concrete Lab** | **Credits: 2** |
| **0-0-2** |

**List of Experiments:**

1. Compressive strength of Cement

2. Mix Design of Concrete and Casting of Specimen.

3. Young’s Modulus of Concrete

4. Non destructive test on concrete.

5. Mix design of high strength concrete including casting and testing of specimens.

6. Mix design of fly ash concrete including casting and testing of specimens.

7. Determination of coefficient of permeability of concrete.

8. Determination of drying shrinkage of concrete.

9. Bending test on a RCC beam under.

a) Single point load

b) Three point load

**Course Outcomes:**

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

CO1: Gain the knowledge on concept of NDT.

CO2: Compare the strengths of concrete by different mix design methods.

CO3: Analyze different characteristics of a structure element for shrinkage and bending.

**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 | L | H |  | M |  |  | L | M | H | L | L |  |
| CO2 | M | M | M | M |  | M |  |  | M | H | H | M | H |  |
| CO3 | H | M | M | H | H | L |  |  | M | H | H | H | H |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **MCI007A – Seminar** | **Credits: 2** |
| **0-0-2** |

**Semester-II**

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| **L-T-P** | **MES001A – Research Methodology** | **Credits: 3** |
| **3-0-0** |

**Objectives:**

* To learn progress from the beginning stage to the end of a research project with the research methodology for each step.
* To learn the quantitative and qualitative methodologies.

**Unit 1**

Nature and Objectives of research; Methods of research: historical, descriptive and experimental. Study and formulation of research problem. Scope of research and formulation of hypotheses; Feasibility, preparation and presentation of research proposal.

**Unit 2**

Introduction to statistical analysis: Measures of central tendency and dispersion: mean, median, mode, range, mean deviation and standard deviation. Regression and correlation analysis.

**Unit 3**

Probability and probability distributions; Binomial, Poisson, Geometric, Negative binomial, Uniform, Exponential, Normal and Log-normal distribution. Basic ideas of testing of hypotheses; Tests of significance based on normal, t and Chi-square distributions.

**Unit 4**

Design of experiments: basic principles, study of completely randomized and randomized block designs. Analysis of variance technique.

**Unit 5**

Edition and tabulation of results, presentation of results using figures, tables and text, quoting of references and preparing bibliography. Use of common softwares like SPSS, Mini Tab and/or Mat Lab. For statistical analysis.

**Course Outcomes:**

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

CO1: At the end of the course students will be able to understand formulation of a research problem with a research design and data collection for the research.

**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 | L | M | L | L | L |  | H | L | M | M | M |

H = Highly Related M = Medium L=Low

***Text Books:***

1. *Borth, Wayne C, et.Al. - The Craft of Research: Chicago Guides to Writing Edition and Publishing.*

***Reference Books:***

1. *Meyer, P.L. - Introduction to Probability & Statistical, Applications, Oxford, IBH.*
2. *Hogg, R.V. & Craig, A.T., Introduction to Mathematical Statistics, MacMillan.*
3. *Goon, A.M., Gupta, M.K. &Dasgupta - Fundamentals of Statistics, Vol.I: World Press.*
4. *Gupta, S.C. & Kapoor, V.K. - Fundamentals of Mathematical Statistics, Sultan Chand & Sons.*
5. *Johnson, R.A. - Probability and Statistics, PHI, New Delhi.*

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| **L-T-P** | **MCI030A – Advanced Design of Steel Structures** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* Perform Limit state design of trusses and frames.
* Perform Minimum weight design of steel structures.

**Unit 1**

Limit States Load and Resistance Factor Design methods. Behaviour and design of members under tension, compression, bending, and combined forces (shear bending, axial force bending).

**Unit 2**

Fasteners: Methods of installation and behaviour of rivets, bolts and welds. Screws and rivets in cold formed steel construction Connections, Types of fasteners, Behaviour of local elements, Analysis, Design and Detailing of Connections. Design for Earthquake Forces.

**Unit 3**

Cold formed Steel Sections - Types of cross sections - Local buckling and post buckling - Design of compression and Tension members - Beams - Deflection of beams - Combined stresses and connections.

**Unit 4**

Design for ductility, R factor, concentrically and eccentrically braced frames, non-buckling bracings.

**Unit 5**

Estimation of wind load - Design of industrial stacks - Self-supporting and guyed stacks lined and unlined – along wind and across wind vibration. Principles of analysis and design of Industrial buildings and bents - Gantry girders and crane

**Course Outcomes:**

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

CO1: Apply the design principles to elevated steel water tanks.

CO2: Identify the configuration of truss bridges and understand the design principles of truss

elements.

CO3: Develop the methodology of designing transmission line tower structures.

CO4: Understand the design concepts of self-supporting chimneys & foundations.

CO5: Develop confidence levels in understanding the plastic analysis, plastic mechanism and apply to

simple beams & 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 | 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 | M |  |
| 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 | L |  |

H =Highly Related M = Medium L=Low

***Text Book:***

1. *N. Subramanian: Design of steel structure.*

***Reference Book:***

1. *L.S. Beedle, “Plastic Design of Steel Frames”, John Wiley & Sons, 1958.*
2. *B.G. Neal, “Plastic Methods of Structural Analysis”, 3rd Edition, Chapman and Hall, 1977.*
3. R. Narayanan et al, “Teaching Resource for Structural steel design” Institute for Steel Development and Growth, 2003.
4. J.F. Baker, “Steel Skeleton”, University Press, 1953.
5. W.F. Chen, D.J. Han, “Plasticity for Structural Engineer”, J Ross Publishing, 2007.

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| **L-T-P** | **MCI031A – Prestressed Concrete Design** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* This subject is thought to give the concepts of pre stress
* To impart the knowledge about analysis and design of pre stressed concrete members.

**Unit 1**

Introduction to prestressed concrete: types of prestressing, systems and devices, materials, losses in prestress.

**Unit 2**

Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions in IS 1343. Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, and flexure combined with axial compression or tension.

**Unit 3**

Analysis and design for shear and torsion, code provisions. Transmission of prestress in pretensioned concepts, crack-width members. Anchorage zone stresses for posttensioned members.

**Unit 4**

Statically indeterminate structures Analysis and design continuous beams and frames, choice of cable profile, linear transformation and concordancy. Composite construction with precast PSC beams and cast insitu RC slab Analysis and design, creep and shrinkage effects. Partial prestressing principles, analysis and design calculations

**Unit 5:**

Analysis and design of prestressed concrete pipes, tanks and spatial structures slabs.

**Course Outcomes:**

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

CO1: Understand the concepts of pre-stressing in concrete structures and identify the materials

for pre-stressing

CO2: Analyse a Pre-stressed Concrete section

CO3: Estimate losses of pre-stressing

CO4: Design pre-tensioned and post tensioned girders for flexure and shear

CO5: Design continuous pre-tensioned and post tensioned beams

**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 | L |  | M | L |  | H | H | H | L |
| CO2 | H | H |  | L | H | L |  | M | L |  | H | H | H | L |
| CO3 | H | M |  | L | H | L |  | M | L |  | H | H | H | L |
| CO4 | H | H |  | L | H | L |  | M | L |  | H | H | H | L |
| CO5 | H | M |  | L | H | L |  | M | L |  | H | H | H | L |

H = Highly Related M = Medium L=Low

***Text Book:***

*1. Krishna Raju.N, (2004), Pre stressed Concrete, Third Edition, Tata McGraw Hill Co.*

***Reference Book:***

*1. Rajagopal.N, (2005), Prestressed Concrete, Second Edition, Narosa Publishing House.*

*2. Dayarathnam P, (2004), Prestressed Concrete Structures, S.Chand Publishers.*

*3. Sinha.N.C and Roy.S.K, (2000), Fundamentals of Pre-stressed Concrete, S.Chand& Company limited.*

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| **L-T-P** | **MCI032A – Theory of Elasticity and Plasticity** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* This subject is taught to impart knowledge on theory of elasticity and plasticity

**Unit 1**

Introduction: Elasticity - notation for forces and stresses - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis - plane stress - plane strain – differential equations of equilibrium - boundary conditions - compatibility equations - stress function – boundary condition.

**Unit 2**

Two dimensional problems in rectangular coordinates - solution by polynomials - Saint- Venant’s principle - determination of displacements - bending of simple beams. Two dimensional problems in polar coordinates – strain components in polar coordinates - displacements for symmetrical stress distributions - simple symmetric and asymmetric problems - general solution of two- dimensional problem in polar coordinates - application of general solution in polar coordinates.

**Unit 3**

Analysis of stress and strain in three dimensions - principal stresses - stress ellipsoid - director surface - determination of principal stresses - max shear stresses – homogeneous deformation - principal axes of strain rotation. General Theorems: Differential equations of equilibrium – conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem.

**Unit 4**

Torsion method - use of soap films in solving torsion problems - hydro dynamical analogies - torsion of shafts, tubes, bars etc. Bending of Prismatic Bars: Stress function - bending of cantilever – circular cross section - elliptical cross section - rectangular cross section - bending problems by soap film method – displacements of Prismatic Bars - torsion of prismatic bars - bars with elliptical cross sections – other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsion problems by energy

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**Unit 5**

Theory of Plasticity: Introduction - concepts and assumptions - yield criterions.

**Course Outcomes:**

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

CO1: To be able to execute the stress state and stresses analysis Topic of Work: The stresses

State analysis

CO2: To be able to solve a problem of strain analysis Topic of Work: The strain state analysis

CO3: To be able to use the numerical methods for the problem of the theory of elasticity in

Practice

CO4: To be able to use theory for solution of practice problem of stress and strain analysis

Final examination

**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 | M |  |
| CO3 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |
| CO4 | H |  | M |  | H | L |  | M |  |  | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. *Theory of Elasticity by Timeshanko, McGrawhill Publications.*

***Reference Book:***

1. *Theory of Plasticity by J.Chakarbarthy, McGrawhill Publications.*
2. *Theory of Elasticity by Y.C.Fung.*
3. *Theory of Elasticity by Gurucharan Singh.*

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| **L-T-P** | **MCI033A –Design Lab (SAP 2000)** | **Credits: 2** |
| **0-0-2** |

**Experiment**

Linear and non linear Analysis of structures

1. 2D/3D Analysis based on state-of-the-art Matrix method to handle extremely large job.
2. Beam, Truss, Tapered Beam, Shell/Plate Bending/Plane Stress. Full/Partial Moment Releases.
3. Design of Concrete Beam/Column/Slab/Footing as per all major international codes
4. Numerical and Graphical Design Outputs with complete reinforcement details. IS 456-2000 for RCC design implemented.
5. RC detailer as per IS 456-2000 has been implemented which has given a new dimension

**Course Outcomes:**

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

CO1: analysis of structure

CO2: understand and design of the beam, truss.

CO3: Study about load distribution theories for multi beam bridges.

CO4: Numerical and graphical design of reinforcement.

CO5: Understand 2D/3D Analysis based on state-of-the-art Matrix method to handle extremely

large job.

**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 | H | H |  |
| CO2 | H |  | H |  | H |  |  | M | H |  | H | H | H |  |
| CO3 | H |  | H |  | H |  |  | M | H |  | H | H | H |  |
| CO4 | H |  | H |  | H |  |  | M |  |  | H | H | H |  |
| CO5 | H |  | H |  | H |  |  | M |  |  | H | H | H |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **MCI034A – Finite Element Lab** | **Credits: 2** |
| **0-0-2** |

**List of Experiments:**

1. Computer programming for analysis of continuous beam

2. Computer programming for analysis of Plane trusses

3. Computer programming for analysis of Plane frame

4. Computer programming for analysis of Grid

5. Computer Programming for analysis of space truss

**Course Outcomes:**

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

CO1: To obtain an understanding of the fundamental theory of the FEA method;

CO2: To develop the ability to generate the governing FE equations for systems governed by partial

differential equations;

CO3: To understand the use of the basic finite elements for structural applications using truss, beam,

frame, and plane elements; and

CO4: To understand the application and use of the FE method for heat transfer problems.

**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 |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **MES002A – Advanced Excel Lab** | **Credits: 1** |
| **0-0-1** |

**Various Methods and Uses of Advance Excel Formulas:** Vlookup, Hlookup, Sumif, Sumifs, Sumproduct, Dsum, Countif, Countifs, If, Iferror, Iserror, Isna, Isnumber, Isnontext, Isblank, Istext, Getpivotdata, Dcount, Dcounta, Or, And, Search, Index, Match Etc

**Various Methods and Uses of IF Conditions:** When should use the "IF" Conditions?, Creation of Multiple IF Conditions in One Cell,Use the IF Conditions with the Other Advance Functions, How to use nested IF statements in Excel with AND, OR Functions

**ADVANCED EXCEL OPTIONS :**Various Methods of Filter and Advance Filter options, Creating and Updating Subtotals, Various Methods of Text to Column options, Uses of Data Grouping and Consolidation options, Uses of Goal Seek and Scenarios Manager, Various Method of Sorting Data, Creating, Formatting and Modifying Chart, Data Validation, Creating drop down lists using different data sources, Linking Workbooks and Uses of Edit Link options, Excel Options, Customizing the Quick Access Tool Bar, Formula Auditing features and Trace formula error

**Pivot Tables & Charts :**Various Methods and Options of Pivot Table, Using the Pivot Table Wizard, Changing the Pivot Table Layout, Subtotal and Grand total Options, Formatting, Grouping Items, Inserting Calculated Fields, Pivot Table Options, Calculation in Pivot Table, Display and Hide Data in Field, Select, Move & Clear Pivot Data, Creating and Modifying Pivot Chart

**Advance Use of Function:** Mixing Function to get Various MIS Outputs, Creating Data Table, Advance Data Validation, Using conditional formatting with Formulas and Function, Using Name Manager, Array Formulas

**Importing Data from External Sources: Macros,** What is a Macro?, Creating Excel Macro, Running Macros and Editing, Automating Tasks with Macro

**Course Outcomes:**

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

CO1: Understand the advance excel formulas and functions

CO2: Understand the filter option in excel and data validation

CO3: Learn the draw the table, graph and charts

**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 | H | H |  |
| CO2 | H |  | H |  | H |  |  | M | H |  | H | H | H |  |
| CO3 | H |  | H |  | H |  |  | M | H |  | H | H | H |  |

H = Highly Related M = Medium L=Low

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| **L-T-P** | **MCI013A - Seminar** | **Credits: 2** |
| **0-0-2** |

**Semester III**

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| **L-T-P** | **MCI035A – Plastic Analysis and Design** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

* To study the plastic methods which are used extremely by engineers for the design of steel structure, including simple beams, continuous beam, simple portal frames.
* To analysis based on either virtual work formulation or sophisticated plastic theory contained in specialist computer packages.

**Unit 1**

Analysis of Structures for Ultimate Load: Fundamental Principles – statical method of Analysis Mechanism method of analysis – Method of analysis, Moment check – Carry over factor –Moment Balancing Method.

**Unit 2**

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

**Unit 3**

Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force – local buckling of flanges and webs – lateral buckling – column stability.

**Unit 4**

Design of Connections: Introduction – requirement for connections – straight corner connections–Haunched connection – Interior Beam-Column connections.

**Unit 5**

Design of Steel Frames: Introduction – Sinole span frames – simplified procedures for Sinole span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections: Introduction –Deflection at ultimate load – Deflection at working load – Deflections of Beams and Sinole span frames.

**Course Outcomes:**

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

CO1: Knowledge of structural analysis using various analysis methods based on ultimate load.

CO2: Knowledge of design and analysis of continuous beams.

CO3: Knowledge based on design of various problems related to axial force, plastic moment, shear

force etc.

CO4: Design of various connections for beams and columns and knowledge of their requirements.

CO5: Analysis and design of steel frames using various theories and estimation of ultimate deflection

based on different forces.

**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 | H | M |  | L | H | H | H | M |
| CO2 | H | H | M | M | H | L | H | M |  | M | H | H | H |  |
| CO3 | H | H | M |  | H | L | H | M |  |  | H | H | H | H |
| CO4 | H | H | M | M | H | L | H | M |  | L | H | H | H | M |
| CO5 | H | H | M | M | H | L | H | M |  | L | H | H | H | M |

H = Highly Related M = Medium L=Low

***Text Book:***

*1. Plastic Design of Steel Frames, L.S.Beedle.*

***Reference Book:***

*1. Design of steel structure, S. Subramanyam.*

*2. Plastic Analysis, B.G.Neal.*

*3. Plastic Analysis, Horve.*

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| **L-T-P** | **MCI036A - Neo Construction Materials** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

* To study the new construction materials, its properties, behaviours.
* To study the materials and its uses in construction.

**Unit 1**

Introduction, Historical back ground of Light weight aggregate concrete - Artificial aggregates, Physical properties of aggregates, Light weight aggregate concrete - Applications of light weight aggregate concrete.

**Unit 2**

Properties of green light weight aggregate concrete - Effect of size aggregate on the strength Recycled aggregate -High performance concrete –applications - Pre placed aggregate concrete - Fiber reinforced concrete.

**Unit 3**

Behaviour of steel fibers in concrete - Glass fiber reinforced concrete - Natural fiber reinforced concrete - High strength concrete - Self-Compacting Concrete, Concrete made with waste rubber.

**Unit 4**

Changes in concrete with respect to time - Corrosion in concrete and its protection, Corrosion of rebars in concrete - Influence of fly ash on the corrosion steel bar in concrete, Industrial waste materials in concrete.

**Unit 5**

Special Concretes, Sulfur Concrete, Ferro cement, Geo synthetics - Adhesives in construction industry, Acrylics - Bridge bearings - Rapid wall panels - Nano Concrete - Moisture Barriers.

**Course Outcomes:**

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

CO1: Knowledge about the aggregates in context of their type, properties, and applications.

CO2: Knowledge of green light weight aggregate, HPA, their applications etc.

CO3: Knowledge of behaviour of steel fibres, glass fibres, natural fibres, in different types of concrete

as HSC, SCC etc.

CO4: Knowledge of concrete properties depending upon time, corrosion effects, effect of fly ash etc

and their influences to concrete properties.

CO5: Knowledge different types of concrete based on their properties and applications.

**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 | H | M |  | L | H | H | H | M |
| CO2 | H | H | M | M | H | L | H | M |  | M | H | H | H |  |
| CO3 | H | H | M | M | H | L | H | M |  |  | H | H | H | H |
| CO4 | H | H | M | M | H | L | H | M |  | L | H | H | H | M |
| CO5 | M | M | M | M | H | L | H | M |  | L | H | H | H | M |

H = Highly Related M = Medium L=Low

***Text Book:***

*1. Kumar Mehta. P and Paulo J M Monteiro, “Concrete Microstructure, Properties and Materials”, McGraw Hill, 2006.*

***Reference Book:***

*1. A.M. Neville, “Properties of Concrete”, 5th Edition, PHI, 2012.*

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| **L-T-P** | **MCI016A – Dissertation Part - I** | **Credits: 12** |
| **0-0-12** |

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| **Elective Subjects (one from each group)** | | | |
| **Elective I** | | **Elective II** | |
| MCI037A | Stability of Structures | MCI019A | Repair and Rehabilitation of Structures |
| MCI038A | Earthquake Resistant design | MCI020A | Advanced Foundation Design |
| MCI022A | Soil Structure Interaction | MCI021A | Design of Tall Buildings |

**Elective I**

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| **L-T-P** | **MCI037A – Stability of Structures** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* To study the stability of structure for different kind of loading
* To study for the different kind of buckling of structural element

**Unit 1**

Beam Columns: Differential equations for beam columns- beam columns with concentrated loads –continuous lateral loads-couples- beam columns with built in ends – continuous beams with axial load –application of trigonometrically series – Effects of initial curvature on deflections – Determination of allowable stresses.

**Unit 2**

Elastic Buckling of bars and frames: Elastic Buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns- Buckling of frames-large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section – Effect of shear force on critical load- built up columns.

**Unit 3**

In Elastic Buckling: Buckle line of straight bar- Double modulus theory – Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae for design – various end conditions

**Unit 4**

Torsion Buckling: Pure torsion of thin walled bars of open cross section – Non-uniform torsion of thin walled bars of open cross section- Torsional buckling – Buckling by torsion and flexure.

**Unit 5**

Lateral buckling of simply supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported Rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

**Course Outcomes:**

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

CO1: Analyze structures with linear and nonlinear behaviour.

CO2: Gain the knowledge on Stability of Continuous systems.

CO3: Distinguish elastic buckling and in elastic buckling.

CO4: Analyse the critical state(s) of a structural system, use such information to enhance the design

analysis process

**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 |  |

H = Highly Related M = Medium L=Low

***Text Book:***

1. *Theory of elastic Stability by Timshenko& Gere-McGraw Hill*

***Reference Book:***

*2. Stability of metallic structures by Blunch- McGraw Hill*

*3. Theory of Beam- Columns Vol I by Chem. &Atste Mc. Graw Hill*

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| **L-T-P** | **MCI038A – Earthquake Resistant Design** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* To deal with different aspect of earthquake forces
* Design of different type of member of building to resist the earthquake

**Unit 1**

Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India.

**Unit 2**

Conceptual design: Introduction-Functional planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility-definition-ductility relationships-flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete-masonry-reinforcing steel. Introduction to earthquake resistant design: Seismic design requirements-regular and irregular configurations-basic assumptions-design earthquake loads-basic load combinations-permissible stresses-seismic methods of analysis-factors in seismic analysis-equivalent lateral force method-dynamic analysis-response spectrum method-Time history method.

**Unit 3**

Reinforced Concrete Buildings: Principles of earthquake resistant deign of RC members- Structural models for frame buildings- Seismic methods of analysis- Seismic deign methods- IS code based methods for seismic design- Seismic evaluation and retrofitting- Vertical irregularities- Plan configuration problems- Lateral load resisting systems- Determination of design lateral forces-Equivalent lateral force procedure- Lateral distribution of base shear. Masonry Buildings: Introduction-Elastic properties of masonry assemblage- Categories of masonry buildings- Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and bands- Behaviour of infill walls-Improving seismic behaviour of masonry buildings- Load combinations and permissible stresses-Seismic design requirements- Lateral load analysis of masonry buildings.

**Unit 4**

Structural Walls and Non-Structural Elements: Strategies in the location of structural walls- sectional shapes- variations in elevation- cantilever walls without openings – Failure mechanism of non structures-Effects of non-structural elements on structural system- Analysis of non-structural elements-Prevention of non-structural damage- Isolation of non-structures.

**Unit 5**

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behaviour of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquakes. Capacity Based

Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

**Course Outcomes:**

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

CO1: Knowledge about earthquake hazards and related basic concepts.

CO2: Ability to understand the Seismic Vulnerability and its estimation.

CO3: Knowledge about methods of seismic retrofitting of buildings.

CO4: Ability to design different type of structural member to resist earthquake forces.

**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 | 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 |

H = Highly Related M = Medium L=Low

***Text Book:***

*1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press*

***Reference Book and Codes:***

*1. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.*

*2. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons*

*3. Masory and Timber structures including earthquake Resistant Design –Anand S. Arya, Nemchand& Bros*

*4. IS: 1893 (Part-1) -2002. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., New Delhi.*

*5. IS: 4326-1993, “Earthquake Resistant Design and Construction of Building”, Code of Practice B.I.S., New Delhi.*

*6 IS: 13920-1993, “Ductile detailing of concrete structures subjected to seismic force” – Guidelines, B.I.S., New Delhi.*

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| **L-T-P** | **MCI022A - Soil Structure Interaction** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

* The ability to identify the situations where the topic is relevant
* Should be able to apply the effects of interaction between soil and foundation
* The ability to apply the concepts for solving multi task applications

**Unit 1**

Scope of soil-foundation interaction analysis, Critical study of conventional methods of foundation design.

**Unit 2**

Nature and complexities of soil-foundation interaction, Interface behaviour, soil response models, Winkler, Elastic continuum. Contact pressures and soil-structure interaction for shallow and deep foundations.

**Unit 3**

Concept of sub grade modulus, effects/parameters influencing sub-grade modulus, Analysis of foundations of finite rigidity, Beams on elastic foundation concept, Interaction problems based on the theory of sub-grade reaction.

**Unit 4**

Concept of analysis of piles and pile groups, axially, laterally loaded piles and pile group interaction analysis, Elastic continuum and elasto-plastic analysis of piles and pile groups.

**Unit 5**

Application of advanced techniques of analysis such as the finite element method, finite differences and interaction for the evaluation of soil-foundation interaction for different types of foundations under various conditions of loading and subsoil characteristics.

**Course Outcomes:**

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

CO1: Designing structures under seismic conditions considering effect of SSI.

CO2: Understand capabilities of various models used to simulate the interaction

CO3: Ground response analysis for different soil conditions.

CO4: Exposure to various different codes of practices.

CO5: Finite element approach in solving in SSI problems.

**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 |  | 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. Bowels J.E. - Analytical and Computer Methods in Foundation, McGraw Hill.*

***Reference Book:***

*2. Selvadurai, A. P. S. - Elastic Analysis of Soil-Foundation Interaction, Elsevier.*

*3. Poulos H. G., & Davis E. H. - Pile Foundation Analysis and Design, John Wiley,*

*4. Bowles J.E. - Foundation analysis and design, McGraw Hill.*

**Elective II**

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| **L-T-P** | **MCI039A – Repair and Rehabilitation of Structures** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* The course seeks to recognize the mechanisms of degradation of concrete structures, provide the students with the knowledge of available techniques and their application for strengthening or upgrading existing structural systems.

**Unit 1**

Introduction: Deterioration of structures with aging, Need for rehabilitation, Effects due to climate, temperature, chemicals, wear and erosion , design and construction errors , corrosion mechanism , Effects of cover thickness and cracking, Method of corrosion production., corrosion inhibitors , corrosion resistant steels, coatings, cathodic production.

**Unit 2**

Structural Health Monitoring: An overview of Structural Health Monitoring, Structural Health Monitoring and Smart Materials, Health Monitoring versus Non Destructive Testing, A broad overview of smart materials, Overview of Application potential of SHM.

**Unit 3**

Maintenance and Repair Strategies: Definitions: Maintenance, Repair, Rehabilitation, Facets of maintenance, Importance of maintenance, preventive measures on various aspects, assessment procedure for evaluating damaged structure, causes of deterioration – Testing techniques.

**Unit 4**

Materials and Methods of Repair: Special concrete and mortar, Concrete chemicals, special elements for accelerator, strength gain, expansive cement , polymer concrete , sulphur infiltrated concrete , ferro-cement, fiber reinforced concrete. Shortcreting, Grouting, Epoxy-cement mortar injection, Crack ceiling

**Unit 5**

Seismic Retrofitting of reinforced concrete buildings: Introduction: Considerations in retrofitting of structures, Source of weakness in RC frame building – Structural damage due to the discontinuous load path, Structural damage due to lack of deformation, Quality of workmanship and materials, Classification of retrofitting techniques, Retrofitting strategies for RC buildings – Structural level (global) retrofits methods, Member level (local) retrofit methods; Comparative analysis of methods of retrofitting

**Course Outcomes:**

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

CO1: various distress and damages to concrete and masonry structures

CO2: The importance of maintenance of structures, types and properties of repair materials etc.

CO3: Assessing damage to structures and various repair techniques

CO4: Strategies and techniques to upgrade the structure performance.

CO5: Ability to understand field monitoring and non-destructive evaluation of concrete 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 | PO 10 | PO 11 | 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. Diagnosis and treatment of structures in distress by R.N.Raikar, Published by R&D Centre of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.*

*2. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.*

***Reference Book:***

*1. Shetty, M.S. (2005), Concrete Technology Theory and Practice, S.Chand and company, New Delhi.*

*2. Santha Kumar, A.R., (1996), Concrete chemical Theory and Applications, Indian society for construction engineering and technology, madras.*

*3. Garas, F.K,.Clarke, J.L, Armer, GST (1997), Structural assessment, Butterworths, UK.*

*4. R.T. Allen and S.C.Edwards, (1998), Repair of Concrete Structures, Blakie and Sons, UK.*

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| **L-T-P** | **MCI040A – Advanced Foundation Design** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

* This subject is taught to impart the knowledge in the area of analysis and design of foundations and earth retaining structures.

**Unit 1**

Shallow Foundation: Terzaghi's bearing capacity equation, General bearing capacity equation , Balla's& Meyerhof's theory, Effect of water table, special footing problems, I.S. Code, Footing pressure for settlement on sand, Soil pressure at a depth, Boussinesq's&westergaard methods, Computation of settlements (Immediate & Consolidation) Permissible settlements, Proportioning of footing, Inclined & Eccentric loads.

**Unit 2**

Pile Foundation:  Timber, concrete, Steel piles, estimating pile capacity by dynamic formula, By wave equation & By static methods, Point Bearing piles, Pile loads tests, Negative skin friction, Modulus of subgrade reaction for laterally loaded piles, Lateral resistance.

**Unit 3**

Single Pile v/s Pile  Groups, Pile group consideration, Efficiency, Stresses on underlying strata, Settlement of pile group, Pile caps, Batter piles, Approximate and exact analysis of pile  groups,  I.S code.

**Unit 4**

Well foundation: Types (open end & closed or box, pneumetic, drilled) shapes, Bearing capacity and settlements, Determination of grip length by dimensional analysis, Design of well foundation construction, Tilts & shifts.

**Unit 5**

Machine Foundations: Types, Analysis and design by Barkens methods, Determination of coeff. of uniform elastic compression, Pauw's analogy and design of a Block type M/C foundation, I.S.I method of design, Co- vibrating soil mass.

**Course Outcomes:**

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

CO1: Design different foundation components.

CO2: Ability to understand various aspects of Design and Construction of foundation including

special foundations on difficult soils.

CO3: Knowledge to amylases shallow the deep foundation.

CO4: Ability to design pile foundation.

CO5: Ability to design well 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 | PO 10 | PO 11 | 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. B. M Das, Principles of Foundation Engineering, Thomson Brooks/Cole*

*2. GopalRanjan and ASR Rao, (2002), Basic and applied Soil Mechanics, Wiley Eastern Ltd.*

***Reference Book:***

*3. N.P. Kurien, Design of Foundation Systems: Principles & Practices, Narosa, New Delhi 1992*

*4. H. F. Winterkorn and H Y Fang, Foundation Engineering Hand Book, GalgotiaBooksource*

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| **L-T-P** | **MCI041A – Design of Tall Buildings** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

* This course is intended to teach the concept of tall structures.
* Various methods to analyze the tall structure will be explained in the classes.

**Unit 1**

Introduction - Classification of buildings according to NBC – Types of loads – wind load– Seismic load – Quasi static approach.

**Unit 2**

Plane Frame System - Calculation of wind load – Approximate method – Portal -Cantilever and factor methods – Kani’s method – Substitute frame method for dead load and live loads.

**Unit 3**

Shear Wall System - Rosman’s analysis – Design aspect – RC frame and shear wall interaction – Equivalent frame method.

**Unit 4**

In-filled Frame Systems - Importance – Methods of analysis – Equivalent truss and frame method – Force-displacement method – Effect of perforation in the in-filled frame.

**Unit 5**

Three Dimensional Analysis - Basic principles – Centre of rotation of a rigid floor – Force displacement method.

**Course Outcomes:**

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

CO1: Study of Structural systems and concepts. Frame, shear wall, Frame shear wall Interaction,

coupled shear walls, braced frames, TubularBuildings, Diagrids and Exoskeleton.

CO2: Understand Approximate and Matrix methods of Analysis, Foundation superstructure

interaction.

CO3: Analyze Wind Effects, Earthquake effects and design for ductility. Review of relevant Indian

standards.

CO4: Design the shear wall system and in filled frame systems.

CO5: Do the three dimensional 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 |  | M |  | H | L | H | M |  |  | H | H | H |  |
| CO2 | H |  | M |  | H | L | H | M |  |  | H | H | H |  |
| CO3 | H |  | M |  | H | L | H | M |  |  | H | H | H | M |
| CO4 | H |  | M |  | H | L | H | M |  |  | H | H | H |  |
| CO5 | H |  | M |  | H | L | H | M |  |  | H | H | H |  |

H = Highly Related M = Medium L=Low

***Text Book:***

*1. Ramachandra (2005), Design of Steel Structures–Vol.II, Standard Book House, 1750-a,NaiSarak, Delhi-6.*

***Reference Book:***

*1 SarwarAlamRaz, (2001), Analytical methods in Structural Engineering, Wiley Eastern*

*Private Limited, New Delhi.*

*2. Ghali.A.,Neville.A.M and Brown.T.G, (2003), Structural Analysis – A unified classical and Matrix Approach (Fifth Edition), Span press.*

**Semester IV**

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| **L-T-P** | **MCI023A – Dissertation Part - II** | **Credits: 28** |
| **0-0-28** |