GURU KASHI UNIVERSITY

Bachelor of Technology in Civil Engineering

Session: 2024-25

Department of Civil Engineering

GRADUATE OUTCOME OF THE PROGRAMME

The programme focuses on advanced conceptual knowledge, technical skills and research promotion in the field of Civil Engineering to identify, formulate, analyze, and solve complex engineering problems in order to develop sustainable computing solutions in broader economic, societal and environmental contexts.

PROGRAMME OUTCOMES

After completing the programme the learner will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate and analysis complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
5. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
6. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
7. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
8. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Structure

Semester I						
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
BCE116	Engineering Chemistry	Basic Science Course	3	0	0	3
BCE111	Engineering Mathematics–I	Basic Science Course	3	1	0	4
BCE117	Programming for Problem Solving	Engineering Science Course	3	0	0	3
BCE118	Communication Skills	Humanities Course	3	0	0	3
BCE119	Manufacturing Practices	Engineering Science Course	1	0	4	3
BCE120	Engineering Chemistry Lab	Basic Science Course	0	0	2	1
BCE121	Programming for Problem Solving Lab	Engineering Science Course	0	0	2	1
BCE122	Communication Skills Lab	Humanities Course	0	0	2	1
BCE123	Basics of Domestic Appliances	Engineering Science Course	2	0	0	2
BCE124	Basics of Domestic Appliances lab	Engineering Science Course	0	0	2	1
Total			**15**	**1**	**12**	**22**

Semester II						
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**Credit**
BCE219	Basic Electrical Engineering	Engineering Science Course	3	1	0	4
BCE213	Engineering Physics	Basic Science Course	3	1	0	4
BCE214	Engineering Mathematics–II	Basic Science Course	3	1	0	4
BCE215	Engineering Graphics & Drawing	Engineering Science Course	1	0	4	3
BCE216	Engineering Physics Lab	Basic Science Course	0	0	2	1
BCE217	Basic Electrical Engineering Lab	Engineering Science Course	0	0	2	1
BCE218	Fundamental of Computer and Information Technology Lab	Engineering Science Course	0	0	2	1
BCE220	Indian Constitution	Value Added Course	2	0	0	NC*
Total			**12**	**3**	**10**	**18**
Note: *Non-credit (NC) course will be evaluated as satisfactory/ unsatisfactory						

Semester: III						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE302	Solid Mechanics	Engineering Science Courses	3	0	0	3
BCE303	Fluid Mechanics	Professional Core Course	3	0	0	3
BCE314	Concrete Technology	Professional Core Course	3	0	0	3
BCE313	Civil Engineering Materials, Testing & Evaluation	Engineering Science Courses	3	0	0	3
BCE315	Building Planning and Computer-aided Civil Engineering drawing	Professional Core Course	2	0	0	2
BCE306	Solid Mechanics Lab	Engineering Science Courses	0	0	2	1
BCE307	Fluid Mechanics Lab	Professional Core Course	0	0	2	1
BCE318	Concrete Technology Lab	Professional Core Course	0	0	2	1
BCE316	Civil Engineering Materials, Testing & Evaluation Lab	Engineering Science Courses	0	0	2	1
BCE317	Building Planning and Computer-aided Civil Engineering drawing Lab	Professional Core Course	0	0	2	1
BCE308	Institutional Training*	Internship	0	0	0	2
Total			**14**	**0**	**10**	**21**
Note: *Institutional Training will be imparted in the Institute at the end of 2nd Semester for 4-weeks duration. However, it is not applicable to LEET Students.						

Semester: IV						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE404	Transportation Engineering	Professional Core Course	3	0	0	3
BCE413	Surveying and Geomatics	Professional Core Course	3	0	0	3
BCE414	Geotechnical Engineering	Professional Core Course	3	0	0	3
BCE415	Hydraulic Engineering	Professional Core Course	3	0	0	3
BCE412	Structural Analysis	Professional Core Course	3	0	0	3
BCE416	Construction Engineering & Management	Professional Core Course	3	0	0	3
BCE417	Civil Engineering - Societal & Global Impact	VAC	2	0	0	NC*
BCE403	Transportation Engineering Lab	Professional Core Course	0	0	2	1
BCE418	Surveying and Geomatics Lab	Professional Core Course	0	0	2	1
BCE419	Geotechnical Engineering Lab	Professional Core Course	0	0	2	1
BCE420	Hydraulic Engineering Lab	Professional Core Course	0	0	2	1
Total			**20**	**0**	**8**	**22**
Note: *Non-credit (NC) course will be evaluated as satisfactory/ unsatisfactory						

Semester: V						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE515	Structural Design -I	Professional Core Course	3	0	0	3
BCE501	Environmental Engineering	Professional Core Course	3	0	0	3
BCE516	Engineering Economics, Estimation & Costing	Professional Core Course	3	0	0	3
BCE517	Hydrology & Water Resources Engineering	Professional Core Course	3	0	0	3
BCE518	Plumbing (Water and Sanitation)	Program Elective Course - 1	3	0	0	3
BCE519	Professional Practice, Law & Ethics	Mandatory Non-credit course	3	0	0	NC*
BCE520	Structural Design –I Lab	Professional Core Course	0	0	2	1
BCE521	Environmental Engineering Lab	Professional Core Course	0	0	2	1
BCE522	Engineering Economics, Estimation & Costing Lab	Professional Core Course	0	0	2	1
BCE523	Plumbing (Water and Sanitation) Lab	Program Elective Course - 1	0	0	2	1
BCE508	Survey Camp#	Internship	0	0	4	2
XXX	XXX	Open Elective	3	0	0	3
Total			**21**	**0**	**12**	**24**

#Survey Camp: The Survey Camp will be organized at a hilly terrain. It will be organized after the final Examinations of 4th semester and will be evaluated in the 5th semester. The total Expenditure will be paid by the students themselves.

Note: *Non-credit (NC) course will be evaluated as satisfactory/ unsatisfactory

Open Elective Subject (Offered to other Departments)						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
OEC109	Environmental Engineering	Open Elective	3	0	0	3

Semester: VI						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE615	Structural Design -II	Professional Core Course	3	1	0	4
BCE616	Intelligent Transportation Systems	Professional Core Course	3	0	0	3
BCE617	Sustainable and Green construction	Professional Core Course	3	0	0	3
XXX	Program Elective Course -2	Program Elective Course	3	0	0	3
XXX	Program Elective Course -3	Program Elective Course	3	0	0	3
BCE618	Energy Efficient Buildings	VAC	2	0	0	NC*
BCE619	Structural Design –II Lab	Professional Core Course	0	0	2	1
XXX	XXX	Open Elective Course	3	0	0	3
Total			**20**	**1**	**2**	**20**
Note: *Non-credit (NC) course will be evaluated as satisfactory/ unsatisfactory						

Program Elective -2 (Anyone of the Following)						
BCE620	Design of Steel Structures	**Program Elective -2**	3	0	0	3
BCE621	Advanced Concrete Technology					
Program Elective -3 (Anyone of the Following)						
BCE622	Sustainable Construction Methods	**Program Elective -3**	3	0	0	3
BCE623	Construction Equipment & Automation					

Open Elective Subject (Offered to other Departments)						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
OEC110	Sustainable and Green construction	Open Elective	3	0	0	3

Semester: VII						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
XXX	Program Elective Course - 4	Program Elective Course	3	0	0	3
XXX	Program Elective Course - 5	Program Elective Course	3	0	0	3
XXX	Program Elective Course -6	Program Elective Course	3	0	0	3
BCE719	Project	Project	0	0	8	4
XXX	Program Elective Course – 4 Lab	Program Elective Course	0	0	2	1
BCE705	Industrial Training**	Internship	0	0	0	4
XXX	XXX	Open Elective	3	0	0	3
Total			**12**	**0**	**10**	**21**

Program Elective -4 (Anyone of the Following)						
BCE702	Foundation Engineering	**Program Elective -4**	3	0	0	3
BCE712	Ground Improvement Techniques					
Program Elective Course – 4 Lab (Anyone of the Following)						
BCE713	Foundation Engineering Lab	**Program Elective Course – 4 Lab**	0	0	2	1
BCE714	Ground Improvement Techniques Lab					
Program Elective -5 (Anyone of the Following)						
BCE715	Contracts Management	**Program Elective - 5**	3	0	0	3
BCE716	Construction Cost Analysis					
Program Elective -6 (Anyone of the Following)						
BCE717	Airport Planning and Design	**Program Elective -6**	3	0	0	3
BCE718	Railway Engineering					
**The marks of 6 weeks Industrial Training undergone at the end of 6th semester will be included here.						

Open Elective Subject (Offered to other Departments)						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
OEC064	Disaster Preparedness & Planning	Open Elective	3	0	0	3

Semester: VIII						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE806	Highway Construction and Management	Professional Core Course	3	0	0	3
XXX	Program Elective Course - 7	Program Elective Course	3	0	0	3
BCE807	Internship	INT	0	0	24	12
BCE808	Disaster Preparedness & Management	VAC	3	0	0	NC*
XXX	XXX	Open Elective	3	0	0	3
Total			**12**	**0**	**24**	**21**
Note: *Non-credit (NC) course will be evaluated as satisfactory/ unsatisfactory						

Program Elective -7 (Anyone of the Following)						
BCE809	Water Resource Management	Program Elective -7	3	0	0	0
BCE810	Solid and Hazardous Waste Management					
Note: The mode of teaching for the theory courses of 8th Semester will be online (Google meet/Zoom/ or any other).						

Open Elective Subject (Offered to other Departments): Online Mode						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
OEC111	Building Construction Practice	Open Elective	3	0	0	3

SEMESTER- I

Course Title: ENGINEERING CHEMISTRY

Course Code: BCE116

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes:

On successful completion of this course, the students would be able to:

1. Demonstrate Schrodinger equation, Particle in a box solution and their applications
2. Conjugated molecules and Nanoparticles,
3. Evaluate band structure of solids and the role of doping on band structures.
4. Distinguish the ranges of Vibrational and rotational spectroscopy of diatomic molecules,
5. Applications, Nuclear magnetic resonance and magnetic resonance imaging
5. Rationalize periodic properties such as ionization potential, electro negativity, Oxidation states and electro-negativity.
6. List the Thermodynamic functions: energy, entropy and free energy and also Estimations of entropy and free energies.

Course Content

UNIT I **15 Hours**

Atomic and molecular structure

Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and Nanoparticles, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations, Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT II **10 Hours**

1. Spectroscopic techniques and applications

Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic

resonance imaging, surface characterization techniques, Diffraction and scattering.

2. **Intermolecular forces and potential energy surfaces**

Ionic, Dipolar and Vander Waals interactions, Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

UNIT III **10 Hours**

1. Use of free energy in chemical equilibria

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria, Water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

2. Periodic properties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

UNIT IV **10 Hours**

1. Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

2. Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Mahan, B. H. (1987). University chemistry.*
- *Sienko, M. J. & Plane, R. A. Chemistry. (1979): Principles*

and Applications. New York: McGraw-Hill.

- *Banwell, C. N. (1966). Fundamentals of Molecular Spectroscop. New York, McGraw-Hill.*
- *Tembe, B. L., Kamaluddin& Krishnan, (2008). M. S. Engineering Chemistry (NPTEL Web- book).*

Course Title: ENGINEERING MATHEMATICS-I

Course Code: BCE111

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. Classify of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. Illustrate the Tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. Use of functions of several variables that is essential in most branches of engineering and tools of matrices and linear algebra in a comprehensive manner.

Course Content

UNIT I **16 Hours**

a. Calculus:

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

b. Advanced Calculus

Differentiation: Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Integration: Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

UNIT II **14 Hours**

Trigonometry

Hyperbolic and circular functions, logarithms of complex number resolving real and imaginary parts of a complex quantity, De Moivre's Theorem.

Theory of equations: Relation between roots and coefficients, reciprocal Equations, transformation of equations and diminishing the roots.

UNIT III **15 Hours**

Sequences and series

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT IV **15 Hours**

Algebra

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank- nullity theorem, composition of linear maps, Matrix associated with a linear map.

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, Eigen bases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.*
- *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.*
- *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.*
- *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
- *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.*
- *G.B. Thomas and R.L. Finney, Calculus and Analytic*

geometry, 9th Edition, Pearson, Reprint, 2002.

- *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.*
- *Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.*
- *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
- *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.*
- *D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.*
- *V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.*
- *Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.*
- *Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.*
- *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.*
- *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.*

Course Title: PROGRAMMING FOR PROBLEM SOLVING

Course Code: BCE117

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design the algorithms to write programs.
2. Illustrate arrays, pointers and structures to formulate algorithms and programs
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration
4. Implement conditional branching, iteration and recursion.

Course Content

UNIT I **15 Hours**

1. Introduction to Programming
2. Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
3. Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.
4. From algorithms to programs; source code, variables (with data types) variables and memory
5. Locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **15 Hours**

1. Arithmetic expressions and precedence
2. Conditional Branching and Loops
3. Writing and evaluation of conditionals and consequent branching
4. Iteration and loops
5. Arrays: Arrays (1-D, 2-D), Character arrays and Strings

UNIT III **8 Hours**

1. Basic Algorithms

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of Equations, notion of order of complexity through example programs (no formal def. required)

2. Function

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference.

3. Recursion

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT IV **7 Hours**

1. Structure

Structures, Defining structures and Array of Structures

2. Pointers

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

File handling (only if time is available, otherwise should be done as part of the lab)

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Byron Gottfried, Schaum's (1995), Outline of Programming with C, McGraw-Hill*
- *E. Balaguru swamy (2005) Programming in ANSI C, Tata McGraw-Hill*

Course Title: COMMUNICATION SKILLS

Course Code: BCE118

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop vocabulary and improve the accuracy in Grammar.
2. Apply the concepts of accurate English while writing and become equally ease at using good vocabulary and language skills.
3. Develop and Expand writing skills through Controlled and guided activities.
4. Compose articles and compositions in English.

Course Content

UNIT I **16 Hours**

Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

UNIT II **14 Hours**

Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

UNIT III **8 Hours**

Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

UNIT IV **7 Hours**

1. **Nature and Style of sensible Writing)**

Describing, Defining, Classifying, providing examples or evidence, Writing introduction and conclusion

2. **Writing Practices):** Comprehension, Précis Writing, Essay Writing

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Swan, Michael. (1995). Practical English. OUP.*
- *Wood, F.T. (2007). Remedial English Grammar. MacMillan.*
- *Zinsser, W. (2001). On Writing Well. Harper Resource Book.*
- *Lyons, L. H.&Heasly, B. (2006). Study Writing. Cambridge University Press.*
- *Kumar, S &Lata, P. (2011). Communication Skills. Oxford University Press.*
- *CIEFL, Hyderabad. Exercises in Spoken English. Parts. I-III. Oxford University Press.*

Course Title: MANUFACTURING PRACTICES

Course Code: BCE119

L	T	P	Credits
3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to: Apply the various manufacturing methods in different fields of engineering.

1. Use the different fabrication techniques
2. Learn about the practices in manufacturing of simple components using different materials.
3. Understand the advanced and latest manufacturing techniques being used in engineering industry

Course Content

UNIT I **8 Hours**

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing

UNIT II **6 Hours**

1. Fitting operations & power tools
2. Electrical & Electronics
3. Carpentry

UNIT III **6 Hours**

1. Plastic moulding, glass cutting
2. Metal casting

UNIT IV **10 Hours**

Welding (arc welding & gas welding), brazing [More hours can be given to Welding for Civil Engineering students as they may have to deal with Steel structures fabrication and erection; 3D Printing is an evolving manufacturing technology and merits some lectures and hands-on training. (1 hour)

Workshop Practice:

1. Machine shop - 10 hours
2. Fitting shop - 8 hours
3. Carpentry - 6 hours

4. Electrical & Electronics - 8 hours
5. Welding shop - 8 hours (Arc welding 4 hours) + gas welding 4 hours))
6. Casting - 8 hours
7. Smithy - 6 hours
8. Plastic moulding & Glass Cutting -6 hours

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Raghuwanshi, B.S. (2009). A Course in Workshop Technology, Vol 1 &II. Dhanpat Rai &Sons.*
- *Jain, R.K. (2010). Production Technology. Khanna Publishers.*
- *Singh, S. (2003). Manufacturing Practice. S.K. Kataria & Sons.*

Course Title: ENGINEERING CHEMISTRY LAB

Course Code: BCE120

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Evaluate the estimate rate constants of reactions from concentration of reactants/products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Apply the theoretical concepts for result analysis and interpret data obtained from experimentation.
4. Identify the compound using a combination of qualitative test and analytical methods

Course Content

List of Experiments:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Course Title: PROGRAMMING FOR PROBLEM SOLVING LAB
Course Code: BCE121

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Create read and write to and from simple text files.
2. Identify and correct logical errors encountered at run time
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.
4. Represent data in arrays, strings and structures and manipulate them through a program.

Course Content

List of Experiments:
Tutorial 1: Problem solving using computers
Lab1: Familiarization with programming Environment
Tutorial 2: Variable types and type conversions
Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions
Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops
Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting
Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings, memory structure
Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value
Lab 7: Simple functions
Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration)
Lab 8 and 9: Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures
Tutorial 12: File handling
Lab 12: File operations

Suggested Readings:

- *Byron Gottfried, Schaum's (1995), Outline of Programming with C, McGraw-Hill*
- *E. Balaguruswamy (2005) Programming in ANSI C, Tata McGraw-Hill.*

Course Title: COMMUNICATION SKILLS LAB
Course Code: BCE122

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Illustrate the importance of pronunciation and apply the same day to day conversation.
2. Apply verbal and non-verbal communicationtechniques in the Professional Environment.
3. Develop coherence, cohesion and competence in Oral discourse.
4. Evaluate the interview process confidently.

Course Content

Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Course Title: BASICS OF DOMESTIC APPLIANCES
Course Code: BCE123

L	T	P	Credits
2	0	0	2

Total hours: 30

Course Outcomes: On successful completion of this course, the students will be able to:

1. Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protection devices.
2. Understand the working principles of different household domestic appliances.
3. Check the electrical connections at house-hold.
4. To learn the skills to repair the electrical appliances for the general troubleshooting and wiring faults.

Course Content

UNIT-I **7 Hours**

Basics of House wiring, Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances.

UNIT-II **8 Hours**

Electric Iron:

Type of Electric Iron – Ordinary type and automatic/Thermostat Control type/steam iron, Construction and working principle of electric irons; common defects, testing and repairs

Electric Stove:

Types of Electric Stoves- Coiled type, covered type, Hot Plate, Grill/Oven, Cooking Range- Construction and working principle of electric stoves, common defects, testing and repairs; Induction heater; OTG and Microwave oven; Three phase heater, star and Delta connections.

Electric Toasters:

Types of Toasters - Ordinary and Automatic; Construction and working principles of electric toaster; common defects, testing and repairs.

UNIT-III **7 Hours**

Table Lamp and Tube Light:

Construction, working principles and use of Table Lamp, Night Lamp and Tube Light; Common faults, their causes, testing and repair, LED Table lamp.

Electric Fan:

Type of Fans – ceiling fan, Pedestal fan, Bracket Fan, Exhaust Fan; Construction working principles, special characteristics and applications of Electric fans; Common faults, their causes, testing and repairs; Installation of Bracket Fan and Exhaust Fan.

UNIT-IV **8 Hours**

Electric Mixer, Grinder and Blender:

Construction, working principles, special characteristics and applications of Electric Mixer, Grinder and Blender; Common Faults, their causes, testing and repairs; Servicing maintenance and overhauling of Electric Mixer, Grinder and Blender.

Emergency Light and Stabilizer:

Constructions and working principles of Emergency Light and Stabilizer; Common faults, their causes, testing and repairs.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand& Co.,
2. A Text book on Electrical Technology, A.K.Theraja.
3. Performance and design of AC machines, M.G.Say, ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications.
5. Consumer Electronics, S.P.Bali, Pearson.
6. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications

Course Title: BASICS OF DOMESTIC APPLIANCES LABORATORY
Course Code: BCE124

L	T	P	Credits
0	0	2	1

Total hours: 15

Course Outcomes: On successful completion of this course, the students will be able to:

1. Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protection devices.
2. Understand the working principles of different household domestic appliances.
3. Check the electrical connections at house-hold.
4. To learn the skills to repair the electrical appliances for the general troubleshooting and wiring faults.

Course Content

Co-curricular Activities (Hands on Exercises):

1. Identifying Phase, Neutral and Earth on power sockets.
3. Identifying primary and secondary windings and measuring primary and secondary voltages in various types of transformers.
4. Observing the working of transformer under no-load and full load conditions.
5. Observing the connections of elements and identify current flow and voltage drops.
6. Studying electrical circuit protection using MCBs, ELCBs.
7. Dismantling and reassemble of reflector type room Heater.
8. Dismantling and reassembling of Electric Iron (i) Ordinary type (ii) Automatic/Thermostat control type.
9. Testing and repair of Electric Iron (i) Ordinary type (ii) Automatic/Thermostat control type.
10. Dismantling and reassembling of Electric Stove (i) Coiled type (ii) Covered type
    (a) Hot plate (b) Grill (iii) Induction Heater (iv) Microwave oven, (v) Three phase heater star and delta connection
11. Connection of Fluorescent tube light (FTL) circuit.
12. Testing and repair of (i) Table Lamp (ii) Night Lamp and (ii) Tube Light (iv) LED table lamp
13. Testing fault finding, repair and overhauling of electric fans.

14. Testing fault finding, repair and overhauling of (i) electric mixer (ii) grinder (iii) blender.
15. Testing fault finding, repair and overhauling of emergency light
16. Testing fault finding, repair and overhauling of voltage stabilizer (manual and automatic)

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand& Co.,
2. A Text book on Electrical Technology, A.K.Theraja.
3. Performance and design of AC machines, M.G.Say, ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications.
5. Consumer Electronics, S.P.Bali, Pearson.
6. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications

SEMESTER- II

Course Title: BASIC ELECTRICAL ENGINEERING
Course Code: BCE219

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the DC and AC electrical circuit elements with RLC.
2. Analysis of simple circuits with dc excitation. Superposition, The venin and Norton Theorems.
3. Use Single Phase AC Circuits and representation of alternating quantities and determining the power in these circuits.
4. Classify the different types of Electrical machines.

Course Content

UNIT I **15 Hours**

DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II **15 Hours**

AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Transformers

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT III **15 Hours**

Electrical Machines

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed

control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT IV **15 Hours**

Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Electrical Installations

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Kothari, D. P. and Nagrath, I. J. (2010). Basic Electrical Engineering. Tata McGraw Hill.*
- *Kulshreshtha, D. C. (2009). Basic Electrical Engineering. McGraw Hill.*
- *Bobrow, L. S. (2011). Fundamentals of Electrical Engineering. Oxford University Press.*
- *Hughes, E. (2010). Electrical and Electronics Technology. Pearson*

COURSE TITLE: ENGINEERING PHYSICS
COURSE CODE: BCE213

L	T	P	Credits
3	1	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
2. Use the knowledge regarding calculus along with physical principles to effectively solve problems encountered in everyday life, further study in science, and in the professional world.
3. Design experiments and acquires data in order to explore physical principles, effectively communicate results, and evaluate related scientific studies.
4. Assess the contributions of physics to our evolving understanding of global change and sustainability while placing the development of physics in its historical and cultural context.

Course Content

UNIT I **15 Hours**

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential, Boundary conditions of electric field and electrostatic potential; method of images. Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

UNIT II **15 Hours**

Magneto statics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; vector potential and its solution for given current densities. Properties of magnetic materials: magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials.

Time Varying Field and Maxwell's Equation: Laws of Electromagnetic Induction, Self and Mutual induction, Concept of Displacement Current, Difference between Conduction Current and Displacement Current, Eddy Current, Maxwell's Equations, Derivation of Maxwell's Equations, Propagation of Electromagnetic Waves in Free Space, Solution of propagation of Plane

Electromagnetic Wave in free space.

UNIT III **15 Hours**

Semiconductors: Intrinsic and extrinsic semiconductors, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Semiconductor materials of interest for optoelectronic devices.

Modern Physics: Particle properties of wave: Planck's hypothesis, Qualitative discussion of Photoelectric effect and Compton Effect. Wave properties of particle: De Broglie wave as mater waves, Heisenberg's uncertainty principle and its application. Quantum Mechanics: Interpretation of wave function, Schrödinger equation (time dependent and time independent), particle in a box,

UNIT IV **15 Hours**

Wave Optics: Interference due to division of wavefront, Young's double slit expt., Principle of Superposition, Interference from parallel thin films, Newton rings, Michelson interferometer. Diffraction: Fresnel Diffraction, Diffraction at a straight edge, Fraunhoffer diffraction due to N slits, Diffraction grating, dispersive and resolving power of Grating. Polarization**:** production of plane polarized light by different methods, Brewster and Malus Laws. Double refraction, Quarter & half wave plate, Nicol prism, specific rotation, Laurent's half shade polarimeter.
Laser: Introduction, principle of Laser, stimulated and spontaneous emission, Einstein's Coefficients, He-Ne Laser, Ruby Laser, Application of Lasers.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *David J Griffths, Introduction to Electrodynamics. Prentice Hall, 2015.*
- *Saslow, W.,Electricity, magnetism and light. e-book.*
- *Subramaniam N & BrijLal, Optics, S Chand & Co. Pvt. Ltd., New Delhi*
- *R Murugeshan, Kiruthiga, Sivaprasath, Modern Physics, S Chand & Co. Pvt. Ltd., New Delhi.*
- *M.N.Avadhanulu, Engineering Physics, S.Chand& Company Ltd.*
- *Arthur Beisser, Concepts of Modern Physics, McGraw Hill Publications, 1981*

COURSE TITLE: ENGINEERING MATHEMATICS –II
COURSE CODE: BCE214

L	T	P	Credits
3	1	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate the methods of forming and solving Ordinary differential equations and solve linear differential equations with constant and variable coefficients
2. Explain the concept of differential equation and classifies the differential equations with respect to their order and linearity.
3. Solve first-order ordinary and exact differential equations and converts separable and homogeneous equations to exact differential equations by integrating factors.
4. Apply the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.

Course Content

UNIT-I **14 Hours**

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders:
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT-II **15 Hours**

Complex Variable – Differentiation
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNIT-III **15 Hours**

Complex Variable – Integration

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

UNIT-IV **16 Hours**

Transform Calculus

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.Fourier transforms.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Reading

- *Thomes, G.B.and Finney, R.L. (2010) Calculus and Analytic Geometry; Ninth Edition; Pearson Education*
- *Kreyszig, E. (1998) Advanced Engineering Mathematics; Eighth Edition, John Wiley and sons.*
- *Grewal, B.S. (1965) Higher Engineering Mathematics; Khanna Publishers, New Delhi.*
- *BabuRam (2009) Advance Engineering Mathematics; First Edition; Pearson Education.*
- *Richard Courant and Fritz John (2012) Introduction to Calculus and Analysis, Volume II , V Springer Publication*
- *Harold M. Edwards (2013) Advanced Calculus: A Differential Forms Approach, Birkhauser.*

COURSE TITLE: ENGINEERING GRAPHICS & DRAWING COURSE CODE: BCE215

L	T	P	Credits
1	0	4	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand about engineering drawing applications and its importance in society.
2. Learn about the visual aspects of engineering design.
3. Discuss the engineering graphics standards.
4. Classify the concept of solid modeling techniques.

Course Content

UNIT I **9 Hours**

1. Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.
2. Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes.

UNIT II **12 Hours**

1. Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
2. Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT III **14 Hours**

1. Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions;

Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

2. Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

3. Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT IV **10 Hours**

1. Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines
(extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerance techniques; dimensioning and scale multi views of dwelling;

2. Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in

standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerance; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Gill, P.S. (2001). Engineering Drawing. S.K; Kataria and Sons, Ludhiana.*
- *Bhatt, N.D. (2012). Engineering Drawing. Charotar Book Stall, TulsiSadan, Anand.*
- *French, T.E. and Vierck. C.J. (1993). Graphic Science. McGraw-Hill, New York.*
- *Zozzora, F. (1958). Engineering Drawing. McGraw Hill, NewYork.*

(Corresponding set of) CAD Software Theory and User Manuals

Course Title: ENGINEERING PHYSICS LAB
Course Code: BCE216

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes On successful completion of this course, the students would be able to:

1. Illustrate the working p-n junction diode.
2. Analyze and solve various engineering problems.
3. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
4. Design new instruments with practical knowledge.

Course Content

List of experiments

1. To study the V-I characteristics of P-N junction.
2. To verify the logic gates.
3. To calculate the acceleration due to gravity "g" using simple pendulum.
4. To find the moment of inertia of flywheel.
5. To measure the diameter of a small spherical/cylindrical body using Vernier calipers/screw gauge.
6. To draw V-I characteristics of Zener diode and determine reverse breakdown voltage.
7. To study the controls and obtain a wave using Cathode Ray Oscilloscope.
8. To find the resolving power of the prism.
9. To determine the angle of the given prism.
10. To determine the refractive index of the material of a prism.
11. To understand the phenomenon Photoelectric effect as a whole.
12. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
13. To determine the Planck's constant from kinetic energy versus frequency graph.
14. To plot a graph connecting photocurrent and applied potential.
15. To determine the stopping potential from the photocurrent versus applied potential graph.

Note : Students will perform any 7-8 experiments from the syllabus.

Course Title: BASIC ELECTRICAL ENGINEERING LAB

L	T	P	Credits
0	0	2	1

Course Code: BCE217

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.
2. Understand the Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.
3. Analysis of Single-Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
4. Compare different types of Electrical machines and classify different electrical measuring equipment's and understanding their principles

Course Content

List of Experiments:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line- line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase

circuits.

5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Title: Fundamental of Computer and Information Technology Lab

Course Code: BCE218

L	T	P	Credits
0	0	2	1

Total Hours: 15

Course learning outcomes: On successful completion of this course, students will be able to:

1. Understanding the concept of input and output devices of Computers
2. Study to use the Internet safely, legally, and responsibly.
3. Understand an operating system and its working, and solve common problems related to operating systems
4. Learn basic word processing, Spreadsheet and Presentation Graphics Software skills

Course Content

1. Various Components of a Computer.
2. Introduction to Microsoft Word & Presentation
3. Make a simple presentation on your college,
4. use 3D effects, on prescribed presentation
5. Applications of Ms-Office Ms-Word
6. Ms-Excel.
7. Ms-PowerPoint.
8. Create web pages for your college using different tags.
9. web Browser and E- Mail
10. Conversion of a word documents into PDF/ Image conversion using image file format.

Course Title: Indian Constitution
Course Code: BCE220

L	T	P	Credits
2	0	0	NC*

Total hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Knowledge and legal literacy and thereby to take up competitive examinations
2. Understand state and central policies, fundamental duties, Electoral Process, and special provisions
3. Analyze powers and functions of Municipalities, Panchayats and Co-operative Societies, and
4. Classify the engineering ethics and responsibilities of Engineer and an awareness about basic human rights in India

Course Content

Unit I **5 Hours**

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

Unit II **10 Hours**

Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India. State Executives – Governor Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.

Unit III **10 Hours**

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchayats and Co – Operative Societies.

Unit IV **5 Hours**

Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- Singh Mahendra, P. (2000). VN Shukla's Constitution of India. Eastern Book Company, Lucknow.
- Agrawal, P. K., & Gupta, V. (2023). The Constitution of India Bare Act with Short Notes-Useful for Competitive Examinations: Bestseller Book by Dr. PK Agrawal; Virag Gupta: The Constitution of India Bare Act with Short Notes-Useful for Competitive Examinations. Prabhat Prakashan.
- Ghosh, P. K. (1966). Constitution of India (Prabhat Prakashan): How it Has Been Framed. Prabhat Prakashan.

SEMESTER- III

Course Title: Solid Mechanics
Course Code: BCE302

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the concept of static equilibrium, deformations, and material constitutive behavior.
2. Comprehend the concepts of stress, strain and elastic behavior of materials including Hooke's law relationships to analyze structural members subjected to tension, compression and torsion.
3. Develop SFD and BMD for different type of beams subjected to different types of loads
4. Plot elastic curves for beams undergoing displacements under different loadings

Course Content

Unit-I: **10 Hours**

Simple Stresses and Strains: Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

Compound Stresses and Strains: Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two-dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

Unit-II: **15 Hours**

Bending moment and Shear Force Diagrams: Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Flexural Stresses-Theory of simple bending: Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Unit-III: 10 Hours

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Unit-IV: 10 Hours

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs Torsion of Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

Transactional Mode:

Lecture based Instruction, Project based learning, Field trip visits, Problem based learning, Interactive workshops & Seminars, peer group discussion, Case studies, Problem based learning

Suggested Readings:

1. *D.S. Bedi, "Strength of Materials", Khanna Book Publishing Co.*
2. *AICTE Prescribed Textbook: Physics (Introduction to Mechanics), Bhattarchaya, A.B., Khanna Book Publishing Co., 2023.*
3. *Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.*
4. *Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.*
5. *Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004*
6. *Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979*
7. *Laboratory Manual of Testing Materials - William Kendrick Hall*
8. *Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.*
9. *Strength of Materials by R. Subramanian, Oxford University Press, New Delh*

Course Title: Fluid Mechanics
Course Code: BCE303

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the basic terms used in fluid mechanics and its broad principles
2. Estimate the forces induced on a plane/ submerged bodies
3. Formulate expressions using dimensionless approach and able to determine design parameters by creating replica of prototype at appropriate scale.
4. Apply the continuity, momentum and energy principles and design the pipelines used for water supply or sewage under different situation.

Course Content

Unit-I: **12 Hours**

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Fluid Statics - Fluid Pressure: Pressure at a point, Pascal's law, Piezometer, U-Tube Manometer, U-Tube Differential Manometer, Micro manometers, pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Unit-II: **13 Hours**

Fluid Kinematics - Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Fluid Dynamics - Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

Unit-III: **10 Hours**

Laminar Flow & Turbulent Flow - Laminar flow through: circular pipes, parallel plates. Stoke's law, Reynolds experiment, Transition from laminar to turbulent flow. Prandtl's mixing length theory, universal velocity distribution equation. Flow through Pipes: Loss of head through pipes, Darcy-Wiesbach equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel

Boundary Layer Analysis- Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub- layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Unit-IV: **10 Hours**

Open Channel Flow - Introduction, Comparison between open channel flow and pipe flow, geometrical parameters of a channel, Uniform Characteristics of uniform flow, Chezy's formula, Manning's formula. Most economical section of channel. Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses.

Transactional Mode:

Lecture based Instruction, Project based learning, Field trip visits, Problem based learning, Interactive workshops & Seminars, peer group discussion, Case studies, Problem based learning

Suggested Readings:

1. *Fluid Mechanics & Hydraulic Machines: Dr. R.K. Bansal*
2. *Hydraulic and Fluid Mechanic by P.N. Modi & S.M. Seth*
3. *Engineering Fluid Mechanics by R.J. Garde & A.G. Mirajgaoker*
4. *Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Pitman*

Course Title: Concrete Technology
Course Code: BCE314

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the relevance of different properties of constituent materials on properties of concrete.
2. Comprehend the behavior and durability aspects of concrete under different loading and exposure conditions.
3. Evaluate the issues involved in production and use of concrete.
4. Design of concrete mixes as per BIS specifications.

Course Content

Unit I: 10 Hours

CEMENTS & ADMIXTURES: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

Unit II: 10 Hours

AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum aggregate size.

Unit III: 15 Hours

Properties of Concrete: Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water, Abram's Law, Factors affecting strength; Characteristics strength of concrete, Target strength, Modulus of elasticity, Modulus of rupture.

Unit IV: 10 Hours

MIX DESIGN: Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method

of mix design.

Special concretes: Types and specifications; Fibre reinforced and steel reinforced concrete; Polymer concrete; Light weight concrete, High strength concrete, Prestressed concrete, Self-Compacting Concrete, Pervious Concrete, Self-Healing Concrete.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Properties of Concrete', A. M. Neville, Prentice Hall*
2. *Concrete Technology', M. S. Shetty, S. Chand &Co.*
3. *Concrete Technology', M. L. Gambhir, Tata McGraw Hill Publishers, New Delhi*
4. *Concrete Technology', A. R. Santha Kumar, Oxford University Press, New Delhi*

Course Title: Civil Engineering Material, Testing & Evaluation
Course Code: BCE313

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Comprehend the role of materials in Civil Engineering
2. Interpret common measurement instruments, equipment's and devices to capture the material response under loading
3. Analyze a variety of established material testing procedures/techniques and the relevant codes of practice
4. Ability to write a technical laboratory report.

Unit-I: **15 Hours**

Introduction to Engineering Materials covering: Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these.

Introduction to Material Testing covering: Mechanical behavior and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics

Unit-II: **10 Hours**

Standard Testing & Evaluation Procedures covering: Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep

Unit-III: **10 Hours**

Testing Procedures for bricks, reinforcing steel, fine aggregates, coarse aggregates, Physical identification of tests for soils. Documenting the experimental program, including the test procedures, collected data, method of interpretation and final results.

Unit-IV: **10 Hours**

Tests and testing reports: Reports in the material selection for various civil engineering projects /construction, Sampling, Acceptance criterion, Code of practice and guidelines in this regard for Cements; Aggregates; Concrete (plain and reinforced); Soils; Bitumen and asphaltic materials; Timbers; Glass and Plastics; Structural Steel.

Transactional Mode:

Lecture based Instruction, Project based learning, Field trip visits, Problem based learning, Interactive workshops & Seminars, peer group discussion, Case studies, Problem based learning

Suggested Readings:

1. *Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann*
2. *Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand & Bros, FifthEdition*
3. *Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineeringapplications*
4. *Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials,Cognella*
5. *E.N. Dowling (1993), Mechanical Behavior of Materials, Prentice Hall International Edition*
6. *American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)*

Course Title: Building Planning and Computer aided Civil Engineering Drawing
Course Code: BCE315

L	T	P	Cr.
2	0	0	2

Total: 30 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1) Implement principles of planning of buildings
2) Design and draw various constructional drawing of the buildings.
3) Plan various building services.

Course Content

UNIT I: 10 Hours

Principles of Residential and Public Buildings: Concept of built environment and its application in planning. Recommendation of National building code., Green building, Introduction-Benefits, National priorities, rating system, check list, Site selection and planning, Water efficiency, Energy efficiency, Materials, Indoor environmental quality, Innovation and design process

Principle of Planning for differently abled publics: Standardization and Contextualization of accessibility in built environment, Overview of accessibility codes (National and International Perspectives), Design for Inclusion : A holistic Approach (User centric approach to design, WINIT Model), Accessibility Elements of Built Environment in urban and rural Contexts (Kerb Ramps, Bollards, Level and gratings, Ramps, Gradients and other relevant elements) Principle of site planning and approaches for accessibility, Accessibility in public Sanitation System (Washroom typologies and Accessibility perspectives emergency evacuation systems and codes)

UNIT II: 10 Hours

Planning of Building: - Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window. Planning of building such as Residential building –Load bearing structure, RCC framed structure. Building for Education – school, college. Library Building for health – Dispensary, Hospital Industrial structure Building for entertainment-Theatre, club house, sports club. Other structure-Office, Hostel, Guest house.

Building's Water Supply and Drainage & Solid Waste Collection and Disposal System: - Design of water supply, waste water and storm water collection system for various types of buildings. Pumps and Pump House. Wet and dry solid waste segregation, Vermi-composting etc. Provision of

Chutes. Accessibility in public Sanitation Systems.

UNIT III: 10 Hours

Electrical Services: - Domestic Supply, Distribution Circuits, basic wiring systems. Design and planning: - Lighting of staircase, corridors. Automatic Water Level controller, Closed Circuit Security Monitors with Intercom/ EPBX facility, Common Dish TV antenna, Use of Solar Panels as source of power, Lightening Conductor for High-rise Buildings.

Fire Protection System: - Introduction, Fire protection, requirement of water quantity estimation. Systems of firefighting external and internal. Wet and dry risers, smoke alarm, Sprinkler system. Safety corridors in Highrise structures.

UNIT IV: 15 Hours

Elevators: - Introduction, types of elevators. Essential features of lifts its size and requirement of minimum numbers, norms for safety doors, Operation and maintenance, Safety norms. Control systems, electrical requirement, and generator back-up, Escalators in Industry and in malls-multiplex. Design of Accessible Circulation System for differently abled publics.

Heating Ventilation and Air Conditioning Ventilation, functional requirement, Heat balance system of ventilation, General rules and regulations in artificial ventilation system, Central air conditioning: - ducting and glass claddings. Operation and maintenance

Building Management System: - Security Guard's Cabin, Postage collection boxes, Parking space.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).

2. Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805)

Course Title: Solid Mechanics Lab
Course Code: BCE306

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Comprehend the importance of physical properties of steel.
2. Identify and comprehend code provisions for testing different properties of steel.
3. Develop stress-strain curve for axial compression, axial tension and shear.
4. Assess hardness and impact strength of steel.

Course Content

1. Tension test
2. Bending tests on simply supported beam and Cantilever beam.
3. Shear test
4. Determination of bending moments in beams
5. Measurement of deflections in statically determinate beam
6. Measurement of strain in a bar
7. Bend test steel bar
8. Yield/tensile strength of steel bar.

Suggested Readings

1. *Laboratory Manual of Testing Materials, William Kendrick Hall*

Course Title: Fluid Mechanics Lab
Course Code: BCE307

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Select appropriate pressure measuring device under different condition of flow.
2. Determine the stability of a floating body and apply Bernoulli's theorem practically.
3. Find discharge of fluid through pipe, orifices and in open channel.
4. Estimate the major and minor losses in pipe, and various elements and energy losses in hydraulic jump.

Course Content

1. To study of pressure measuring devices as piezometer, U-tube manometer, and pressure gauges.
2. To verify Bernoulli's Theorem
3. To determine the meta centric height of a of Floating Body under different condition.
4. To determine the coefficient of discharge of a Venturimeter.
5. To determine the coefficient of discharge of an Orifice Meter
6. To determine the coefficient of friction of different diameter pipes.
7. To estimate the minor losses as energy loss in pipe bend, sudden contraction or enlargement in pipe.
8. To determine the coefficient of discharge on rectangular and V-notches.
9. To determine the various element of a hydraulic jump.

Suggested Readings

1. *Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndts son and P.N. Chadramouli, Oxford University Press,2010*
2. *Hydraulics and Fluid Mechanics, PM Modi and SMSeth, Standard Book House*
3. *Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill*
4. *Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc GrawHill.*

Course Title: Concrete Technology Lab
Course Code: BCE318

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Evaluate the different properties of constituent materials on properties of concrete.
2. Interpret the behavior and durability aspects of concrete under different loading and exposure conditions.
3. Evaluate the issues involved in production and use of concrete and interpret special type of non-conventional concretes.
4. Design of concrete mixes as per BIS specifications.

Course Content

The following experiments are to be performed in the Concrete Lab.

1. To Determine the Specific Gravity of cement.
2. To Determine the Standard Consistency, Initial and Final Setting Times of Cement.
3. To Determine Soundness of Cement.
4. To Determine the Compressive Strength of Cement.
5. To Determine the Compressive Strength of Bricks/Tiles.
6. To Determine the Fineness Modulus of Fine and Coarse Aggregates.
7. To Determine the Bulk Density, Water Absorption and Sp. Gr. of Fine and Coarse Aggregates.
8. To Determine the Slump, Compaction Factor and Vee-Bee Time of Concrete.
9. Mix Design of Concrete.
10. To carry out the Tensile and Flexural tests of Concrete.
11. To determine the Compressive Strength of hardened Concrete by Non-Destructive Test

Suggested Readings:

1. Concrete Manual by Dr. M.L. Gambhir, Dhanpat Rai & Sons Delhi.
2. Concrete Lab Manual by TTTI Chandigarh

Course Title: Civil Engineering, Materials, Testing and Evaluation Lab
Course Code: BCE316

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Course Content

1. Gradation of coarse and fine aggregates
2. Different corresponding tests and need/application of these tests in design and quality control
3. Tensile Strength of materials & concrete composites
4. Compressive strength test on aggregates
5. Tension I - Elastic Behavior of metals & materials
6. Tension II - Failure of Common Materials
7. Direct Shear - Frictional Behavior
8. Concrete I - Early Age Properties
9. Concrete II - Compression and Indirect Tension
10. Compression – Directionality
11. Soil Classification
12. Consolidation and Strength Tests
13. Tension III - Heat Treatment
14. Torsion test ¬ Hardness tests (Brinnel's and Rockwell)
15. Tests on closely coiled and open coiled springs
16. Theories of Failure and Corroboration with Experiments
17. Tests on unmodified bitumen and modified binders with polymers
18. Bituminous Mix Design and Tests on bituminous mixes - Marshall method
19. Concrete Mix Design as per BIS

Course Title: Building Planning and Computer Aided Civil Engineering Drawings Lab
Course Code: BCE317

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Course Content

I. Preparation of detailed constructional plan of a residential building.
II. Preparation of front elevation, detailed sectional view, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window.
III. Concept of perspective drawing- one point, two-point, three point and uses. • Preparation of line plans of various public buildings like: Building for Education – School, College. Library • Building for health –Dispensary, Hospital Industrial structure Building for entertainment Theatre, Club House, Sports Club. Other Structure- Office, Hostel, Guest house.
IV. Prepare layout for water supply and drainage for a residential building and for multistoried buildings.
V. Building's Solid Waste Collection and disposal system: Wet and dry solid waste segregation, Vermi-composting etc. Provision of Chutes.
VI. Fire Protection System: Design of emergency exits and emergency vehicle routes with fire protection symbols

Text Books

1. Scott Onstott, AutoCAD 2018 and AutoCAD LT 2018 Essentials, Wiley (2017), (ISBN: 9788126569298)
2. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).
3. Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805)

Recommended Reading:

1. Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117)
2. Croome, J. D. & Roberts, B. M., "AIR-CONDITIONING AND VENTILATION OF BUILDINGS VOL-1". Pergamon Press, (ISBN: 0080247792)
3. SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095)
4. N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990)

SEMESTER- IV

Course Title: Transportation Engineering
Course Code: BCE404

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Course Outcomes:

After completing this course, the student must demonstrate the knowledge and ability to:

1. Appreciate the importance of different modes of transportation and characterize the road transportation.
2. Alignment and geometry of pavement as per Indian Standards according to topography.
3. Assess the properties of highway materials in laboratory
4. Understand the importance of railway infrastructure planning and design.
5. Identify the functions of different component of railway track.
6. Outline the importance of Airport Infrastructure

Course Content

Unit I: 10 Hours

Introduction: Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport

Geometric Design of Highways

Typical cross-sections of highway, cross sectional elements – payment structure, camber, width of carriageway, width of formation, road margins, widening of pavements at horizontal curves, right of way, super elevation, design speed and sight distances. Design of horizontal and Vertical alignments, IRC specifications

Unit II: 10 Hours

Highway Development & Planning:

Principles of Highway Planning, Road Development in India, Classification of Roads, Road Patterns, Planning Surveys

Unit III: 13 Hours

Railway Engineering: History of Railways, Development of Indian Railway, Organization of Indian Railway, Railway Gauges: Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge, Railway Track, Requirements of a Good Track, Track Specifications, Detailed Cross Section of Single/Double Track used in Indian Railways. Components of permanent way - Rails, Sleepers, Ballast, Sub-grade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.

Airport Engineering: Introduction, Aircraft Parking System & Visual Aids, Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.: Marking and Lighting of Runway and Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

Unit IV: **12 Hours**

TRAFFIC ENGINEERING

Traffic Engineering: Traffic characteristic, volume studies, speed study, capacity, density, traffic control devices, signs, signals, design of signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection.

References

• Khanna S.K., and Justo, C.E.G. "Highway Engineering", Nem Chand and Brothers, Roorkee,1998.
• Kadiyali, L.R. "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi, 1997.
• Flaherty, C.A.O. "Highway Engineering", Volume 2, Edward Arnold, London, 1986.
• Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S. Chand & Company Ltd., New Delhi, 1985.

Course Title: Surveying & Geomatics
Course Code: BCE413

L	T	P	Credits
3	0	0	3

Total: 60 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the concept, various methods and techniques of surveying Compute angles, distances and levels for given area.
2. Apply the concept of tachometry survey in difficult and hilly terrain.
3. Select appropriate instruments for data collection and survey purpose to Analyze, retrieve the information from remotely sensed data, and interpret the data for survey.
4. Comprehend the concepts related to GIS and GPS and analyze the geographical data.

Course Content

Unit-I: **10 Hours**

Introduction to Surveying: Principles, Survey stations, Survey lines-ranging, direct &indirect ranging, Bearing and its measurement with prismatic compass, calculation of angles from bearings, Local Attraction Leveling: Principles of leveling- booking and reducing levels; differential, reciprocal leveling, profile leveling and cross sectioning. Digital and Auto Level, Errors in leveling; contouring Characteristics, methods, uses; areas and volumes. Setting up the plane table and methods of plane tabling (Radiation and three-point problem only).

Unit-II: **10 Hours**

Triangulation and Trilateration: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Balancing of Traverse, Omitted Measurements, Tachometry: Definition, determination of tachometer constants and reduced level from tachometric observations. Triangulation - network- Signals. Baseline choices - extension of base lines - corrections - Trigonometric leveling.

Unit-III: **12 Hours**

Curves: Elements of simple and compound curves – Method of setting out Transition curve – length of curve – Elements of transition curve.
Photogrammetry Surveying: Introduction, Basic concepts, flight planning; Stereoscopy, photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

Unit-IV: **13 Hours**

Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems-Segments, GPS measurements, errors and biases, Surveying with GPS, LADAR (drone and vehicle based)
Remote Sensing: Introduction – Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors.

Transactional Mode:
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings
1. Duggal, S.K., Surveying Vol I & II, Tata McGraw Hill
2. *Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Surveying Vol. I, II & III, Laxmi Publications*
3. *Agor, R., Surveying, Khanna Publishers*
4. *Bhavikatti, S.S. Surveying & Levelling Volume I &* II

Course Title: Geotechnical Engineering
Course Code: BCE414

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the origin of soil, identify different types of soil and apply the knowledge of soil and rock to judge its behavior and suitability for civil engineering structures.
2. Comprehend the Darcy's law for the flow of water through saturated soils; determine the coefficient of permeability and equivalent hydraulic conductivity in stratified soil.
3. Interpret the various physical and engineering characteristics of different types of soil.
4. Calculate seepage, pore water pressure distribution, uplift forces and seepage stresses for simple geotechnical systems

Course Content

UNIT I: 10 Hours

Basic Concepts: Definition of soil and soil mechanics common soil problems in Civil Engineering field. Principal types of soils. Important properties of very fine soil i.e., adsorbed water, Base Exchange and soil structure. Characteristics of main Clay mineral groups i.e. Montmorillonite, illiteandkaollite, and Basic definitions in soil mechanics. Weight volume relationship, theory and determination of specific gravity from pycnometer test. Field density from sand replacement method and other methods.

UNIT II: 10 Hours

Index Properties: Grain size analysis. Stock's law and Hydrometer analysis. Consistency and sensitivity of Clay, Atterberg's Limits Flow Index and Toughness Index. Classification of soils as per Indian standard classification system(IS-1498-1970).

Compaction: Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

UNIT III: 10 Hours

Consolidation: Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, Concept of various consolidation characteristics i.e., av, mv and cv, primary and secondary consolidation concept of cv, tv& U. Consolidation test: determination of cv from curve fitting methods, Pre consolidation pressure determination. Normally consolidated and over consolidated clays. Causes of over consolidation. Effect disturbance on e-Log

σ curves of normally consolidated clays, importance of consolidation settlement in the design of structures. Final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

UNIT IV: 15 Hours

Permeability and Seepage: Concept of effective stress principal, seepage pressure, critical hydraulic gradient and quicks and condition. Capillary phenomenon in soil. Darcy's Law and its validity, seepage velocity, co-efficient of permeability and its determination in the laboratory. Average permeability of stratified soil mass, factors affecting 'K' and brief discussion.

Shear Strength: Stress analysis of a two-dimensional stress system by Mohr circle. Coulomb's law of shear strength coulomb-Mohr strength theory. Direct, triaxial and unconfined shear strength tests. Triaxial shear tests based on drainage conditions. Derivation of skempton's pore pressure parameters. Stress strain and volume change characteristics of sands.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Soil Mech. & Foundation Engg, by K.R. Arora*
- *Geotechnical Engineering, by P. Purshotama Raj*
- *Soil Mech. & Foundation Engg., by V.N. S. Murthy*

Course Title: Hydraulic Engineering
Course Code: BCE415

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Become familiar with different water resources terminology like hydrology, ground water, hydraulics of pipelines and open channel.
2. Understand and be able to use the energy and momentum equations.
3. Analyze flow in closed pipes, and design and selection of pipes including sizes.
4. Become familiar with open channel cross sections, hydrostatic pressure distribution and Manning's law. 5. Familiar with drainage systems and wastewater sources and flow rates.

Course Content

UNIT I: 12 Hours

Introduction to Open Channel Flow: Difference between Open Channel Flow and Pipe Flow, Types of Channel, Geometric parameters of a channel, Classification of Open Channel Flow, Continuity and Momentum equation. Uniform flow: Resistance flow formula, Velocity distribution, Equivalent roughness coefficient, Velocity coefficients, Uniform flow in rigid boundary channel, Uniform flow in mobile boundary channel.

UNIT II: 10 Hours

Energy and Momentum Principle: Concept of Specific Energy, Critical Depth, Alternate depth, Specific Force, Sequent depth. Non-Uniform Flow: Governing equation of GVF, Classification of Gradually Varied Flow, Computation of GVF profile, Rapidly Varied Flow, hydraulic Jump, Flow over a Hump, Flow in Channel Transition.

UNIT III: 13 Hours

Canal Design: Concept of best hydraulic section, Design of rigid boundary canal, design of channel in alluvial formation- Kennedy's theory, Lacy's theory, Method of Tractive force, Free-board in canal. Unsteady Flow: Wave and their classification, Celerity of wave, Surges, Characteristic equation

UNIT IV: 10 Hours

Pipe Flow: Losses in pipes, Pipe in series and parallel, Pipe network analysis, Water hammer, Surge tank. Hydraulic Model Study: Important dimensionless flow parameters, Similitude: Geometric, Kinematic and Dynamic Similarity, Model scales.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- Chow,V.T. Open Channel hydraulics McGraw Hill Publication
- Subramanya, K., Flow through Open Channels, TMH, New Delhi
- RangaRaju, K.G., Flow through open channels, T.M.H. New Delhi
- Rajesh Srivastava, Flow through Open Channels, Oxford University Press
- Streeter, V.L.& White E.B., Fluid Mechanics McGraw Hill Publication
- Modi& Seth Hydraulics & Fluid Mechanics Standard Publications.
- RK Bansal Fluid Mechanics and Hydraulic Machines Laxmi Publication
- AK Jain Fluid Mechanics Khanna Publication.
- Houghtalen, Fundamentals of Hydraulics Engineering Systems 4/e Pearson Education, Noida

Course Title: Structural Analysis
Course Code: BCE412

L	T	P	Cr.
3	0	0	3

Total: 60 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the various methods of structural displacements.
2. Analyze the determinate structure and its reaction diagram.
3. Draw the influence line diagram for rolling loads.
4. Interpret the various methods of structural displacements.

Course Content

UNIT I: 10 Hours

Structural Engineering, role of structural engineer, engineer, architect, builder; Objectives of designing a structure, safety, sustainable development in performance.

Concept of determinacy and indeterminacy, Analyses of indeterminate beams, frames and trusses using Slope deflection method, Moment distribution method, unit load method and Castigliano's theorem.

UNIT II: 12 Hours

Moving Loads and Influence Line Diagrams: Concept of influence line diagram, rolling loads; Bending moment and shear force diagrams due to single and multiple concentrated rolling loads, uniformly distributed moving loads; Equivalent UDL; Muller Breslau principle; Influence lines for beams, girders with floor beams and frames; calculation of the maximum and absolute maximum shear force and bending moment; Concept of envelopes; Influence line for displacements; Influence line for bar force in trusses.

UNIT III: 10 Hours

Analysis of Cables and Suspension Bridges: General cable theorem, shape, elastic stretch of cable, maximum tension in cable and back-stays, pressure on supporting towers, suspension bridges, three hinged stiffening girders

UNIT IV: 13 Hours

FINITE ELEMENT METHOD (FEM): Basic concept, discretization, procedure, elementary applications of principles and formulation of problems, steps of FEM (No Numerical Problems)

The direct stiffness method: Structure stiffness equations - properties of [K] - solution of unknowns - element stiffness equations - assembly of elements - node numbering to exploit matrix sparsity - displacement boundary conditions - gauss elimination solution of equations - conservation of computer storage - computational efficiency - stress computation - support reactions - summary of

the finite element procedure

Transactional Mode:
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Water Supply Engineering Environmental Engg. I by B.C. Punmia, Ashok Jain, Arun Jain.*
2. *Environmental Engineering-A Design Approach by ARCADIOP.SINCERO, GREGORIAA. SINCERO*
3. *Environmental Engineering and Technology, by PEAVY, ROWE.*

Course Title: Construction Engineering and Management
Course Code: BCE416

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to

- An idea of how structures are built and projects are developed on the field
- An understanding of modern construction practices
- A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics
- A basic ability to plan, control and monitor construction projects with respect to time and cost
- An idea of how to optimize construction projects based on costs.

Course Content

Unit I: 10 Hours

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

Construction project planning- Stages of project planning: pre-tender planning, preconstruction 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, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion

Unit II: 10 Hours

Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures;

Basic construction methods for steel structures; Basics of construction methods for Bridges.
Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

Unit III: 15 Hours

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction Module: Project Monitoring & Control- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

Unit IV: 15 Hours

Contracts Management basics: Importance of contracts; Types of Contracts, partiesto a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.
Construction Costs: Make-up of construction costs; Classification of costs, time cost trade-off in construction projects, compression and decompression.

Transactional Mode:

Lecture based Instruction, Project based learning, Field trip visits, Problem based learning, Interactive workshops & Seminars, peer group discussion, Case studies, Problem based learning.

Suggested Readings:

1. Sharma, S.C. & Deodhar S.V., Construction Engineering and Management, Khanna Book Publishing Co., 2022.
2. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
4. Chudley, R., Construction Technology, ELBS Publishers, 2007.
5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
6. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
7. Rajoria, K.B., Case Studies in Construction Project Management, Khanna Publishing House, 2023.

Course Title: Civil Engineering - Societal & Global Impact
Course Code: BCE417

L	T	P	Cr.
2	0	0	NC

Total: 30 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Comprehend the scope of Civil Engineering
2. Analyze the past interfaces for the growth of civil engineering
3. Providing inspiration for doing creative and innovative work for the benefit of the society and think innovatively to ensure sustainability
4. Highlighting the depth of engagement possible with in civil engineering and exploration of various possibilities of a career in this field.

Course Content

Unit I: 7 Hours

Civil Engineering and its historical developments; Understanding the importance of Civil Engineering in shaping and impacting the world; the ancient and modern Marvels and Wonders in the field of Civil Engineering; Scope of work involved in various branches of Civil Engineering and future vision; Recent Civil Engineering breakthroughs and innovations; Avenues for entrepreneurial working.

Unit II: 8 Hours

Understanding the past to look into the future; Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution and how these eras helped the civil engineering to grow; Concept of sustainability and the steady erosion of the environment due to haphazard developments; Global warming, its impact and possible causes; Atmospheric pollution; Pollution Mitigation measures; Health & Safety aspects for stakeholders; Environmental Impact Analysis: Concept and procedures; Innovations and methodologies for ensuring Sustainability.

Unit III: 7 Hours

Infrastructure development and growth of the Nation; its effects on the GDP, employment, living standards of the people, etc.; Introduction and overview to Futuristic systems: Megacities, Smart Cities, Stadia; Roads, Railways, Metros, Hyper Loop, Airports, Seaports, River ways, Sea canals, Tunnels, bridges.

Unit IV: **8 Hours**

Energy Generation: Hydro, Solar, Wind, Wave, Tidal, Geothermal, Thermal energy; Telecommunication needs: towers, above-ground and underground cabling; Flood control: Dams, Canals, River interlinking; Energy efficient built-environments and LEED ratings; Awareness of various Codes & Standards governing Infrastructure development.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Salvadori, M and Heller, M, Structures in Architectures, PHI.*
2. *Fintel, C, Handbook of Civil Engineering, CBS Publications.*
3. *Ž iga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht*
4. *Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition*
5. *NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004*

Course Title: Transportation Engineering Lab
Course Code: BCE403

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Appreciate the importance of different modes of transportation and characterize the road transportation.
2. Alignment and geometry of pavement as per Indian Standards according to topography.
3. Assess the properties of highway materials in laboratory.
4. Comprehend the importance of railway infrastructure planning and design.

Course Content

1. Tests on Sub-Grade Soil
IS Compaction Test
California Bearing Ratio Test

2. Testson Road Aggregates
Gradation Test Crushing Value Test, Abrasion Value Test, Impact Value Test
Specific Gravity & Water Absorption Test
Shape Test
Marshal Stability Test

3. Tests on Bituminous Materials
Penetration Test, Ductility Test, Softening Point Test
Flash & Fire Point Test
Bitumen Extraction Test

4. Field Tests
Roughness Measurements of Road by Profilograph

Suggested Readings:

1. Khanna S.K., and Justo, C. E. G. "Highway Testing Manual", Nem Chand and Brothers, Roorkee,1998.

Course Title: Surveying & Geomatics Lab
Course Code: BCE418

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Assess horizontal & vertical angles by Theodolite.
2. Survey the area using different methods of plane tabling and compass survey and to adjust the compass traverse graphically.
3. Compute the reduce levels using various methods of leveling.
4. Predict the location of any point horizontally and vertically using Tachometry.

Course Content

1. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
2. Different methods of leveling, height of instrument, rise & fall methods.
3. Measurement of horizontal and vertical angle by theodolite.
4. Determination of tachometric constants and determination of reduced levels by tachometric observations.
5. Plane table survey, different methods of plotting, Three-point problem.
6. Determination of height of an inaccessible object.
7. Setting out of circular curves in the field using different methods.
8. Plotting of traverse using the Total Station and GPS.

Course Title: Geotechnical Engineering Lab
Course Code: BCE419

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the origin of soil and to identify different types of soil and apply the knowledge of soil and rock to judge its behavior and suitability for civil engineering structures.
2. Analyze the Darcy's law for the flow of water through saturated soils; determine the coefficient of permeability and equivalent hydraulic conductivity in stratified soil
3. Comprehend the various physical and engineering characteristics of different types of soil
4. Calculate seepage, pore water pressure distribution, uplift forces and seepage stresses for simple geotechnical systems

Course Content

Experiments on the following:

1. Determination of in-situ density by core cutter method.
2. Determination of in-situ density by sand replacement method.
3. Determination of Liquid Limit &plastic Limit by Casagrande apparatus and Penetrometer method.
4. Determination of specific gravity of soil solids by pycnometer method.
5. Grain size analysis of a given sample of sand and determination of coefficient of uniformity and coefficient of curvature.
6. Direct shear and triaxial test on a given soil sample. Unconfined compression test for fine grained soil.
7. Determination of permeability by constant Head Method and variable head method.
8. Compaction test (proctor) and modified proctor test.
9. Determination of Relative Density of soil.

Course Title: Hydraulic Engineering Lab
Course Code: BCE420

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Become familiar with different water resources terminology like hydrology, ground water, hydraulics of pipelines and open channel.
2. Understand and be able to use the energy and momentum equations.
3. Analyze flow in closed pipes, and design and selection of pipes including sizes.
4. Become familiar with open channel cross sections, hydrostatic pressure distribution and Manning's law.
5. Familiar with drainage systems and wastewater sources and flow rates

Course Content

Experiments on the following

1. Determination of Manning's "n"
2. Specific energy curve
3. Gradually Varied Flow Profile
4. Hydraulic Jump
5. Flow over Hump
6. Flow through Channel Contraction
7. Pipe friction
8. Water hammer

Course Title: Structural Design - I
Course Code: BCE515

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Implement concept of working stress method for analysis and design of RCC structural elements.
2. Implement concept of limit state method for analysis and design of RCC structural elements.
3. Apply principles of pre-stressed concrete for design of PC sections

Course Content

UNIT I **10 Hours**

Working stress method and ultimate load method of design: Reinforced Concrete Fundamentals (working Stress Method): Concept of reinforced concrete, stress strain characteristics of concrete and steel reinforcement, elastic theory, singly reinforced, balanced section, under reinforced section and over reinforced section.

UNIT II **12 Hours**

Limit state method: Concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to limit states of collapse in flexure, direct compression, shear and limit states of serviceability in deflection and cracking, design of singly and doubly reinforced rectangular and T sections for flexure. Design of members in shear and bond. Design of columns for Axial Load, Uni-axial bending moment and Bi-axial bending moment as per IS Code method.

UNIT III **13 Hours**

Limit state method: Design of one-way and two-way slabs. Design of beam subjected to bending and torsion. Design of Isolated square and rectangular footings subjected to axial load and moments, Design of combined foundations. Design of Doglegged, Open well type staircases. Design of Flat slab and Post tensioned slab.

UNIT IV **10 Hours**

Pre-stressed concrete: Basic principles of pre-stressed concrete: materials used and their properties, methods and systems of pre-stressing. Losses in pre-stress, analysis of various types of sections subjected to pre-stress and

external loads. Prestressed and post tensioned members, Different types of Prestressed sections, BoxSection, Girder.

Transactional Mode:
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Text/Reference Books
1. Jain and Jaikrishna, Plain and Reinforced Concrete, Vol. I, Nemchand Brothers.(ISBN-8185240086/978-8185240084).
2. Shrikhant Vanakudre, Prestressed Concrete (Materials, Analysis and Design), Khanna Publishing House, (ISBN: 9789386173317)
3. V. L. Shah and Karve, Limit State Design - Reinforced Concrete Structures Publications. (ISBN-9788190371711/8190371711).
4. N. Krishna Raju, Pre-stressed Concrete, Tata McGraw Hill. (ISBN-9789387886209/9387886204).

Recommended Reading
1. P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford & IBH. (ISBN-9789386479785/9386479788).
2. T.Y. Lin, Design of Prestressed Concrete Structures, John Wiley and Sons Inc., 2010. (ISBN1539788126528035/978-8126528035).
3. P.D. Arthur and V. Ramkrishnan, Ultimate Strength Design for Structural Concrete, Wheeler&Co. Pvt Ltd. (ISBN- 0273403230, 978-0273403234).
4. B.P. Hughes, Limit State Theory for Reinforced Concrete Design, Pitman. (ISBN- 0273010239, 978-0273010234).
5. IS456 (2000), Plain and Reinforced Concrete.
6. IS 875 (1987), Part I- Design Loads (Other than earthquake) for Buildings and Structures (Dead Loads).
7. IS 875 (1987), Part II- Design Loads (Other than earthquake) for Buildings and Structures (Imposed Loads).
8. IS 875 (2015), Part III- Design Loads (Other than earthquake) for Buildings and Structures (Wind Loads).
9. IS 875 (1987), Part IV- Design Loads (Other than earthquake) for Buildings and Structures (Snow Loads).

Course Title: Environmental Engineering
Course Code: BCE501

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the impact of humans on environment and environment on humans.
2. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
3. Be able to plan strategies to control, reduce and monitor pollution.
4. Be able to select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
5. Be conversant with basic environmental legislation.

Course Content

UNIT I **10 Hours**

Water: Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, need for planned water supply schemes, Water demand-industrial and agricultural water requirements, Components of water supply system-Transmission of water, Distribution system, Various valves used in W/S systems.

Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.

UNIT II **13 Hours**

Sewage: Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans,

Wastewater treatment: aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage-quality requirements for various purposes. Government authorities and their roles in water supply and sewerage disposal.

UNIT III **10 Hours**

Air: Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution, automobile pollution, Chemistry of combustion, Automobile

engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations.
Noise: Basic concept, measurement and various control methods.

UNIT IV **12 Hours**

Solid waste management: Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities. Role of Government authorities in Solid waste management and monitoring/control of environmental pollution.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Text/Reference Books

1. Environmental Engineering, M.P. Poonia, SC. Sharma, Santosh Kumar, Khanna Book Publishing Co., New Delhi.
2. Air Pollution and Control, Keshav Kant, Rajni Kant, Khanna Book Publishing Co., New Delhi.
3. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
4. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
5. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw-Hill International Editions, New York 1985.
6. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication.

Course Title: Engineering Economics, Estimation & Costing
Course Code: BCE516

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
2. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
3. Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
4. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
5. Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

Course Content

UNIT I **12 Hours**

Basic Principles and Methodology of Economics, Demand/Supply–elasticity–Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes. Welfare, Externalities, Labour Market, Components of Monetary and Financial System.

Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation market.

Indian economy: Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

UNIT II **12 Hours**

Estimation / Measurements for various items: Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry,

Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.

UNIT III **10 Hours**

Specifications: Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.

Rate analysis: Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

UNIT IV **11 Hours**

Tender: Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc.

Preparing Bids: Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management

Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Text/Reference Books

1. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House
2. Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia
3. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
4. M Chakravarty, Estimating, Costing Specifications & Valuation
5. Joy P K, Handbook of Construction Management, Macmillan
6. B.S. Patil, Building & Engineering Contracts

Course Title: Hydrology and Water Resource Engineering
Course Code: BCE517

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the interaction among various processes in the hydrologic cycle
2. Understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
3. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
4. Application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering and water resources engineering.

Course Content

UNIT I **12 Hours**

Introduction: hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data.

Precipitation: forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth- area duration relationships, maximum intensity/depth duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

Abstractions from precipitation: evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

UNIT II **13 Hours**

Runoff: runoff volume, SCS-CN method of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph, surface water resources of India, environmental flows.

Ground water and well hydrology: forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

UNIT III **10 Hours**

Water withdrawals and uses: water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply.

Water requirement of crops: Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

Distribution systems: canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods.

UNIT IV **10 Hours**

Dams and spillways: embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Text/Reference Books

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. Santosh Kumar Garg, Irrigation Engineering, Khanna Book Publishing Co.
3. G L Asawa, Irrigation Engineering, Wiley Eastern.
8. L W Mays, Water Resources Engineering, Wiley.
5. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.

Course Title: Plumbing (Water and Sanitation)
Course Code: BCE518

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Study plumbing codes and good engineering practices.
2. Coordinate plumbing works from inception to completion with Owners, Architects, other consultants and contractors.
3. Select proper plumbing materials and systems.
4. Read and interpret plumbing drawings.
5. Supervise code based plumbing installations.
6. Understand methods to conserve water and energy.

Course Content

UNIT I **10 Hours**

Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I, NBC and other codes, Local Municipal Laws, approvals, general regulations, standards, water supply, sewerage system, drainage system, workmanship, water conservation, protection of pipes and structures, waterproofing.

Architectural and Structural coordination: Provisions for plumbing systems, coordination during the planning stage, various agencies involved and their roles, space planning for plumbing systems, water tanks, pump room, centralized hot water systems, toilet locations, water treatment, sewage treatment, toilet planning, plumbing shafts, basements and terraces planning. Structural parameters, sunken toilets, location of columns and beams, posttension slabs, importance of ledge walls, water proofing.

Plumbing Terminology: Definitions, use/purpose of terms- Plumbing Fixtures: accessible, readily accessible, aerated fittings, AHJ, bathroom group, carrier, flood level rim, floor sink, flushometer valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber. Traps: indirect waste, vent, blow off, developed length, dirty arm, FOG, indirect waste, receptors, slip joints, trap, and vent. Drainage: adapter fitting, adjusted roof area, AAV, air break, air gap, area drain, base, bell and spigot joint, building drain, branch, DFU, grease interceptor, joints, roof drain, smoke test, stack. Water supply: angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, ferrule, gate valve, gray water, joints, PRV.

UNIT II **10 Hours**

Plumbing Fixtures and Fittings: Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, bidets, urinals, flushing devices, washbasins, bath/shower, toilets for differently

abled, kitchen sinks, water coolers, drinking fountain, clothes washer, dish washer, mop sink, overflows, strainers, prohibited. fixtures, floor drains, floor slopes, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

Traps, Interceptors, Indirect Waste and Vents: Traps required, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps. Discharge for indirect waste piping, nature of contents or systems, proper methods to install indirect waste piping, air gap and air break, sink traps, dish washers, drinking fountains, waste receptors, sterile equipment, appliances, condensers, point of discharge, venting. Vent requirement, purpose of venting, trap seal protection, materials, vent connections, flood rim level, termination, vent stacks, water curtain and hydraulic jump, cleanouts, venting of interceptors, introduction to vent sizing

UNIT III **15 Hours**

Sanitary Drainage and Storm Drain: Preamble, one pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices, hydraulic jump, change in direction of flow, T and Y fittings, cleanouts, pipe grading, fixtures below invert level, suds relief, testing, building sewers, trenching, testing, sumps and pumps, introduction to Drainage Fixture Units (DFU) and sizing of horizontal and vertical pipes. Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters, channels or scuppers, roof drains, strainers, leaders, conductors and connections, catchment, collect/capture storm water, discharging storm water, sizing case study as per NBC, safety, traps required, prohibited installations. Rain Water Harvesting (RWH) definition, need, catchment, conduits, settlement tanks, treatment, possible uses, recharging pits, NBC requirements, MOEF&CC requirements, and advantages of RWH.

Water Supply, Gray and Reclaimed Water: Preamble, sources of water, potable and non-potable water, reclaimed water, calculating daily water requirement and storage, hot and cold water distribution system, backflow prevention, air gap, cross connection control, pressure and velocity, pipe materials and jointing methods, alternative materials, hangers and supports, workmanship, prohibited fittings and practices, protection of pipes and structures, pressure controls, unions, thermal expansion, types of valves, installation and testing, disinfection, protection of underground pipes, color codes and arrow marking, introduction to Water Supply Fixture Units (WSFU) and sizing. Hot water systems. Definition of gray water, approvals, specifications and drawings, safety, total gray water discharge, holding tanks, valves and piping. Reclaimed water systems, definition of reclaimed water,

pipe identification, installation, safety signs, valves, cross connection, approved uses.

UNIT IV **10 Hours**

Pumping Systems: Terminology, pump heads, types of Pumps, applications, pump selection, pump characteristics, pumps and motors, pump efficiency, motor efficiency, Hydro Pneumatic Systems (HPS), Zoning, Storm Water and Drainage Pumps, introduction to starters and control panels.

Introduction to WTP and STP: Introduction to Net Zero concept, need to reduce and reuse, rating of Water Efficient Plumbing fixtures and fittings, 24x7 water supply, metering and sub-metering, typical daily water and wastewater calculations for a project. Sources, utility and treatment of water, parameters of water quality, parts of water treatment plant (WTP), disinfection methods, storage conditions, RO water systems, rainwater harvesting treatment, desalination. Grey water and black water, characteristics of domestic sewage, sewage treatment methods, aerobic and anaerobic treatment, level of treatment, reclaimed water, comparison of various methods.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Text/Reference Books

1. Uniform Illustrated Plumbing Code-India (UIPC-I) published by IPA and IAPMO (India)
2. National Building Code (NBC) of India
3. IS 17650 Part 1 and Part 2 for Water Efficient Plumbing Products
4. Water Efficient Products-India (WEP-I) published by IPA and IAPMO (India)
5. Water Efficiency and Sanitation Standard (WE.Stand) published by IPA and IAPMO (India)
6. Water Pollution, Berry, CBS Publishers.
7. Elements of Water Pollution Control Engineering, O.P. Gupta, Khanna Book Publishing, New Delhi.
8. 'A Guide to Good Plumbing Practices', a book published by IPA.

Course Title: Professional Practice, Law and Ethics
Course Code: BCE519

L	T	P	Cr.
3	0	0	NC

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. To familiarize the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
3. To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labor.
4. To give an understanding of Intellectual Property Rights, Patents.
5. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.

Course Content

UNIT I **12 Hours**

Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC) (formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)

Professional Ethics: Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

UNIT II **13 Hours**

General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /“ Red Flag” conditions; Contract award & Notice To Proceed;

Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms.

UNIT III **10 Hours**

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

UNIT IV **10 Hours**

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

Text/Reference Books

1. Premvir Kapoor, Professional Ethics and Human Values, Khanna Publishing House.
2. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
3. The National Building Code, BIS, 2017
4. Dutt (1994), Indian Contract Act, Eastern Law House
5. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
6. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
7. Engineering Ethics, National Institute for Engineering Ethics, USA
8. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd.
9. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
10. Avtarsingh (2002), Law of Contract, Eastern Book Co.

Course Title: Structural Design – I Lab
Course Code: BCE520

L	T	P	Cr.
0	0	2	1

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyze and design beam, column, slab, foundation, staircases and cantilever and counterfort retaining walls.
2. Draw detailed structural drawings for slab, beam, column, foundation, staircases and cantilever and counterfort retaining walls.

Course Contents

1. Design and drawing of singly reinforced, doubly reinforced rectangular and T-section simply supported and continuous beam.
2. Design and drawing of one way, two way simply supported and continuous slab system.
3. Design and drawing of Dog-legged and open wall type staircases.
4. Design and drawing of columns and foundation.
5. Design and drawing of Retaining wall. (Cantilever and counterfort)

Course Title: Environmental Engineering Lab

Course Code: BCE521

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Course Content

Experiments on the following:

1. To measure the pH value of a water/waste water sample.
2. To determine optimum Alum dose for Coagulation.
3. To find MPN for the bacteriological examination of water.
4. To find the turbidity of a given waste water/water sample
5. To find B.O.D. of a given waste water sample.
6. To measure D.O. of a given sample of water.
7. Determination of Hardness of a given water sample
8. Determination of total solids, dissolved solids, suspended solids of a given water sample.
9. To determine the concentration of sulphates in water/wastewater sample.
10. To find chlorides in a given sample of water/waste water.
11. To find acidity/alkalinity of a given water sample
12. To determine the COD of a wastewater sample

Course Title: Engineering Economics, Estimation & Costing Lab

Course Code: BCE522

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Course Content

LIST OF EXPERIMENT

1. Estimation of building (long wall and short wall method)
2. Estimation of building (center line method)
3. Analysis of rate for concrete work
4. Analysis of rate for brick work
5. Analysis of rate for plaster work
6. Estimate quantity of reinforcement
7. Preparation for approximate estimate for road project
8. Estimating cost of building on plinth area method

Course Title: Plumbing (Water and Sanitation) Lab
Course Code: BCE523

L	T	P	Cr.
0	0	2	1

Total: 15 Hours

Course Content

- Attend demonstration by a reputed manufacturer (Min. 2) of water supply pipes and fittings. Cut and joint water supply pipes and fittings as recommended, for the given dimensions.
- Measure the flow of various plumbing fixtures and fittings in residential, commercial and institutional toilets in liters per minute or liters per flush and give your comments.
- Attend demonstration by a reputed manufacturer of DWV pipes and fittings. Cut and joint a trap, drainage pipes and fittings as recommended, for the given dimensions.
- Site visit: Visit any plumbing site and submit a report on observations on plumbing system, architectural and structural provisions, pipe materials, work methods, site conditions, safety and recommendations based on the provisions of UIPC-I/ NBC.

Course Title: Survey Camp
Course Code: BCE508

L	T	P	Cr.
0	0	4	2

Learning Outcomes: After completion of this course, the learner will be able to:

1. Comprehend the concept, various methods and techniques of surveying
2. Compute angles, distances and levels for given area.
3. Apply the concept of tachometry survey in difficult and hilly terrain.
4. Select appropriate instruments for data collection and survey purpose.
5. Analyze and retrieve the information from remotely sensed data and interpret the data for survey.

Course Content

The students will be required to make a topographic map of an undulating hilly terrain measuring about 250 acres. The work will be as under: Reconnaissance, selection of main stations, measurement of horizontal and vertical angles, measurement of base line, determination of R.L. of main station by double leveling from B.M., measurement of bearing of any one line, computation of coordinates of station points, plotting of details, interpolation of contours. The duration of survey camp is of 4weeks.

Semester VI

Course Title: Structure Design - II
Course Code: BCE615

L	T	P	Cr.
3	1	0	4

Total: 60 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply the limit state design philosophy for analysis and design of structural steel components.
2. Apply the limit state design philosophy for analysis and design of structural steel connections.
3. Analyze and design structural steel roofing and flooring systems.

Course Content

UNIT I **15 Hours**

Bolted and welded connections: Introduction to riveted connection, design of bolted and welded connections, axially and eccentrically loaded joints, simple connection of bracket plates to columns, beam to beam and beam to column connections, design of framed, unstiffened and stiffened seat connections

UNIT II **15 Hours**

Roofing system: Imposed loads on flat and sloping roofs and floors, wind loads on sloping roofs and vertical cladding including effect of degree permeability and wind drag, analysis of pin-jointed trusses under various loading cases, computation of design forces in members, design and detailing of connections and supports.

UNIT III **15 Hours**

Flooring system: Concept of floor system with secondary beams, main beams and columns, design of simply supported beams using rolled steel sections.

UNIT IV **15 Hours**

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

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Text/Reference Books

- S.K. Duggal, Limit State Design of Steel Structures, Tata McGraw Hill Education Private Limited, 2017. (ISBN: 9789351343493/9351343499).
- V.L. Shah and V. Gore, Limit State Design of Steel Structures IS:800-2007, Structures Publication, 2012. (ISBN: 8190371754).
- S.S. Bhavikatti, Design of Steel Structures, I.K. International Publishing House Limited, 2017. (ISBN: 9789385909559/938590955X).
- IS 800 (2007), General Construction in Steel- Code of Practice, Ced 7: Structural Engineering and Structural Section, Published by Bureau of Indian Standard ManakBhavan, New Delhi.
- IS 875- Part 1 (1987): Dead Loads, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Published by Bureau of Indian Standard Manak Bhavan, New Delhi.

Course Title: Intelligent Transportation Systems
Course Code: BCE616

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand ITS & ATIS
2. Explain about Advanced Transportation Management System
3. Know about APTS, CVO, new technology and ETC
4. Details about regional architecture, integration of infrastructure and operational planning
5. Summarizes about ITS issues in terms of various factors and emerging issues.

Course Content

UNIT I **10 Hours**

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI).

UNIT II **10 Hours**

Geographic Information Systems (GIS), video data collection. Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System.

UNIT III **10 Hours**

ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS)

UNIT IV **15 Hours**

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management; Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Text/Reference Books

1. Ghosh, S., Lee, T.S. Intelligent Transportation Systems: New Principles and Architectures, CRC Press, 2000.
2. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2003.
3. R.P Roess, E.S. Prassas, W.R. McShane. Traffic Engineering, Pearson Educational International, Third Edition, 2004.

Course Title: Sustainable and Green Construction
Course Code: BCE617

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

- Define sustainability and identify major sustainability challenges.
- Students will have an understanding of the carrying capacity of ecosystems as related to providing for human needs.

Course Content

Unit I: 10 Hours

Introduction to sustainable Development: Definition and principles of sustainable development, Historical context and evolution of sustainability, Global and local challenges related to sustainability. Environment Science and Ecology: Fundamentals of ecology, Biodiversity and conservation, Climate change and its impacts, Environmental pollution and waste management. Sustainable construction Material and Technology: Green building materials and technologies, Life cycle assessment of materials, Resource efficiency and waste reduction in construction, Low-impact construction methods

Unit II: 10 Hours

Energy Efficiency in Buildings: Principles of energy-efficient design, Renewable energy integration in building design, Energy-efficient HVAC systems, Building energy modeling and simulation Water Management in Construction: Sustainable water use in construction processes, Rainwater harvesting and greywater recycling, Water-efficient construction practices, Strategies for mitigating water pollution on construction sites Sustainable Site Planning: Site selection and evaluation for sustainable construction, green space planning and landscaping, Sustainable stormwater management.

Unit III: 10 Hours

Sustainable Building Design: Principles of green building design, Passive design strategies for energy efficiency, Daylighting and natural ventilation, Integration of sustainable technologies in design Construction and Demolition Waste Management: Waste reduction and recycling in construction, Responsible demolition practices, Circular economy concepts in construction. Building Certifications and Standards: LEED (Leadership in Energy and Environmental Design) certification, BREEAM (Building

Research Establishment Environmental Assessment Method), Other regional and international green building certifications Environmental Regulations and Policy: - Building codes and regulations for sustainable construction - Environmental impact assessments - Government policies promoting green construction

Unit IV: 15 Hours

Economics of Sustainable Construction: - Cost-benefit analysis for green building projects - Financial incentives for sustainable construction - Business models for green technologies in construction Project Management for Sustainable Construction: - Sustainable project planning and execution - Stakeholder engagement and communication - Monitoring and evaluating sustainability performance Ethics and Social Responsibility in Construction: - Ethical considerations in sustainable construction - Social impacts of green construction projects - Community engagement and stakeholder involvement.

Transactional Mode:

Lecture based Instruction, Project based learning, Field trip visits, Problem based learning, Interactive workshops & Seminars, peer group discussion, Case studies, Problem based learning

Suggested Readings:

1. "The Future We Choose: Surviving the Climate Crisis" by Christiana Figueres and Tom Rivett-Carnac.
2. "Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist" by Kate Raworth
3. "Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming" edited by Paul Hawken

Course Title: Energy Efficient Buildings
Course Code: BCE618

L	T	P	Cr.
2	0	0	NC

Total: 30 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

- Define sustainability and identify major sustainability challenges.
- Students will have an understanding of the carrying capacity of ecosystems as related to providing for human needs.

Course Content

Unit I: 7 Hours

Introduction to energy efficient buildings; Building physics; heat gains in the building; Psychometric analysis; Weather analysis; Energy use in buildings; Energy Supply in Buildings: Heating, Ventilating, and Air Conditioning (HVAC) Systems; Heating and cooling loads.

Unit II: 7 Hours

Daylighting and artificial lighting

- Daylighting and artificial lighting, relationship between daylight and human health and benefits of daylighting)
- Sky condition models and their characteristics
- Parameters for daylighting design (critical indoor illuminance, critical outdoor illuminance level, daylight factor distribution and glare)
- Parameters affecting daylighting factor (room depth, height of the window head, shading devices, glazing type, reflectance of room surfaces)
- Daylighting components (intermediate light spaces, interior light spaces, lateral pass-through components, zenithal pass-through components, global pass-through components)
- Control elements

Unit III: 8 Hours

Passive/low energy heating systems

- Principle of passive heating
- Types of passive heating systems

Passive/low energy cooling systems

- Building design strategies to reduce cooling demand
- Types of passive cooling systems (evaporative cooling, indirect evaporative cooling and earth cooling systems)

Unit IV: **8 Hours**

Building Performance analysis and Modelling:

- Daylight analysis
- Thermal modelling, ventilation modelling, heat flow analysis
- Weather simulation and analysis tool (Climate Analysis, Solar Exposure analysis, Passive strategies through psychometric chart
- Energy Codes, Guidelines and Standards.

Transactional Mode:

Lecture based Instruction, Project based learning, Field trip visits, Problem based learning, Interactive workshops & Seminars, peer group discussion, Case studies, Problem based learning

Suggested Readings:

1. Crosbie, M.J., 1998. The Passive Solar Design and Construction Hand Book, John Wiley & Sons Inc., New York.
2. Ed. Baker, N., Fanchiotti, A. And Steemers, K., 1993. Daylighting in Architecture: A European Reference Book, James & James (Science Publishers) Ltd., London.
3. Givoni, B., 1994. Passive and Low Energy Cooling of Buildings, John Wiley & Sons Inc., New York.
4. Givoni, B., 1998. Climatic Consideration in Building and Urban Design, John Wiley & Sons, Inc., Canada.
5. Gregg D Ander, 2003. Daylighting Performance and Design Second Edition, John Wiley & Sons, Inc., New Jersey.
6. Guzowski, M., 2000. Daylighting for Sustainable Design, McGraw-Hill, New York.
7. Nayak ,J.K.andPrajapati, J.A., 2006. Handbook on Energy Conscious Buildings, Prepared under the interactive R & D Project No. % (03) 99 - SEC between Indian Institute of Technology, Bombay and Solar Energy Centre, Ministry of New and Renewable Energy, India.
8. Santamouris, M., 1996. Passive Cooling of Buildings, James & James (Science Publishers) Ltd., London.

Course Title: Structural Design – II Lab
Course Code: BCE619

L	T	P	Cr.
0	0	2	1

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify and compute the design loads on various structural steel systems.
2. Apply principles and relevant codal provisions for the analysis and design of various structural steel systems.
3. Use commercial software for analysis and design of steel structures.
4. Prepare detailed structural drawings for any given design.

Course Contents

5. Design of roof truss system.
6. Design of columns and columns bases.
7. Design of structural steel flooring system.
8. Design of bolted and welded connections.

Course Title: Design of Steel Structures
Course Code: BCE620

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Recall and interpret the fundamentals of steel structures.
2. Calculate the plastic moment of different cross section and design of bolted and welded connections
3. Analyze and design the tension, compression & column bases member under axial and combined loading
4. Comprehend the pre-engineered buildings, bridges & trusses

Course Content

Unit I: **10 Hours**

Properties of materials; loads and stresses, Design of semi-rigid, rigid and moment resistant connections;

Unit II: **10 Hours**

Built-up sections Design of tension members subjected to axial tension and bending, splicing of tension member, Design of compression members, Beam-column connections,

Unit III: **15 Hours**

Design of columns and their bases Design of flexural members and Plate girder; loads, specification and design Industrial buildings; loads, design of purlins, trusses, bracings; gantry girders;

Unit IV: **10 Hours**

Introduction to Plastic analysis; Simple cases of beams and frames; All design steps/process to as per the most recent BIS code of practices

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Limit state design of steel structures: S K Duggal, Mc Graw Hill*
- *Design of steel structures: N Subramanian Oxford Higher Education*
- *Design of steel structures (Vol. 1): Ram Chandra Standard Book House - Rajsons*

- *Design of steel structures (by limit state method as per IS: 800-2007): S. S.Bhavikatti. I K International Publishing House*
- *IS 800: 2007 (General construction in steel-Code of practice)*

Course Title: Advanced Concrete Technology
Course Code: BCE621
Total: 45 Hours

L	T	P	Cr.
3	0	0	3

Learning Outcomes: After completion of this course, the learner will be able to:

- Discuss the concrete ingredients and its influence at gaining strength.
- Design of concrete mix and grade as per IS codes.
- Summarise the concepts of conventional concrete and its differences with other concretes like no fines, light weight etc.
- Describe the application and use of fiber reinforced concrete.
- Design and develop the self-compacting and high-performance concrete.

Course Content

Unit I: 10 Hours

Properties of cement, fine aggregate and coarse aggregates, Additives and Admixtures in Concrete, Rheology of Concrete.

Unit II: 13 Hours

Manufacturing and methods of concreting, Properties of fresh and hardened concrete, mix design by I.S. method, Design and manufacture of normal concrete, Light weight concrete – Cellular concrete – No fines concrete – Aerated & foamed concrete

Unit III: 10 Hours

Design and manufacture of fiber reinforced concrete – Polymer concrete – Fly ash concrete

Unit IV: 12 Hours

Design and manufacture of Self compacting concrete – High performance concrete – Very high strength concrete – High density concrete

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. Neville, A.M., “Properties of Concrete”, 3rd Edition, Longman Scientific and General, 1992.

2. Shanta Kumar A.R., “Concrete Technology”, 2 nd Edition, Oxford University Press, New Delhi, 2000.
3. Krishna Raju. N, “Design of Concrete Mixes”, 2nd Edition, CBS Publishers and Distributors, 2009.
4. Shetty, M.S., “Concrete Technology”, 3 rd Edition, S.Chand Publications, 2008.

Course Title: Sustainable Construction Methods
Course Code: BCE622
Total: 45 Hours

L	T	P	Cr.
3	0	0	3

Learning Outcomes: After completion of this course, the learner will be able to:

- Discuss the concrete ingredients and its influence at gaining strength.
- Design of concrete mix and grade as per IS codes.
- Summarise the concepts of conventional concrete and its differences with other concretes like no fines, light weight etc.
- Describe the application and use of fiber reinforced concrete.
- Design and develop the self-compacting and high-performance concrete.

Course Content

Unit I: 10 Hours

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls);

Unit II: 13 Hours

Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures;

Unit III: 10 Hours

Basics of construction methods for Bridges; Identification of cutting-edge sustainable construction materials, technologies, and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.

Unit IV: 12 Hours

Examination of the current LEED for New Construction rating system, and case study analysis of highly successful recent "green construction projects" through student team assignments and presentations. Preparation for the LEED Green Associate professional licensing exam.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- "Sustainable Construction: Green Building Design and Delivery" by Charles J. Kibert
- "The Green Building Handbook" edited by Tom Woolley, Sam Kimmins, Paul Harrison, and Rob Harrison
- "Fundamentals of Integrated Design for Sustainable Building" by Marian Keeler and Bill Burke
- "Sustainable Construction Processes: A Resource Text" by Steve Goodhew

Course Title: Construction Equipment & Automation
Course Code: BCE623
Total: 45 Hours

L	T	P	Cr.
3	0	0	3

Learning Outcomes: After completion of this course, the learner will be able to:

1. Select appropriate equipment for specific construction projects based on site conditions and requirement.
2. Identify and describe the different types of construction equipment used in the industry.
3. Understand the capabilities and limitations of drones in construction projects.
4. Recognize emerging trends and innovations in automation for construction

Course Content

Unit I: 10 Hours

Introduction: Distinctive characteristics of construction equipment, Necessity of construction equipment, Importance of equipment in construction projects, Trends and innovations in construction equipment

Unit II: 13 Hours

Construction Equipment: Excavating Equipment, Pavers, Rollers, plastering machines, Cranes and Hoists, Concrete Batching Plants, Hauling and conveying equipment; Capacity, Feasibility, Safety, owning and operating cost of Different Construction Equipment

Unit III: 10 Hours

Automation in Construction Industry: Emerging Trends in Automation in Construction; Need, Challenges and Benefit of automation; Automated equipment and machinery for construction: Automation in Canal lining, Automation in Highway Construction, Automation in concrete technology.

Unit IV: 12 Hours

Drones and Robotics in Construction:

Drones: Photogrammetry, Project Monitoring- real time data, aerial mapping, land survey, quantity survey, quality survey, structural health monitoring survey, under water survey.

Robotics: Introduction, Benefits of Robotics in construction industry with respect to time, cost, quality, safety. Robotics Applications: Brick laying, Demolition, Material Handling, Structural steel cutting, Rebar tying/bending, Form work production, 3D printing parts and objects of homes, buildings, bridges and roads.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. Construction Project management, Theory & Practice, Kumar Neeraj Jha, Pearson Education India.
2. Construction Planning, Methods and Equipment, R.L Peurifoy, McGraw Hill, 2011
3. Construction equipment and its planning and application Mahesh Varma Metropolitan Book Co
4. BIM and Construction Management: Proven Tools, Methods, and Workflows By Brad Hardin, Dave McCool, John Wiley & Sons
5. Enhancing BIM Methodology with VR Technology, Open access peer
6. Robotics and Automation in Construction, Open access peer- reviewed edited volume
7. Automation in Construction Management: Automated management of Construction Materials Using RFID Technology, Javad Majrouhi Sardroud, Scholars' Press

Semester VII

Course Title: Foundation Engineering
Course Code: BCE702

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the origin of soil and to identify different types of soil and apply the knowledge of soil and rock to judge its behavior and suitability for civil engineering structures.
2. Evaluate the Darcy's law for the flow of water through saturated soils; determine the coefficient of permeability and equivalent hydraulic conductivity in stratified soil
3. Classify the various physical and engineering characteristics of different types of soil
4. Calculate seepage, pore water pressure distribution, uplift forces and seepage stresses for simple geotechnical systems

Course Content

Unit-I **15 Hours**

Shallow Foundation-I: Type of shallow foundation Depth and factors affecting it. Definition of ultimate bearing capacity, safe b.c. and allowable b.c. Rankine's analysis and Terzaghi's analysis. Types of failures. Factors affecting bearing capacity. Skemptons equation. B.I.S. recommendations for shape, depth and inclination factors. Plate Load test and standard penetration Test. Their procedure, merits and demerits Factors affecting 'N' value Corrections to be applied to observed value. Bosussinesq equation fora point load, uniformly loaded circular and rectangular area, pressure distribution diagrams. New marks chart and its construction. Two - to - one method of load distribution. Comparison of Bosussinesq and westerguard analysis for a point load. Limitations of elastic formula

Shallow Foundation-II: Contact pressure Distribution. Causes of settlement of structures, comparison of Immediate and consolidation settlement calculation of settlement by plate load Test and Static Cone penetration test data. Allowable settlement of various structures according to I.S. Code. Situation most suitable for provision of rafts. Proportioning of rafts in sand-s and Clays. Various methods of designing raft. Floating foundation.

Unit-II **15 Hours**

Soil Investigation:

Object of soil investigation for new and existing structures. Depth of exploration for different structures. Spacing of bore Holes. Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance. Essential features and

application of the various types of samples. Geophysical exploration by seismic and resistivity methods. Bore Hole log for S.P.T

Unit-III **15 Hours**

Pile Foundations – I: Necessity and uses of piles classification of piles. Merits and demerits of different types based on composition. Types of pile driving hammers & their comparison. Effect of pile driving on adjacent ground. Use of engineering News Formula andHiley's Formula for determination of allowable load. Limitations of pile driving formulae. Pile load test-object, pre- requisites, test arrangement, procedure and assessment of safe load. Separation of skin friction and point resistance using cyclic pile load test date. Related numerical problems.

Pile Foundation – II: Determination of point resistance and frictional resistance of a single pile by Static formulas. Piles in Clay-Safe load on a Friction and point Bearing pile. Pile in sand Spacing of piles in a group. Efficiency of pile group by converse - Labare formula. Bearing capacity of apile group in clay by block failure and individual action approach.

Unit-IV **15 Hours**

Caissons and Wells: Major areas of use of caissons advantages and disadvantages of open box and pneumatic caissons. Essential part of a pneumatic caisson. Components of a well foundation. Calculation of allowable bearing pressure. Conditions for stability of a well, Terzaghi's analysis for lateral stability for a light well-embedded in sand. Modification of the analysis for a heavy well. Forces acting on a well foundation. Computation of scour depth.

Earth Pressure: Terms and symbols used for a retaining wall. Movement of all and the lateral earth pressure. Earth pressure at rest. Rankine states of plastic equilibrium and derivations of expressions for Ka and Kp for horizontal backfills. Rankine's theory both for active and passive earth pressure for Cohesion less backfill with surcharge and fully suBCErged case. Cohesive backfill condition. Rankine's Earth pressure for a cohesion less backfill with sloping surface (with proof) concept of active and passive Earth pressure on the basis of stability of a sliding wedge. Coulomb's method for cohesionless backfill. Merits and demerits of Ranking and Coulomb's theories graphical construction and Rebhan's graphical construction (without surcharge load).

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Soil Mechanics & Foundation Engineering by B.C. Punmia*
2. *Geotechnical Engineering by Alam Singh*

Semester VII

Course Title: Ground Improvement Techniques
Course Code: BCE712

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the need and objective of ground improvement techniques
2. List the different techniques that are available for improvement
3. Choose the suitable technique depending upon the condition of soil and requirements
4. Know different methods that are available for Compaction or densifying the soil
5. Identify the type of techniques required for various soils

SSCourse Content

Unit-I **5 Hours**

Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement.

Unit-II **10 Hours**

Mechanical stabilization

Shallow and deep compaction requirements, Principles and methods of soil compaction. Shallow compaction and methods, Properties of compacted soil and compaction control, Deep compaction and Vibratory methods, Dynamic compaction.

Hydraulic modification

Ground Improvement by drainage, Dewatering methods, Design of dewatering systems, Preloading, Vertical drains, vacuum consolidation, Electro-kinetic dewatering, design and construction methods.

Unit-III **15 Hours**

Modification by admixtures

Cement stabilization and cement columns, Lime stabilization and lime columns, Stabilization using bitumen and emulsions, Stabilization using industrial wastes, Construction techniques and applications,

Grouting

Permeation grouting, compaction grouting, jet grouting, different varieties of grout materials, grouting under difficult conditions

Unit-IV **15 Hours**

In situ soil treatment methods & Case studies

Soil nailing, rock anchoring, micro-piles, design methods, construction techniques, Case studies of ground improvement projects.

Suggested reading

1. *"Principles of Soil Stabilization and Ground Improvement" by S. K. Garg*
2. *"Ground Improvement Techniques" by P. Purushothama Raj*
3. *"Ground Improvement, Third Edition" by Kerry Rowe*
4. *"Engineering Principles of Ground Modification" by Manfred R. Hausmann*

Course Title: FOUNDATION ENGINEERING LAB
Course Code: BCE713

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes On successful completion of this course, the students would be able to:

1. Utilize domain knowledge required for analysing and resolving field problems in Geotechnical engineering.
2. Write and present a substantial technical report of the comprehended problem and its recommended solution.
3. Demonstrate a definite higher degree of mastery in the comprehension and analysis of Geotechnical engineering problems.
4. Equipped with theoretical and practical skills to investigate and undertake complex projects of inter-disciplinary nature with wide impact.
5. Imbibe social and environmental ethics, readily adapting to ever changing and transforming technical requirements and working towards sustainable development of the society

Course Content

List of experiments

1. Plate load test
2. Standard penetration test
3. Static cone penetration test
4. Dynamic cone penetration test Triaxial shear test
5. Large shear box test
6. testing of Geotextiles and geofibres.

Course Title: GROUND IMPROVEMENT TECHNIQUES LAB
Course Code: BCE714

L	T	P	Credits
0	0	2	1

Total Hours-15

Learning Outcomes On successful completion of this course, the students would be able to:

1. Explain the need and objective of ground improvement techniques
2. List the different techniques that are available for improvement
3. Choose the suitable technique depending upon the condition of soil and requirements
4. Know different methods that are available for Compaction or densifying the soils
5. Identify the type of techniques required for various soils.

Course Content

List of experiments

- Compaction test
- Study on Dynamic compaction
- Demonstration of Plate load test
- CBR Test of different types of soil
- CBR Test of Soil Stabilized
- Design of Drains
- Study on various types of grouting

Semester VII

Course Title: CONTRACTS MANAGEMENT
Course Code: BCE715

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. To make students understand various contracts, their suitability and the procurement process involved in construction projects.
2. To make student capable of understanding and reviewing various provisions included in the contract for effective management of the projects
3. To make the student understand various contract management processes involved in construction projects

Course Content

Unit-I **7 Hours**

INTRODUCTION

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People-Resource Management, Fundamentals, Qualities of a good contractor and their qualifications, Types of contracts, contract conditions, contract problems, Contract for labor material, Design and construction, Drafting of contract documents, Construction contracts, Arbitration and legal requirements.

Unit-II **8 Hours**

CONTRACT FORMATION AND LEGAL ESSENTIALS

Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination.

Unit-III **20 Hours**

CONTRACTS MANAGEMENT

Changes & variations, Earnest Money Deposit (EMD), Security Deposit (Performance Bond), Advance Payment or Mobilization Advance, Retention Money, Insurance and Bonding Costs, Liquidated Damages (LD), Notices under contracts; Conventional and Alternative Dispute Resolution methods. Various Acts governing Contracts; Contract Administration and Payments-Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in

ICB Works Contracts, Contract of Supply of Goods, Design, Supply and Installation Contracts, Contract Management in Consultancy,

MANAGING RISKS AND CHANGE- Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post- Implementation Review;

Unit-IV **10 Hours**

LEGAL ASPECTS IN CONTRACT MANAGEMENT

Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance- Introduction, Monitoring and Measurement; Case Studies.

Suggested reading

1. *"Construction Project Management: Theory and Practice" by K. K. Chitkara*
2. *"Contract Management: Theory and Practice" by P. K. Joy*
3. *"Construction Contracts: Law and Management" by John Murdoch and Will Hughes*
4. *"Construction Contracting: A Practical Guide to Company Management" by Richard H. Clough, Glenn A. Sears, and Keoki Sears*

Semester VII

Course Title: Construction Cost Analysis
Course Code: BCE716

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. To recognize ethical and professional responsibilities in construction cost analysis situations related to engineering codes and standards, the semester project, and response to issues in the course.
2. To identify, formulate, and solve complex engineering problems in construction cost analysis related to overheads, labor, equipment, excavation, concrete, masonry and associated project items.
3. To analyze and apply construction costs to meet specified needs with consideration to civil engineering project from inception to design and construction.
4. Demonstrate communication skills in both oral and written during the semester project presentation
5. To acquire and apply new knowledge with emphasis on construction cost analysis using appropriate learning strategies.

Course Content

Unit-I **5 Hours**

Engineering economics

Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A, A/P), Future payment compared to uniform series payments (F/A, A/F), Arithmetic gradient, Geometric gradient.

Unit-II **15 Hours**

Comparison of alternatives

Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.

Unit-III **10 Hours**

Depreciation, Inflation and Taxes

Depreciation, Inflation, Taxes. Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.

Unit-IV **15 Hours**

Cost estimating

Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost. Financial management: Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

Suggested reading

1. *"Construction Cost Analysis and Estimating" by Phillip F. Ostwald*
2. *"Costing and Estimating for Engineers and Architects" by R. R. Garge*
3. *"Estimating and Costing in Civil Engineering: Theory and Practice" by B. N. Dutta*
4. *"Estimating Construction Costs" by Robert L. Peurifoy and Garold D. Oberlender*

Semester VII

Course Title: AIRPORT PLANNING AND DESIGN
Course Code: BCE717

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop the knowledge of Airport Engineering in the context of regional mass transportation systems
2. Design of Air transportation systems along with infrastructures required for Airports.
3. Estimate the environmental and other impacts impended due to Airport projects.
4. Design of runway, taxiway, aprons and cargo facilities with pavement design.
5. Design of parking configurations and apron facilities at Airport.

Course Content

Unit-I **10 Hours**

AIR TRANSPORTATION

Airport terminology, component parts of Aero plane, Classification and size of airports; Aircraft characteristics. Air traffic control need for ATC, Air traffic control network, Air traffic control aids – enroute aids, landing aids. Airport site location and necessary surveys for site selection, airport obstructions.

Unit-II **10 Hours**

PLANNING

Airport master plan –FAA recommendations, Regional Planning, ICAO recommendations, Estimation of future airport traffic needs layout of AirPort.

Unit-III **15 Hours**

RUNWAYS

Runway orientation – Wind rose diagram, basic runway length, corrections for elevation, temperature and gradient, runway geometric design, Airport drainage.

TAXIWAYS AND APRONS

Loading aprons –holding aprons –Geometric design standards, exit taxiways –optimal location, design, and fillet and separation clearance.

Unit-IV **10 Hours**

OTHER FACILITIES

Lighting, visual airport marking, airport lighting aids.

OPERATIONS AND SCHEDULING

Ground transportation facilities; Airport capacity, runway capacity and delays.

Suggested readings

1. *"Airport Engineering: Planning, Design, and Development of 21st Century Airports" by S. K. Agarwal*
2. *"Airport Planning and Management" by S. K. Khanna and M. G. Arora*
3. *"Airport Planning and Design" by B. S. Tiwari*
4. *"Airport Planning and Design" by G. S. P. Raghavan*
5. *"Airport Design and Operation" by Johannes W. R. S. de S. Tavares*

Semester VII

Course Title: RAILWAY ENGINEERING
Course Code: BCE718

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply the knowledge of railway track components, materials and fixtures and fastenings.
2. Solve problems of railway track geometrics, train resistance, points and crossings, Signaling and control system.
3. Carry out feasibility study of rail tracks.
4. Compute economical spans, hydraulic design of bridge and carry out erection and maintenance of bridge

Course Content

Unit-I **8 Hours**

Introduction to Railway Engineering

Role of railways in transportation system, railways and highways comparisons, classification of Indian railways, railway zones in India, railway gauges, creep, coning of wheels and traction resistance.

Unit-II **7 Hours**

Permanent Ways

Rail & rail joints (welding of rails, LWR, SWR, CWR), Sleepers, Ballast, Formation and its drainage, track fitting and fastening, Stresses in railway tracks; Construction of Railway Tracks.

Unit-III **15 Hours**

Geometric Design of Railway Tracks

Alignment and grades, cross section and its elements (at filling & cutting), grade compensation, cant and cant deficiency, negative cant and widening of gauges on curves, curves used for railway track (horizontal and vertical curves), level crossing, points and crossing, stations and yards, signals and interlocking system

Railway System in the Urban Area: Surface railways, Elevated railways, Underground railway.

Unit-IV **15 Hours**

High Speed Rail Engineering

Development, engineering, design and construction of high- speed rail (HSR) passenger transport systems with particular emphasis on the unique engineering elements of HSR technology. Key elements of HSR systems and sub-systems including: core systems (trains, power, signal, communication and control), track system and civil infrastructure (earthwork, bridges,

viaducts and tunnels). Also covered are basic design and construction of HSR stations and rolling stock maintenance facilities.

Suggested Readings:

1. *"Railway Engineering" by S. C. Saxena*
2. *"Fundamentals of Railway Engineering" by V. N. M. P. Srinivas*
3. *"Railway Track Engineering" by John W. Dick*
4. *"Railway Engineering: Track and Structure" by S. K. Sharma*

Semester VII

Course Title: DISASTER PREPAREDNESS & PLANNING
Course Code: OEC064

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify various types of disasters, their causes, effects & mitigation measures.
2. Demonstrate the understanding of various phases of disaster management cycle and create vulnerability and risk maps.
3. Understand the use of emergency management system to tackle the problems.
4. Discuss the role of media, various agencies and organizations for effective disaster management.
5. Design early warning system and understand the utilization of advanced technologies in disaster management.
6. Compare different models for disaster management and plan & design of infrastructure for effective disaster management.

Course Content

Unit I **15 Hours**

Introduction to Disaster Management

Define and describe disaster, hazard, vulnerability, risk-severity, frequency and details, capacity, impact, prevention, mitigation.

Disasters: Identify and describe the types of natural and manmade disasters, hazard and vulnerability profile of India, mountain and coastal areas, Factors affecting vulnerability such as impact of development projects and environment modifications (including dams, land-use changes, urbanization etc.), Disaster impacts (environmental, physical, social, ecological, economic etc.); health, psycho-social issues; demographic aspects (gender, age, special needs), Lessons and experiences from important disasters with specific reference to civil engineering.

Unit II **10 Hours**

Disaster Mitigation and Preparedness: Disaster Management Cycle-its phases; prevention, mitigation, preparedness, relief and recovery; structural and nonstructural measures; Preparedness for natural disasters in urban areas.

Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems; Use of Remote Sensing Systems (RSS) and GIS in disaster Management, early warning systems.

Unit III **10 Hours**

Post disaster response: Emergency medical and public health services; Environmental post disaster response (water, sanitation, food safety, waste management, disease control, security, communications); reconstruction and rehabilitation; Roles and responsibilities of government, community, local institutions, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.

Unit IV **10 Hours**

Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.

Suggested Readings:

1. *NaturalHazardsintheUrbanHabitatbyIyengar,C.B.R.I.,Tata McGrawHill,Publisher*
2. *NaturalDisastermanagement, JonIngleton(Ed),PublishedbyTudorRose,Leicester 92*
3. *Singh B.K., 2008, Handbook of disaster management: Techniques & Guidelines, RajatPublications.*
4. *Disaster Management, R.B. Singh (Ed), RawatPublications*
5. *ESCAP: Asian and the Pacific Report on Natural Hazards and Natural DisasterReduction.*

Semester VIII

Course Title: HIGHWAY CONSTRUCTION AND MANAGEMENT

Course Code: BCE806

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. The students will gain an experience in the implementation of Transportation Engineering on engineering concepts which are applied in field Highway Engineering.
2. The students will get a diverse knowledge of highway engineering practices applied to real life problems.
3. The students will learn to understand the theoretical and practical aspects of highway engineering along with the design and management applications.

Course Content

Unit I **5 Hours**

INTRODUCTION

Introduction to highway engineering, Essential aspects of road infrastructure, history, classifications, and types of roads, principles of highway planning, alignment, and design, considering factors like topography, soil, and traffic volume, geotechnical investigations and subgrade preparation.

Unit II **10 Hours**

MATERIALS FOR HIGHWAY CONSTRUCTION

Types of construction materials (aggregates, bitumen, cement concrete, stabilizers), Properties and uses of materials in flexible and rigid pavements, Introduction to modified binders and Geo-synthetics. Use of Glass, Fiber, Plastic, Geo-textiles and Geo-grids.

Sub-base and base materials in pavement construction, Use of recycled materials in pavements, Laboratory tests on materials (gradation, impact, penetration, concrete strength tests).

Unit III **10 Hours**

HIGHWAY CONSTRUCTION TECHNIQUES

Compaction techniques for different pavement layers, Construction practices including modern materials, construction of Water Bound Macadam and Soil Stabilized Roads.

Construction steps for flexible pavement, rigid pavement, semi rigid pavement Bituminous surfacing and application techniques, Equipment used in highway construction (earthmoving, pavers, rollers, graders), Quality control

in construction (material testing, field testing, compaction, curing), Safety standards and regulations in highway construction

Unit IV **20 Hours**

HIGHWAY MAINTENANCE, MANAGEMENT, AND EVALUATION

Highway Maintenance:

Overview of Pavement Management System (PMS), Data collection for road condition surveys and traffic data, Types of highway maintenance (routine, periodic, emergency), Pavement distress types and failure analysis (Potholes, Undulations and Corrugations, Crack Formation and Repair, Road Surface Wear and Tear,), Traffic Management during Maintenance, Maintenance strategies for flexible and rigid pavements

Maintenance of road shoulders, Drainage System Maintenance, and road furniture

Highway Evaluation

Pavement distress in flexible and rigid pavements. Pavement evaluation - roughness, present serviceability index, skid resistance, evaluation by deflection measurement. Strengthening of existing pavements–types of overlays, design of different types of overlays.

Suggested Readings:

1. *Khanna S.K., and Justo, C.E.G. "Highway Engineering", Nem Chand and Brothers, Roorkee,1998.*
2. *Kadiyali, L.R. "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi, 1997.*
3. *Flaherty, C.A.O. "Highway Engineering", Volume 2, Edward Arnold, London, 1986.*
4. *Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S. Chand & Company Ltd., New Delhi, 1985.*

Semester VIII

Course Title: DISASTER PREPAREDNESS & MANAGEMENT
Course Code: BCE808

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify various types of disasters, their causes, effects & mitigation measures.
2. Demonstrate the understanding of various phases of disaster management cycle and create vulnerability and risk maps.
3. Understand the use of emergency management system to tackle the problems.
4. Discuss the role of media, various agencies and organizations for effective disaster management.
5. Design early warning system and understand the utilization of advanced technologies in disaster management.
6. Compare different models for disaster management and plan & design of infrastructure for effective disaster management.

Course Content

Unit I **15 Hours**

Introduction to Disaster Management

Define and describe disaster, hazard, vulnerability, risk-severity, frequency and details, capacity, impact, prevention, mitigation.

Disasters: Identify and describe the types of natural and manmade disasters, hazard and vulnerability profile of India, mountain and coastal areas, Factors affecting vulnerability such as impact of development projects and environment modifications (including dams, land-use changes, urbanization etc.), Disaster impacts (environmental, physical, social, ecological, economic etc.); health, psycho-social issues; demographic aspects (gender, age, special needs), Lessons and experiences from important disasters with specific reference to civil engineering.

Unit II **10 Hours**

Disaster Mitigation and Preparedness: Disaster Management Cycle-its phases; prevention, mitigation, preparedness, relief and recovery; structural and nonstructural measures; Preparedness for natural disasters in urban areas.

Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems; Use of Remote Sensing Systems (RSS) and GIS in disaster Management, early warning systems.

Unit III **10 Hours**

Post disaster response: Emergency medical and public health services; Environmental post disaster response (water, sanitation, food safety, waste management, disease control, security, communications); reconstruction and rehabilitation; Roles and responsibilities of government, community, local institutions, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.

Unit IV **10 Hours**

Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.

Suggested Readings:

- *1.NaturalHazardsintheUrbanHabitatbyIyengar,C.B.R.I.,Tata McGrawHill,Publisher*
- *2.NaturalDisastermanagement,JonIngleton(Ed),PublishedbyTudorRose,Leicester 92*
- *Singh B.K., 2008, Handbook of disaster management: Techniques & Guidelines, RajatPublications.*
- *Disaster Management, R.B. Singh (Ed), RawatPublications*
- *ESCAP: Asian and the Pacific Report on Natural Hazards and Natural DisasterReduction*

Semester VIII

Course Title: WATER RESOURCE MANAGEMENT
Course Code: BCE809

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Learning Outcomes: After completion of this course, the learner will be able to:

1. Expand their knowledge of the physical, chemical, biological, and social sciences and learn how to apply this knowledge to the management of water resources.
2. Understand water resource decision-making at governance levels from local to national.
3. Use a wide range of analytical tools to sustainably manage water resources.
4. Participate in as well as lead interdisciplinary teams.
5. Orally and in writing communicate to stakeholders the findings and recommendations of interdisciplinary projects.
6. Have an understanding of professional and ethical responsibility.

Course Content

Unit I **15 Hours**

Sources of Water

Types of sources—surface and ground Surface Water Sources: investigations for reservoir planning, determination of storage capacity and yield from reservoir. Intakes structures for surface water sources—lakes, streams and rivers, impounding reservoir and canal.

Ground Water Sources

Types of aquifer and aquifer parameters, well hydraulics and Darcy's law. Rain water harvesting.

Unit II **10 Hours**

Water Quantity/Demand

Population forecast—arithmetic, incremental and geometric methods. Estimation of Water Requirement: Design period, per capita consumption, factors affecting per capita demand and fluctuations in demand pattern.

Quality of Water

Common impurities of water, physical, chemical and biological characteristics of water, IS and WHO water quality standards, water borne diseases, water pollution, role of regulatory bodies &local bodies. Water Act 1974.

Unit III **10 Hours**

Water Purification

Objective of water treatment, unit operations, introduction to physical, chemical and biological processes. Mixing, aeration, sedimentation, coagulation, flocculation and filtration–slow and rapid sand filters.

Softening of Water

Definition, methods of removal of hardness by lime soda process and zeolite process, RO & Membrane technique.

Disinfection of Water

Chlorination, chlorine demand, residual chlorine, use of bleaching powder, UV irradiation treatment.

Unit IV **10 Hours**

Conveyance of Water

Conveyance of water, pumping stations. Distribution of Water: Methods of distribution–direct supply from mains, direct pumping, hydro-pneumatic systems, overhead tanks distribution—pipes, laying of mains and pipes, jointing, backflow prevention, inspection and testing after installation.

Plumbing Services

Terminology used for home plumbing systems and distribution of water for multi-story buildings.

Suggested Readings:

1. *"Water Resources Engineering" by M. R. Yadava*
2. *"Water Resource Systems Planning and Management" by K. N. S. Raju*
3. *"Integrated Water Resources Management" by K. P. Singh*
4. *"Water Resources Engineering" by Larry W. Mays*

SEMESTER-VIII

Course Title: Solid & Hazardous Waste Management
Course Code: BCE810

L	T	P	Cr.
3	0	0	3

Total: 45 Hours

Course Outcomes:

After completion of this course, the learner will be able to:

1. Understanding of problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste etc.
2. Knowledge of legal, institutional and financial aspects of management of solid wastes
3. Become aware of Environment and health impacts solid waste mismanagement.
4. Understand engineering, financial and technical options for waste management
5. To understand the awareness regarding hazardous waste related health and environmental problem.

Course Content

UNIT I: **10 Hours**

General introduction including definitions of solid waste including municipal, hospital and industrial solid waste; legal issues and requirements for solid waste management and health and environmental issues related to solid waste management.
Sampling and characterization of solid waste

UNIT II: **10 Hours**

Analysis of hazardous constituents in solid waste including QA/QC issues

Municipal Solid Waste Management – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options

UNIT III: **10 Hours**

Hazardous Waste Management – Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects

Environmental Risk Assessment Defining risk and environmental risk; methods of risk assessment; case studies

UNIT IV: **15 Hours**

Biological Treatment of Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation

Landfill design Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

Transactional Mode:
Video based teaching, Group Discussion, Cooperative teaching, Demonstration, Open Talk

Recommended Books:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous Waste Management, McGraw Hill International Editions, New York, 1994.
3. Richard J. Watts, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York, 1997

Suggested Readings:

1. *"Solid Waste Management: Principles and Practice" by S. K. S. Yadav*
2. *"Solid Waste Management" by R. C. Gaur*
3. *"Hazardous Waste Management" by George Tchobanoglous, Hilary Theisen, and Samuel A. Vigil*
4. *"Introduction to Waste Management" by M. S. Swaminathan*

SEMESTER-VIII

Course Title: BUILDING CONSTRUCTION PRACTICE
Course Code: OEC111

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Total: 45 Hours

Course Outcomes: After completion of this course, the learner will be able to:

1. Understand elements of building construction with respect to substructure and superstructure
2. Understand the construction of built forms from foundation to roof in various building practices
3. Gain in depth knowledge and understanding of different building materials used for construction
4. Understand the contextual relevance of natural and man-made materials and their applicability in various construction practices.

Course Content

UNIT I: **15 Hours**

Specifications, details and sequence of activities and construction co-ordination, Site Clearance, Marking, Earthwork, masonry, stone masonry – Bond in masonry, concrete hollow block masonry, flooring, damp proof courses, construction joints, movement and expansion joints,pre cast pavements

UNIT II: **15 Hours**

Building foundations, basements, temporary shed, centering and shuttering, slip forms, scaffoldings, de-shuttering forms, Fabrication and erection of steel trusses, frames, braced domes, laying brick, weather and water proof, roof finishes, acoustic and fire protection; 194 Sub Structure Construction Techniques of Box jacking, Pipe Jacking. Under water construction of diaphragm walls and basement

UNIT III: **10 Hours**

Tunnelling techniques, piling techniques, well and caisson, sinking cofferdam, cable anchoring and grouting-driving diaphragm walls, sheet piles, shoring for deep cutting, well points, Dewatering and stand by Plant equipment for underground open excavation

UNIT IV: **10 Hours**

Super Structure Construction, launching girders, bridge decks, off shore platforms, special forms for shells - techniques for heavy decks, in-situ pre-stressing in high rise structures, Material handling, erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors, Erection of articulated structures, braced domes and space decks

Suggested Readings:

1. *"Building Construction" by B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain*

2. *"Building Construction: A Handbook for Engineers" by S. C. Rangwala*
3. *"Construction Technology" by R. Chudley (Indian Edition)*
4. *"Construction Methods and Management" by S. W. Nunnally*
5. *"Building Construction Illustrated" by Francis D.K. Ching*