GURU KASHI UNIVERSITY

Bachelor of Technology in Civil Engineering

Session: 2023-24

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**	**No. of Credits**
BCE101	Basic Electrical Engineering	Core	3	0	0	3
BCE110	Engineering Physics	Core	3	1	0	4
BCE111	Engineering Mathematics–I	Core	3	1	0	4
BCE104	Engineering Graphics & Drawing	Core	1	0	4	3
BCE105	Engineering Physics Lab	Skill based	0	0	4	2
BCE112	Basic Electrical Engineering Lab	Skill based	0	0	4	2
BCE113	Fundamental of Computer and Information Technology	Value added	2	0	0	2
BCE114	Constitution of India	Value added	2	0	0	NC
		Total	**14**	**2**	**12**	**20**
Note: * Non credit (NC) course will be evaluated as satisfactory/ unsatisfactory.						

Semester: II						
Course Code	**Course Name**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE201	Engineering Chemistry	Core	3	0	0	3
BCE214	Engineering Mathematics–II	Core	3	1	0	4
BCE203	Programming for Problem Solving	Core	3	0	0	3
BCE204	Communication Skills	Skill based	3	0	0	3
BCE205	Manufacturing Practices	Skill based	1	0	4	3
BCE206	Engineering Chemistry Lab	Skill based	0	0	2	1
BCE207	Programming for Problem Solving Lab	Skill based	0	0	2	1
BCE208	Communication Skills Lab	Skill based	0	0	2	1
Value Added Course (Anyone of the following)						
BCE209	Entrepreneurship Development	VAC	1	0	0	1
BCE210	Numerical Aptitude & Reasoning Ability					
BCE211	Stress Management					
Total			**14**	**1**	**10**	**20**

Semester: III						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE301	Surveying & Geomatics	Core	4	0	0	4
BCE302	Solid Mechanics	Core	3	1	0	4
BCE303	Fluid Mechanics	Core	3	1	0	4
BCE311	Building Materials & Construction	Core	3	0	0	3
BCE305	Surveying & Geomatics Lab	Skill based	0	0	2	1
BCE306	Solid Mechanics Lab	Skill based	0	0	2	1
BCE307	Fluid Mechanics Lab	Skill based	0	0	2	1
BCE399	XXX	MOOC	-	-	-	2
Discipline Elective-I (Anyone of the Following)						
BCE309	Basic Electronics & applications in Civil engineering	Discipline Elective-I	3	0	0	3
BCE310	Civil Engineering- Introduction, Societal & Global Impact					
Total			**16**	**2**	**6**	**21**

Semester: IV						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE401	Concrete Technology	Core	3	0	0	3
BCE410	Transportation Engineering-I	Core	4	0	0	4
BCE411	Construction Machinery & Works Management	Core	3	0	0	3
BCE412	Structural Analysis	Core	4	0	0	4
BCE406	Disaster Preparedness & Planning	Value added	3	0	0	3
BCE405	Environmental Studies	Value added	2	0	0	NC
BCE402	Concrete Technology Lab	Skill based	0	0	2	1
BCE403	Transportation Engineering Lab	Skill based	0	0	2	1
Discipline Elective-II (Anyone of the following)						
BCE407	Material, Testing & Evaluation	Discipline Elective-II	3	0	0	3
BCE408	Hydrology & Water Resources					
Total			**22**	**0**	**4**	**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**
BCE513	Design of Steel Structures-I	Core	4	0	0	4
BCE509	Geotechnical Engineering	Core	4	0	0	4
BCE514	Design of Concrete Structure-I	Core	4	0	0	4
BCE501	Environmental Engineering	Core	3	0	0	3
BCE506	Geotechnical Engineering Lab	Skill based	0	0	2	1
BCE508	Survey Camp*	Skill based	0	0	4	2
BCE599	XXX	MOOC	-	-	-	2
Discipline Elective-III (Anyone of the following)						
BCE502	Mechanics of materials	Discipline Elective-III	3	0	0	3
BCE510	Engineering Geology					
Total			**18**	**0**	**6**	**23**

***Survey Camp:** The Survey Camp will be organized at a hilly terrain. It will be organized after the final Examinations of 4 semester and will be evaluated in the 5 semester.

Semester: VI						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE610	Design of Concrete Structures-II	Core	4	0	0	4
BCE602	Irrigation Engineering	Core	4	0	0	4
BCE607	Repair & Rehabilitation of Structures	Core	3	0	0	3
BCE605	Engineering Economics, Estimation & Costing	Core	4	0	0	4
BCE612	Computer Aided Structural Drawing	Skill based	0	0	4	2
BCE613	Project-I	Skill based	0	0	4	2
Discipline Elective-IV (Anyone of the following)						
BCE614	Composite Materials	Discipline Elective-IV	3	0	0	3
BCE608	Human Relations at Work					
Total			**18**	**0**	**8**	**22**

Project: The problem related with design, construction, experimentation etc. based on specialization group of electives is to be carried out the result and analysis followed by discussion regarding suitability or non-suitability of project with conclusion and recommendation for future extension of the project must be covered. The project work will be carried out in groups (Maximum 5 students are allowed in one group)

Semester-VII						
Course Code	**Course Title**	**Course Type**	**L**	**T**	**P**	**No. of Credits**
BCE706	Design of Steel Structures-II	Core	4	0	0	4
BCE702	Foundation Engineering	Core	4	0	0	4
BCE707	Transportation Engineering - II	Core	3	0	0	3
BCE799	XXX	MOOC	-	-	-	2
Discipline Elective-V (Any one of the following)						
BCE708	Rural water Supply And onsite Sanitation Systems	Discipline Elective-V	3	0	0	3
BCE709	Solid & Hazardous waste Management					
BCE710	Project-II	Skill based	0	0	10	5
Open Elective Course-I						
XXX	XXX	Open Elective-I	2	0	0	2
Total			**16**	**0**	**10**	**23**
Open Elective-I (Open Elective Course for other Departments)						
BCE711	Introduction to Civil Engineering	Open Elective-I	2	0	0	2

Project: The problem related with design, construction, experimentation etc. based on specialization group of electives is to be carried out the result and analysis followed by discussion regarding suitability or non-suitability of project with conclusion and recommendation for future extension of the project must be covered. The project work will be carried out in groups (Maximum 5 students are allowed in one group)

Semester: VIII						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**
BCE802	Construction Equipment & Management	Core	4	0	0	4
BCE803	Metro Systems & Engineering	Core Course	4	0	0	4
BCE804	Project-III	Skill based	0	0	20	10
Open Elective Course-II						
XXX	XXX	Open Elective-II	2	0	0	2
Total			**10**	**0**	**20**	**20**
Open Elective-II (Open Elective Course for other Departments)						
BCE805	Introduction to Concrete Technology	Open Elective-II	2	0	0	2
Grand total			**128**	**5**	**76**	**171**

Evaluation Criteria for Theory Courses

A. Continuous Assessment (30 Marks)

CA1 Surprise Test (Two best out of three) (10 Marks)

CA2 Assignment (10 Marks)

CA3 Term Paper / Quiz / Presentation (5 Marks)

B. Attendance (5 marks)

C. Mid Semester Test (30 Marks)

D. End Semester Exam (40 Marks)

Evaluation Criteria for Practical Courses

Performance of each practical (10 Marks)

Report (5 Marks)

Practical Viva (5 Marks)

Total (20 Marks) (Each Practical)

SEMESTER-I

Course Title: Basic Electrical Engineering

Course Code: BCE101

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. 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, Kirchhoff's 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 **10 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 **10 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 **10 Hours**

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 Modes

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: BCE110

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 polarimetry.

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. (1999). Introduction to Electrodynamics. Prentice Hall.*
- *Walker, Jearl, David Halliday, and Robert Resnick. (2011). Fundamentals of Physics. Hoboken, N.J: Wiley.*
- *Saslow, W. (2008). Electricity, magnetism and light. e-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**

Calculus: Evaluates 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 Hospital's rule; Maxima and minima.

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.

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

Transaction Modes

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. (2002). Calculus and Analytic geometry. Pearson.*
- *Veerarajan T. (2008). Engineering Mathematics for first year. Tata McGraw-Hill, New Delhi.*
- *Ramana B.V. (2010). Higher Engineering Mathematics. Tata McGraw Hill New Delhi.*
- *N.P. Bali and Manish Goyal. (2010). A text book of Engineering Mathematics.Laxmi Publications.*
- *B.S. Grewal. (2000). Higher Engineering Mathematics. Khanna Publishers.*
- *V. Krishnamurthy, V.P. Mainra and J.L. Arora. (2005). An introduction to Linear Algebra. Affiliated East–West press.*
- *Erwin Kreyszig. (2006). Advanced Engineering Mathematics. John Wiley & Sons.*

Course Title: ENGINEERING GRAPHICS & DRAWING

Course Code: BCE104

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**

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 Involutes; Scales – Plain, Diagonal and Vernier Scales;

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**

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. 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**

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; 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, shares, 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];

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**

Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to Credits ate drawings, Credits ate, 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;

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 Credits eating 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 Modes

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: BCE105

L	T	P	Credits
0	0	4	2

Total hours 30

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

1. Illustrate the working p-n junction diode.
2. Analyse 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 **30 Hours**

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

Course Code: BCE112

L	T	P	Credits
0	0	4	2

Total Hours: 30

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

List of Experiments:

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single-phase transformer and calculate the efficiency.
10. Demonstration of cut-out sections of machines: Induction machine (squirrel cage rotor and slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.

Course Title: FUNDAMENTAL OF COMPUTER AND INFORMATION TECHNOLOGY
Course Code: BCE113

L	T	P	Credits
2	0	0	2

Total Hours: 30

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

1. Understand the concept of input and output devices of Computers
2. Study to use the Internet safely, legally, and responsibly.
3. discuss 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

UNIT I **8 Hours**

Computer Hardware / Software: Definition, History, Generation, Characteristics, Types & Applications, Overview of a computer system:

Hardware/Software: Definition of Hardware**,** Input Unit: Keyboard, Mouse, Scanner etc.**,** CPU: Arithmetic Logic Unit (ALU), Control Unit (CU), Memory Unit (MU)**,** Output Unit: Monitor, Printer etc.**,** Storage Devices: Primary &Auxiliary Memory (Floppy Disk, Hard Disk, Compact Disk, DVD, Flash Disk etc.)**,** Others: Network Card, Modem, Sound Card etc.

Software: Definition & types of Software, Programming Language, Live ware, Firmware and Cache Memory

UNIT II **7 Hours**

Setting & Protection: of Computer Room and Computer- Concept of Computer related threats (virus, worms, Trojan, phishing etc.) remedies and protection

File Management Basics: Physical structure of disk

UNIT III **7 Hours**

Concept of E-mail / Internet / Extranet, World Wide Web (WWW): Familiarity with internet browsers (e.g., Internet Explorer, Firefox, Opera, Safari, Google Chrome etc.), Introduction of IP address, subnet mask and default gateway, Introduction to Network Media, topology and protocol, Setting up Microsoft Network, Dial-Up Networking

UNIT IV **8 Hours**

Number System: Introduction to binary, octal, decimal and hexadecimal number system Introduction to ASCII and Unicode standards

Transaction Modes

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

Suggested Readings

- *Rajaraman, V., & Adabala, N. (2014). Fundamentals of computers. PHI Learning Pvt. Ltd.*
- *Doja, M. N. (2005). Technology. Deep and Deep Publications.*
- *Bangia, R. (2008). Computer Fundamentals and Information Technology. Firewall Media.*

Course Title: CONSTITUTION OF INDIA

Course Code: BCE114

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.

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-II

Course Title: ENGINEERING CHEMISTRY
Course Code: BCE201

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. Demonstrate Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and Nano particles,
2. Evaluate band structure of solids and the role of doping on band structures.
3. Distinguish the ranges of Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging
4. Rationalize periodic properties such as ionization potential, electro-negativity, Oxidation states and electro-negativity.

Course Content

UNIT1 **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**

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.

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.

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 equilibriums, Water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

UNIT III **10 Hours**

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 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.

UNIT IV **10 Hours**

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 Modes

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 –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 Modes

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

Suggested Readings

- *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.*
- *Babu Ram (2009) Advance Engineering Mathematics; First Edition; Pearson Education.*
- *Richard Courant and Fritz John (2012) Introduction to Calculus and Analysis, Volume II, V Springer Publica*

Course Title: PROGRAMMING FOR PROBLEM SOLVING
Course Code: BCE203

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**

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

UNIT II **15 Hours**

Arithmetic expressions and precedence: Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching

Iteration and loops

Arrays: Arrays (1-D, 2-D), Character arrays and Strings

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

UNIT III **8 Hours**

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

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**

Structure: Structures, Defining structures and Array of Structures

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 Modes

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. Balaguruswamy (2005) Programming in ANSI C, Tata McGraw-Hill.*

Course Title: COMMUNICATION SKILLS
Course Code: BCE204

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, Cliché

UNIT IV **7 Hours**

Nature and Style of sensible Writing: Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion

Writing Practices: Comprehension, Précis Writing, Essay Writing.

Transaction Modes

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

L	T	P	Credits

Course Code: BCE205

1	**0**	**4**	**3**

Total Hours: 45

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

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

Course Content

UNIT I **8 Hours**

Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

UNIT II **6 Hours**

CNC machining, Additive manufacturing, Fitting operations & power tools

UNIT III **6 Hours**

Electrical & Electronics Carpentry, Plastic moulding, glass cutting

UNIT IV **10 Hours**

Metal casting, 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.]

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 hrs. + gas welding 4 hrs.)

Transaction Modes

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: BCE206

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: BCE207

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

1. Problem solving using computers
2. Familiarization with programming Environment
3. Variable types and type conversions
4. Simple computational problems using arithmetic expressions
5. Branching and logical expressions
6. Problems involving if-then-else structures
7. Loops, while and for loops
8. Iterative problems e.g., sum of series
9. 1D Arrays: searching, sorting
10. 1DArray manipulation
11. 2D arrays and Strings, memory structure
12. Matrix problems, String operations
13. Functions, call by value
14. Simple functions
15. Numerical methods (Root finding, numerical differentiation, numerical integration)
16. Numerical methods problems
17. Recursion, structure of recursive calls
18. Recursive functions
19. Pointers, structures and dynamic memory allocation
20. Pointers and structures
21. File handling
22. 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: BCE208

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 communication techniques 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: ENTREPRENEURSHIP DEVELOPMENT
Course Code: BCE209

L	T	P	Credits
1	0	0	1

Total Hours: 15

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

1. Assess the commercial viability of new technologies, business opportunities and existing companies
2. Plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market
3. Carry out scientific research in the field of entrepreneurship
4. Improved your interpersonal and collaborative skills

Course Content

UNIT I **10 Hours**

Introduction to Generic Skills: Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.

Managing Self: Knowing Self for Self-Development- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc., Managing Self – Physical- Personal grooming, Health, Hygiene, Time Management, Managing Self – Intellectual development -Information Search: Sources of information, Reading: Purpose of reading, different styles of reading, techniques of systematic reading, Note Taking: Importance of note taking, techniques of note taking, Writing: Writing a rough draft, review and final draft. Managing Self – Psychological, Stress, Emotions, Anxiety-concepts and significance, Techniques to manage the above.

UNIT II **5 Hours**

Managing in Team: Team - definition, hierarchy, team dynamics, Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group - conversation and listening skills.

UNIT III **5 Hours**

Task Management: Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management

Problem Solving: Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving, Different approaches for problem solving. Steps followed in problem solving. Exercises/case studies on problem solving.

UNIT IV **10 Hours**

Entrepreneurship: Introduction, Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and

other relevant institutions/organizations at State/National level. Market Survey and Opportunity Identification (Business Planning)- How to start a small-scale industry, Procedures for registration of small-scale industry, List of items reserved for exclusive manufacture in small-scale industry, Assessment of demand and supply in potential areas of growth, understanding business opportunity, Considerations in product selection, Data collection for setting up small ventures. **Project Report Preparation-** Preliminary Project Report, Techno-Economic Feasibility Report, Exercises regarding "Project Report Writing" for small projects.

Transaction Modes

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

Suggested Readings

- *Khanka, S. S. (2006). Entrepreneurial development. S. Chand Publishing.*
- *Desai, V. (2009). Dynamics of entrepreneurial development and management (pp. 119-134). Himalaya Publishing House.*
- *Kennedy, A. (2015). Business development for dummies. John Wiley & Sons*

Course Title: NUMERICAL APTITUDE AND REASONING ABILITY
Course Code: BCE210

L	T	P	Credits
1	0	0	1

Total Hours: 15

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

1. Understand the basic concepts of quantitative ability and logical reasoning Skills
2. Learn the basic concepts of Acquire satisfactory competency in use of reasoning
3. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning
4. Create the ability to appear in exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

Course Content

UNIT I **4 Hours**

Numerical problem: Percentages *(like profit & loss %, marks, shares etc.,)*, Time & Work, Speed & Distance problems, Fraction, Ratios, Average & Volume, Factoring *(LCM, HCF)*, Mensuration formulas, Simple interest & Compound interest.

UNIT II **4 Hours**

Logical Reasoning: Statements & Assumption, Syllogism, Puzzles, Constraint-Based Reasoning, Proposition Testing, Course of Action, Assertion and Reason, Input Output Relations, Conclusion Estimation from Passages, Cause and Effect Reasoning, Theme Detection etc.

UNIT III **4 Hours**

Verbal Reasoning: Analogy, Series Completion, Blood Relations, Venn Diagrams, Sequential Output Tracing, Ranking & Time Sequence Test, Alphabet Test, Logical Sequence of Words, Inserting the Missing Character, Data Sufficiency, Arithmetical Reasoning Questions, Coding-Decoding, Puzzle Test, Eligibility Test, Situation Reaction Test, Assertion & Reason, etc.

UNIT IV **3 Hours**

Non-Verbal Reasoning: Mirror Images, Reverse Images, Spotting Embedded Figures, Figure Matrix, Paper Folding, Cubes & Dice, Construction of Squares & Triangles, Grouping of Identical Figures, Paper Cutting, Rule Detection, Dot Situation, Figure Formation & Analysis, Series, Classification, Analogy etc.

Transaction Modes

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

Suggested Readings

- *Aggarwal, R. S. (2012). Quantitative Aptitude for Competitive Examinations. S. Chand & Company Pvt Limited (Unit II, III).*
- *Experts, D. (2021). (Free Sample) NTA UGC NET Paper 1 Topic-wise 52 Solved Papers (2020 to 2004). Disha Publications.*

Course Title: STRESS MANAGEMENT
Course Code: BCE211

L	T	P	Credits
1	0	0	1

Total Hours: 15

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

1. Identify the nature and causes of stress in organizations
2. Knowledge of stress prevention mechanism
3. Classify the strategies that help cope with stress
4. Apply stress management principles in order to achieve high levels of performance and adopt effective strategies, plans and techniques to deal with stress

Course Content

UNIT I **3 Hours**

Understanding Stress, Stress – concept, features, types of stress, Relation between Stressors and Stress, Potential Sources of Stress – Environmental, Organizational and Individual, Consequences of Stress – Physiological, Psychological and Behavioral Symptoms, Stress at work place – Meaning, Reasons

Impact of Stress on Performance, Work Stress Model, Burnout – Concept, Stress v/s Burnout

UNIT II **4 Hours**

Managing Stress – I, Pre-requisites of Stress-free Life, Anxiety - Meaning, Mechanisms to cope up with anxiety, Relaxation - Concept and Techniques Meditation-Concept, types, benefits, elements and ways to building skills

Benefits of meditation, Time Management - Meaning, Importance of Time Management, Approaches to Time Management, Stress Management - Concept, Benefits, Managing Stress at Individual level, Role of Organization in Managing Stress/ Stress Management Techniques

2.10 Approaches to Manage Stress - Action oriented, Emotion oriented, Acceptance oriented.

UNIT III **4 Hours**

Models of Stress Management – Transactional Model, Health Realization/ Innate Health Model, General Adaption Syndrome (GAS) - Concept, Stages, Measurement of Stress Reaction - The Physiological Response, The Cognitive Response, The Behavioral Response, Stress prevention mechanism - Stress management through mind control and purification theory and practice of yoga education, Stress management interventions: primary, secondary, tertiary.

Meditation – Meaning, Importance

UNIT IV **4 Hours**

Stress Management Leading to Success, Eustress – Concept, Factors affecting Eustress, Stress Management Therapy - Concept, Benefits, Stress Counseling – Concept, Value education for stress management, Stress and New Technology, Stress Audit Process, Assessment of Stress - Tools and Methods, Future of Stress Management.

Transaction Modes

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

Suggested Readings

- *Heena T. Bhagtani. (2018). Stress Management. Himalaya Publishing House.*
- *Dutta, P. K, (2010). Stress Management. Himalaya Publishing House.*
- *Roy, S (2012). Managing Stress. Sterling Publication.*

SEMESTER- III

Course Title: Surveying & Geomatics
Course Code: BCE301

L	T	P	Credits
4	0	0	4

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 and 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: **15 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: **15 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. Base line choices - extension of base lines - corrections - Trigonometric leveling.

Unit-III: **15 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 stereoplotting instruments, mosaics, map substitutes.

Unit-IV: **15 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: Solid Mechanics
Course Code: BCE302

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. 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: **14 Hours**

Concept of Equilibrium: Loads, supports, reactions, displacements; General equilibrium equations; Equilibrium of a point and a member; Concept of free body diagram; Statically determinacy of a problem.

Stresses and Strains: Concept of stress and strain; Type of stresses and strains; Stress-strain diagrams for ductile, brittle materials; Generalized Hooke's law; Concept of working stress and factor of safety; Lateral strain, Poisson's ratio and Volumetric strain; Elastic modulii and relationship between them; Bars of varying section, composite bars, thermal stresses.

Unit-II: **15 Hours**

Principal Stresses and Strains: Concept of principal stresses, principal strains and principal planes; use of Mohr circle in computation of stresses and strains; Rectangular block subjected to normal stress along and across two planes, combination of normal and tangential stress along with shear stress.

Shear Force and Bending Moment Diagrams: Introduction to the concept of shear force, bending moment and the sign convention; Shear force and bending moment diagrams for cantilever, simply supported and overhang beams subjected to point loads, uniformly distributed loads, uniformly varying loads, moments or their combination, point of contra flexure.

Unit-III: **15 Hours**

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.

Bending and Shear Stresses: Assumptions - theory of simple bending; Derivation of bending equation; Centroid and section modulus of various cross-sectional shapes including rectangular, circular, I, channel, angle etc.; Determination of bending stresses, bending stress distribution across various beam sections; Determination of shear stress,

shear stress distribution across various beam sections.

Unit-IV: **16 Hours**

Columns and Struts: Stability of Columns; buckling load of axially loaded columns with various end conditions; Euler's and Rankine's formula; Columns under eccentric load, lateral load.

Torsion of Circular Shafts: Derivation of torsion equation and its assumptions, application of equation to circular shafts; combined torsion and bending of circular shafts, principal stress and maximum shear stress under combined loading of torsion and bending.

Stresses and strains in thin cylinders: spherical shells subjected to internal pressures; Normal stress, tangential stress.

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. *'Elements of Strength of Materials', Timoshenko, S. and Young, D. H., DVNC, New York, USA.*
2. *'Solid Mechanics', Kazmi, S. M. A., TMH, New Delhi.*
3. *'Mechanics of Materials', Hibbeler, R. C., Pearson Prentice Hall.*
4. *'An Introduction to the Mechanics of Solids', Crandall, S. H., N. C. Dahl, and T. J. Lardner, McGraw Hill.*
5. *'Mechanics of Materials', Ferdinand P. Beer, E. Russel Jhonston Jr. and John T. D. Ewolf, TMH.*
6. *'Strength of Materials', James M. Gere and Barry J. Goodno, Cengage Learning India Pvt. Ltd., New Delhi.*
7. *'Strength of Materials', R. Subramanian, Oxford University Press, New Delhi.*

Course Title: Fluid Mechanics
Course Code: BCE303

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. 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; 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: **18 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: **16 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. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram. 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: **14 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, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative 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: Building Materials & Construction
Course Code: BCE311

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 properties of different building materials.
2. Analyze quality control tests on Cement.
3. Interpret the importance of building components and building services.
4. Evaluate the impact of building construction on society and demonstrate awareness of contemporary issues.

Course Content

Unit-I: **10 Hours**

Building Stones & Bricks: General, Characteristics of a good building stone, Deterioration and preservation of stones, Artificial Stones, Composition of good brick earth, Qualities of good bricks, Classification of bricks, Tests on bricks, Varieties of fire bricks.

Cement: Composition of cement, Raw Materials, Manufacturing process, Varieties of cement, Hydration of cement, Properties, testing of cement.

Unit-II: **12 Hours**

Concrete: Introduction, Constituents of concrete, batching of materials, Manufacturing process of cement concrete, workability and factors affecting it, Methods to determine workability, segregation and bleeding of concrete, Strength of concrete and factors affecting it.

Timber: Structure of a tree, classification of trees, Defects in timber, Qualities of good a timber, Seasoning of timber, Decay of timber, Preservation of timber

Miscellaneous materials: Paints, Distempering, Glass, Plastics.

Unit-III: **10 Hours**

Foundation and Walls: Definition, types of foundations, causes of failures of foundation and remedial measures, Types of walls and thickness considerations.

Brick and stone masonry: Terms used, Types of bonds & their merits and demerits, rubble and ashlar joints in stone masonry, cement concrete hollow blocks and their advantages and disadvantage.

Damp Proofing: Sources, causes and bad effects of dampness, preventive measures for dampness in buildings.

Unit-IV: **13 Hours**

Roofs: Terms used, Classification of roofs and roof trusses, Different roof covering materials.

Plastering and pointing: Objects, Methods of plastering, Materials and types, Defects in plastering, Special material for plastered surface, distempering white washing and colour washing.

Floors: General, Types of floors used in building & and their suitability, factors for selecting suitable floor for building.

Miscellaneous topics: Building Services – Plumbing service, Electrical services, Air conditioning, Accoustics and sound insulation, Fire protection measures, Lift

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. *Rangwala – Building materials*
2. *Bindra SP, Arora KR Building construction*
3. *Shetty MS, Concrete Technology*
4. *Punmia BC, Building construction*
5. *Singh, Parbin, Building materials*
6. *Sushil Kumar, Building Construction*

Course Title: Surveying & Geomatics Lab
Course Code: BCE305

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: 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. Determination of physical properties of steel including strength and ductility.
2. Study of tensile and compressive stress-strain behavior of steel.
3. Compression test on brick.
4. Development of shear stress-strain curve for steel in torsion.
5. Determination of hardness of a material by Rockwell and Brinell hardness testing machine.
6. Determination of impact strength of a material by Izod and Charpy tests.
7. Determination of bending strength of a wooden beam specimen.
8. Determination of fatigue strength of a material.
9. Study of behavior of columns and struts with different end conditions.
10. To verify the moment area theorem for slope and deflection of a given beam.

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: Basic Electronics & applications in Civil Engineering

Course Code: BCE309

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 construction of diodes and their rectifier applications.
2. Appreciate the construction and working bipolar junction transistors and MOSFETs.
3. Design Op-Amp IC based fundamental applications.
4. Comprehend working of basic elements of digital electronics and circuits.

Course Content

Unit I: **10 Hours**

Semiconductor Diodes and Applications - Semiconductor Diode - Ideal versus Practical, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications;

Unit II: **12 Hours**

Transistors & Amplifiers - Bipolar Junction Transistor (BJT) – Construction, Operation, Common Base, Common Emitter and Common Collector Configurations, Distortion, Operating Point, Voltage Divider Bias Configuration; Introduction to nMOS and pMOS.

Unit III: 13 Hours

Operational Amplifiers and Applications - Introduction to Op-Amp, Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground, Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Differentiator and Integrator, Square Wave and Triangular Wave Generation.

Unit IV: 10 Hours

Digital Electronics -Boolean Algebra - Binary, Octal, Hexadecimal Number Systems, Addition, Subtraction using 1's and 2's compliment method, Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); K- Map simplification Truth Tables and Functionality of Flip-Flops – SR, JK and DFlip-Flop.

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. *David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.*
2. *Santiram Kal (2002), Basic Electronics Devices, Circuits and IT Fundamentals, Prentice*

Hall, India. 3. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education.

3. *Paul, B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics–A Text-Lab. Manual, TMH*
4. *R. T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson.*

Course Title: Civil Engineering- Introduction, Societal & Global Impact
Course Code: BCE310

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 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: **10 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: **15 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: **10 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: **10 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*

SEMESTER- IV

Course Title: Concrete Technology
Course Code: BCE401

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: **10Hours**

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: **10Hours**

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: **10Hours**

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: Transportation Engineering-I
Course Code: BCE410

L	T	P	Cr.
4	0	0	4

Total: 60 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

Unit I: **15 Hours**

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

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

Unit II: **15 Hours**

Highway Alignment: Requirements, Alignment of Hill Roads, Engineering Surveys.

Highway Geometric Design: Cross Section Elements, Carriageway, Camber, Sight Distances, Horizontal Curves, Extra-widening, Super-elevation, Vertical Curves

Unit III: **15 Hours**

Highway Materials: Properties of Sub-grade and Pavement Component Materials, Tests on Sub-grade Soil, Aggregates and Bituminous Materials.

Highway Construction: Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements

Unit IV: **15 Hours**

Highway Drainage and Maintenance: Importance of drainage and maintenance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas, Pavement Failures, Pavement Evaluation, Maintenance and Strengthening Measures.

Highway Economics & Financing: Total Transportation Cost, Economic Analysis, Sources of Highway Financing.

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. *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.*

Course Title: CONSTRUCTION MACHINERY & WORKS MANAGEMENT
Course Code: BCE411

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. Associate the knowledge of construction of substructures and superstructures.
2. Analyze the techniques of Erection of Construction units.
3. Demonstrate basic knowledge about Construction equipment and machinery.
4. Interpret about hauling and conveying equipment.

Course Content

Unit I: **10 Hours**

INTRODUCTION: Need for project planning & management, time, activity & event, bar chart, Milestone chart, uses & draw backs.

PERT: Construction of PERT network, time estimates, network analysis, forward pass & backward pass, slack, critical path, data reduction, suitability of PERT for research project, numerical problems.

Unit II: **10 Hours**

CPM: Definitions, network construction, critical path, fundamental rules, determination of project schedule, activity time estimates, float types, their significance in project control, numerical problems.

Unit III: **15 Hours**

COST ANALYSIS AND CONTRACT: Type of costs, cost time relationships, cost slopes, conducting a crash programme, determining the minimum total cost of project, numerical problems. updating a project, when to update, time grid diagram, resource scheduling. Planning of different components of civil engineering projects such as a house, workshop, dam, tunnel.

Unit IV: **10 Hours**

CONSTRUCTION EQUIPMENT AND MACHINERY: Tractors, bull dozers, rippers, scrappers, power shovels, dragline, hoes. Line diagram of each, sizes, output, uses, factors affecting selection of each equipment, economic life of equipment, maintenance and repair cost. Hoisting & Transporting Equipment's: Hosts, Winches, Cranes, Belt conveyors, Ropeways, trucks & Wagons.

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 Planning and Equipment - R. L. Peurifoy - Tata McGraw Hill, New Delhi*
2. *PERT and CPM - L. S. Srinath, East West Press*
3. *Management Guide to PERT & CPM - Wiest & levy; Prentice Hall*
4. *Construction Equipment & Planning and Application. - Mahesh Verma Artec Publication.*
5. *Construction Planning and Management by U. K. Shrivastava; Galgotia Publications Pvt. Ltd.*

Course Title: Structural Analysis
Course Code: BCE412

L	T	P	Cr.
4	0	0	4

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: **15 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: **15 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: **15 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: **15 Hours**

FINITE ELEMENT METHOD (FEM): Basic concept, discretisation, 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: Disaster Preparedness & Planning
Course Code: BCE406

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. Apply emergency management system to tackle the problems.
4. Interpret the role of media, various agencies and organizations for effective disaster management and design an early warning system and the utilization of advanced technologies in 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.

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. *www.http//ndma.gov.in*
2. *http://www.ndmindia.nic.in*
3. *Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill, Publisher*
4. *Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester 92*
5. *Singh B.K., 2008, Handbook of disaster management: Techniques & Guidelines, Rajat Publications.*
6. *Disaster Management, R.B. Singh (Ed), Rawat Publications*
7. *ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction*

Course Title: Environmental Science
Course Code: BCE405

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. Interpret various environmental variables and results.
2. Summarize the concept of Ecosystem and apply knowledge in real life.
3. Apply knowledge for the solutions to environmental problems related to resource use and management.
4. Compare the results of scientific studies of environmental problems.

Course Content

Unit 1: **8 Hours**

The Multidisciplinary nature of environmental studies

Definition and scope and importance of multidisciplinary nature of environment, need for public awareness.

Natural Resources: Natural resources and associated problems, use and over-exploitation, case study of forest resources and water resources.

Unit II: **8 Hours**

Ecosystems

Concept of an ecosystem, Structure, Producers, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spot of biodiversity.

Environmental Pollution

Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Unit III: **7 Hours**

Social Issues and the Environment

From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and

rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Waste land reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of Environmental legislation public awareness.

Unit IV: **7 Hours**

Human Population and the Environment

Population growth, variation among nations, Population explosion – Family Welfare Program Environment and human health, Human Rights, Value Education, HIV / AIDS Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

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. *Aggarwal, K. C. Environment Biology, Nidi Publ. Ltd. Bikaner.*
2. *Jadav, H and Bhosale, V.M. Environment Protection and Laws. Himalaya Pub House, Delhi.*
3. *Rao M. N. and Datta A.K. Waste Treatment. Oxford and IBH Publ.*

Course Title: Concrete Technology Lab
Course Code: BCE402

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: 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: Material, Testing & Evaluation
Course Code: BCE407

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: Types, properties, advantages and uses of: Cement; Concrete; Admixtures; Glass and Plastics; Paints and Varnishes, Acoustical material; Geo-synthetics, Bitumen and Asphalt; Ceramics and Refractory's; Bricks; Concrete hollow blocks & Interlocking tiles.

Sand: Composition, types, Physical Properties, uses. Fly ash: Source, types, properties and uses Timbers: Properties, Seasoning, defects, preservation methods, laminates and adhesives,

Unit-II: **10 Hours**

Ferrous and nonferrous metals, Importance of Structural steel; Their characteristics and mechanical behavior (elastic, plastic and elasto plastic, strength and durability w.r.t Climatic variation); Creep – fundaments and characteristics, concept of fatigue of materials; Impact test, toughness – different materials.

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**

Quality control- Use of test data/ testing 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, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative 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, Fifth Edition*
3. *Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications*
4. *Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella*
5. *E.N. Dowling (1993), Mechanical Behaviour of Materials, Prentice Hall International Edition*
6. *American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)*

Course Title: Hydrology & Water Resources
Course Code: BCE408

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 interaction among various processes in the hydrologic cycle.
2. Calculate the average annual rainfall of any area using the rain gauge data and inter-relations of various parameters as infiltration, Evapotranspiration etc.
3. Analyze the various component of hydro graphs and able to estimate the runoff.
4. Estimate the water requirement for different crops and able to proposed appropriate method of applying water.

Course Content

Unit I: **10 Hours**

Introduction - Hydrologic Cycle, History of Hydrology, Water-Budget Equation, 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.

Unit II: **10 Hours**

Abstractions from precipitation - Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapotranspiration, Interception, Depression Storage, Infiltration, Infiltration Capacity, Measurement of Infiltration, Modelling Infiltration Capacity, Classification of Infiltration Capacities, Infiltration Indices.

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.

Unit III: **15 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.

Unit IV: **10 Hours**

Water Logging: Causes, Effects and Remedial Measures. Lining of Canals, Types of Lining. Drainage of Irrigated Lands: Necessity, Methods.

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

Suggested Readings:

1. *K Subramanya, Engineering Hydrology, Mc Graw Hill.*
2. *K N Muthreja, Applied Hydrology, Tata Mc Graw Hill.*
3. *K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc Graw Hill.*
4. *G L Asawa, Irrigation Engineering, Wiley Eastern*
5. *L W Mays, Water Resources Engineering, Wiley.*
6. *J. D Zimmerman, Irrigation, John Wiley & Sons*

SEMESTER- V

Course Title: Design of Steel Structure-I
Course Code: BCE513

L	T	P	Cr.
4	0	0	4

Total: 60 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: **15 Hours**

Introduction: Properties of structural steel, I.S. rolled sections, I.S. specifications.

Connections: Riveted, bolted and welded connections for axial and eccentric loads

Unit II: **15 Hours**

Tension members: Design of members subjected to axial tension.

Compression members: Design of axially loaded members, built-up columns, laced and battened columns including the design of lacing and battens

Unit III: **15 Hours**

Flexural members: Design of laterally restrained and un-restrained rolled and built-up sections, encased beams.

Column bases: Design of slab base, gusseted base and grillage foundation.

Unit IV: **15 Hours**

Roof truss: Design loads, combination of loads, design of members (including purlins) and joints, detailed working drawings.

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)*
- *SP: 6(1) (Handbook for structural engineers-Structural steel sections)*

Course Title: Geotechnical Engineering
Course Code: BCE509

L	T	P	Cr.
4	0	0	4

Total: 60 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: **15 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., montmorilonite, illite and kaollite, 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: **15 Hours**

Index Properties: Grain size analysis. Stock's law and Hydrometer analysis. Consistency and sensitivity of Clay, Atterbergs 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: **15 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: Design of Concrete Structure – I
Course Code: BCE514

L	T	P	Cr.
4	0	0	4

Total: 60 Hours

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

1. Interpret the concept of Concrete & Steel.
2. Analyze the load on singly & doubly reinforced beams.
3. Evaluate the concept of Columns & design the Columns (axially loaded & Eccentric loaded)
4. Evaluate the concept of stairs & design the Staircase.

Course Content

UNIT I **15 Hours**

Objectives and Methods of Analysis and Design, Properties of Concrete and Steel, Design Philosophies of Working Stress Method and Limit State Method, Limit State of Collapse – Flexure, Computation of Parameters of Governing Equations, Determination of Neutral Axis Depth and Computation of Moment of Resistance.

UNIT II **15 Hours**

Analysis of beams: Moment of Resistance of singly, doubly and flanged beams, Design of continuous beams, Numerical Problems on Singly Reinforced Rectangular Beams, Doubly Reinforced Beams – Theory and Problems, Flanged Beams – Theory and Numerical Problems, Shear, Bond, Anchorage, Development Length and Torsion, Reinforced Concrete Slabs: One- and Two-way Slabs

UNIT III **15 Hours**

Calculation of cracking and deflection for Limit State of Serviceability. Design of axially and eccentrically loaded columns.

UNIT IV **15 Hours**

Staircases: Introduction, types and design

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. *Reinforced Concrete Design; Pillai & Menon; Tata McGraw-Hill Education*
2. *Limit state Design of Reinforced Concrete; Varghese P C; Prentice-Hall of India Pvt. Ltd".*
3. *Reinforced Cement Concrete, Mallick and Rangasamy; Oxford-IBH.*

BIS Codes of practice and Design Handbooks:

1. IS 456-2000- Indian Standard. Plain and Reinforced concrete -Code of practice

2. IS 3370- Code of practice for concrete structures for storage of liquids
3. Design Aid SP 16 4. Explanatory hand book SP24.
4. Detailing of Reinforcement SP 34 Note: The codes marked with * are permitted in examination.

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. Classify the different methods are used to purify the water and rectify the water which improves the standard and living style of the community.
2. Evaluate the population forecast for a city to meet its water requirement
3. Design water treatment plant by different methods.
4. Comprehend the drainage and plumbing system in commercial, residential and industrial area.

Course Content

UNIT I: **13 Hours**

PUBLIC WATER SUPPLY: Beneficial uses of water, water demand, per capita demand, variation in demand; causes, detection and prevention of wastage of water, population forecasting.

SOURCES OF WATER SUPPLY: Surface and underground sources, relation and development of source in r/o quality and quantity of water, Development of wells, Storage reservoir-balancing and service storage, capacity determination by mass curve method. Intake and transmission system distribution systems: network design.

UNIT II: **12 Hours**

QUALITIY AND EXAMINATION OF WATER: Necessity for examination of water impurities in water, sampling of water, physical, chemical and bacteriological quality for domestic water supply. Drinking water quality standards and criteria.

WATER SUPPLY AND DRAINAGE OF BUILDINGS: System of water supply houses connections, mattering, internal distribution, and sanitary fittings pipe joints, Different types of pipes and pipes materials.

UNIT III: **10 Hours**

WATER TREATMENT: Unit operations in water treatment screening, sedimentation, and its theory sedimentation aided with coagulation, flocculation, sand filtration-slow, rapid, gravity and pressure filters, Disinfecting, Necessary: requirements of disinfectant, methods of disinfecting, different practices of chlorinating.

UNIT IV: **10 Hours**

MISCELLANEOUS METHODS of WATER TREATMENT: Aeration, taste and odour control iron and manganese removal water softening processes Base exchange process,

Swimming pool water Treatment

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: Geotechnical Engineering Lab
Course Code: BCE506

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: 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 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.
4. 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 4 weeks.

Total: 45 Hours

Course Title: Mechanics of materials

Course Code: BCE502

L	T	P	Cr.
3	0	0	3

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

1. Interpret the concepts of force, stress, strain, displacement.
2. Apply the systematic procedure to solve problems of engineering interest for force and displacement.
3. Estimate the possible modes of failure of these structural elements and the failure load is outlined.
4. Determine principal stresses and angles, maximum shearing stresses and angles, and the stresses acting on any arbitrary plane within a structural element.

Course Content

UNIT I: **10 Hours**

Tension, compression & shear

Types of external loads – self weight – internal stresses – normal and shear stresses – strain – Hooke's law – Poisson's ratio – relationship between elastic constants – stress strain diagrams working stress – elongation of bars of constant and varying sections – statically indeterminate problems in tension and compression – assembly and thermal stresses – strain energy in tension, compression and shear.

UNIT II: **10 Hours**

Stress on inclined planes for axial and biaxial stress fields – principal stresses – Mohr's circle of stress – principal strains – strain rosette – principal stress/strain problem as an Eigen value problem.

UNIT III: **15 Hours**

Bending moment and shear force

Different types of beams – shear force and bending moment diagrams for simply supported overhanging and cantilever beams – relationship connecting intensity of loading, shearing force and bending moment – shear force and bending moment diagrams for statically determinate plane frames.

Stresses in laterally loaded symmetrical beams

Theory of simple bending – limitations – bending stresses in beams of different cross sections – moment of resistance- beams of uniform strength – beams of two materials – shearing stresses in bending–principal stresses in bending –strain energy due to bending.

Unsymmetrical bending

Shear flow – shear center – determination of shear center for simple sections.

UNIT IV **10 Hours**

Theory of columns

Axial loading of short strut – long columns – differential equation of the elastic curve – Euler's formula – eccentric loading – direct and bending stresses – buckling load as an Eigen value problem.

Torsion

Torsion of circular solid and hollow shafts – power transmission – strain energy in shear and torsion – close coiled and open coiled helical springs.

Thin and thick cylinders

Lame's equation – stresses in thick cylinders due to internal and external pressures – compound cylinders – shrink fit – wire wound pipes and cylinders.

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. *Gere, J.M., Mechanics of Materials, Thomson, Singapore, 2001.*
2. *Popov, E.P., Mechanics of Materials, Prentice Hall India, New Delhi, 2002.*
3. *Timoshenko, S.P., and Young, D.H., Elements of Strength of Materials, East West Press, New Delhi, 2003.*
4. *Beer, F. P. and Johnston, E. R., Mechanics of Materials, Tata McGraw Hill, New Delhi, 2005*
5. *Hearn, E. J., Mechanics of Materials Pergamon Press, Oxford, 1982.*
6. *Nash, W. A., Strength of Materials, Schaum's Outline Series, McGraw Hill, New York, 1988.*

Course Title: Engineering Geology
Course Code: BCE510

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 importance of seismic activity considerations in a terrain.
2. Interpret geology and its types, various features like fault, fissures, weathering etc., minerals, rocks, and rock formations in relation to civil engineering structures.
3. Classify the various techniques to analyses and to made possible solutions for various Geological Engineering problems.
4. Classify various techniques to determine engineering properties of rocks etc.

Course Content

UNIT I **10 Hours**

General Geology:

Importance of Engineering Geology applied to Civil Engineering. Practices. Weathering, definition, types and effect. Geological works of rivers, wind, glaciers as agents of erosion, transportation and deposition.

Rocks & Minerals:

Minerals, their identification igneous, sedimentary & metamorphic rocks. classification of rocks for engineering purposes. Rock quality designation (ROD)

UNIT II **10 Hours**

Structural Geology:

Brief idea about stratification, apparent dip, true dip, strike and in conformities. Folds, faults & joints: definition, classification relation to engineering, Operations.

Engineering Geology:

Geological considerations in the Engineering. Projects like tunnels, highways, foundation, dams, and reservoirs. Earthquake: Definition, terminology, earthquake waves, intensity, recording of earthquake.

UNIT III **12 Hours**

Engineering properties of rocks and laboratory measurement:

Uniaxial compression test, tensile tests, permeability test, shear tests, size and shape of specimen rate of testing. Confining pressure, stress strain curves of typical rocks. Strength of intact and fissured rocks, effect of anisotropy, influence of effect of pore fluid type unsaturated and temperature.

UNIT IV **13 Hours**

In-situ determination of Engineering Properties of Rock masses:

Necessity of in-situ tests, Uniaxial load tests in tunnels and open excavations, cable tests, flat jack test, shear test, pressure tunnel test. Simple methods of determining in situ stresses bore hole inner coring technique-bore hold deformation gauges.
Improvement in properties of Rock masses: Pressure grouting for dams and tunnels, rock reinforcement rock bolting.

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. *Introduction to Rock Mechanics: Richard E. Goodman, CBS Publishers & Distributors Pvt. Ltd.*
2. *Rock Mechanics and Engg.: Jaager C, George Allen &Unwin Publishers.*

Engineering Geology: D. S. Arora, Khanna Publishers, New Delhi

SEMESTER- VI

Course Title: Design of Concrete Structure -II
Course Code: BCE610

L	T	P	Cr.
4	0	0	4

Total: 60 Hours

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

1. Apply the loads on building frames and analyze them using direct and indirect methods.
2. Analyze the concrete components such as continuous beams, flat slabs, tanks and retaining walls, etc.
3. Design and detail the concrete components such as curved beams, flat slabs, tanks and retaining walls, etc.
4. Analyze and design the special foundations such as raft, pile and machine foundations.

Course Content

UNIT I **15 Hours**

Foundations - Theory and Design: Isolated Footing (Square, Rectangular), Combined Footing (Rectangular, Trapezoidal, Strap), Raft Footing

UNIT II **15 Hours**

Compression Members: Definitions, Classifications, Guidelines and Assumptions, Design of Short Axially Loaded Compression Members, Design of Short Compression Members under Axial Load with Uniaxial and biaxial Bending, Preparation of Design Charts, Design of Slender Columns

UNIT III **15 Hours**

Design of Continuous beams and curved beam, Design of Domes.

UNIT IV **15 Hours**

Design of Retaining walls: Cantilever type retaining wall, Counter fort type retaining wall.

Introduction to water retaining structures. Design of circular and rectangular water tanks resting on ground.

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. *Reinforced Concrete Design; Pillai & Menon; Tata McGraw-Hill Education*

2. *Limit state Design of Reinforced Concrete; Varghese P C; Prentice-Hall of India Pvt. Ltd".*
3. *Reinforced Cement Concrete, Mallick and Rangasamy; Oxford-IBH.*

BIS Codes of practice and Design Handbooks:

1. IS 456-2000- Indian Standard. Plain and Reinforced concrete -Code of practice
2. IS 3370- Code of practice for concrete structures for storage of liquids
3. Design Aid SP 16 4. Explanatory hand book SP24.
4. Detailing of Reinforcement SP 34 Note: The codes marked with * are permitted in examination.

Course Title: Irrigation Engineering
Course Code: BCE602

L	T	P	Cr.
4	0	0	4

Total: 60 Hours

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

1. Comprehend the basic concepts of irrigation and construction of various hydraulic structures.
2. Comprehend the basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management.
3. Analyze the elementary hydraulic design of different structures and the concepts of maintenance shall also form part.
4. Develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects.

Course Content

UNIT I **15 Hours**

INTRODUCTION: Importance of Irrigation Engineering, purposes of Irrigation, objectives of Irrigation, Benefits of Irrigation, Advantages of various techniques of irrigation--Furrow Irrigation, Boarder strip Irrigation, Basin Irrigation, Sprinkler Irrigation, Drip Irrigation.

METHODS OF IRRIGATION: Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta, Duty of water, Base Period, relation between delta, duty and base period, Soil crop relation-ship and soil fertility.

UNIT II **15 Hours**

CANAL IRRIGATION: Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages, Silt theories-Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's &Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy &Lacey's theories.

LINED CANALS: Types of lining, selection of type of lining, Economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals, methods of providing drainage behind lining.

UNIT III **15 Hours**

LOSSES IN CANALS, WATER LOGGING AND DRAINAGE: Losses in canals, Evaporation and seepage, water logging, causes and ill effects of water logging anti water logging measures. Drainage of land, classification of drains - surface and subsurface drains Design considerations for surface drains, Advantages and maintenance of tile drains.

INVESTIGATION AND PREPARATION OF IRRIGATION PROJECTS: Classification of project, Project preparation-investigations, Design of works and drawings, concept of multi - purpose projects, Major, Medium and miner projects, planning of an irrigation project, Economics & financing of irrigation works. Documentation of project report.

UNIT IV **15 Hours**

TUBE - WELL IRRIGATION: Types of tube wells - strainer type, cavity type and slotted type. Type of strainers, Aquifer, porosity, uniformity coefficient, specific yield &specific retention, coefficients of permeability, transmissibility and storage. Yield or discharge of a tube well, Assumptions, Theim's & Dupuit's formulae, Limitations of Theim's and Dupuit's formulae. Interference of tube wells with canal or adjoining tube-wells, causes of failure of tube wells, optimum capacity, Duty and delta of a tube well. Rehabilitation of tube well.

RIVER TRAINING WORKS: Objectives, classification of river-training works, Design of Guide Banks. Groynes or spurs - Their design and classification ISI. Recommendations of Approach embankments and afflux embankments, pitched Islands, Natural cut-offs and Artificial cut-offs and designs Considerations.

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. *Principles & practice of Irrigation Engg. S. K. Sharma; S. Chand, Limited.*
2. *Irrigation & Water Power Engg. B.C. Punmia, Pande B. B. Lal; Laxmi Publications (p) Ltd*
3. *Fundamentals of Irrigation Engg. Dr. Bharat Singh; Nem Chand & Bros*
4. *Irrigation Engg. & Hydraulic Structure S.R. Sahasrabudhe; S. K. Kataria & Sons*
5. *Irrigation Engg. & Hydraulic Structure Varshney, Gupta & Gupta; Nem Chand and Brothers*
6. *Irrigation Engg. & Hydraulic Structure Santosh Kumar Garg; Khanna Publishers*

Course Title: Repair & Rehabilitation of Structures
Course Code: BCE607

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 quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.
2. Classify various distress and damages to concrete and masonry structures.
3. Classify various types and properties of repair materials
4. Comprehend the importance and methods of substrate preparation

Course Content

UNIT I: **10 Hours**

Introduction Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures. Cracks in R.C. buildings various cracks in R.C. buildings, causes and effects

Maintenance importance of maintenance, routine and preventive maintenance. Damages to masonry structures various damages to masonry structures and causes

UNIT II: **10 Hours**

Repair materials Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials Special mortars and concretes Polymer Concrete and Mortar, Quick setting compounds

Grouting materials Gas forming grouts, Sulfamate grouts, Polymer grouts, Acrylate and Urethane grouts. Bonding agent's Latex emulsions, Epoxy bonding agents. Protective coatings Protective coatings for Concrete and Steel FRP sheets

UNIT III: **10 Hours**

Damage diagnosis and assessment Visual inspection, Non-Destructive Testing using Rebound hammer, ultrasonic pulse velocity, semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement Substrate preparation Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcing steel cleaning

UNIT IV: **15 Hours**

Crack repair Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, reinforced concrete jacketing, Steel jacketing, FRP jacketing. Strengthening strengthening, Beam shear strengthening, Flexural strengthening

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. *Shetty M.S., "Concrete Technology – Theory and Practice", S. Chand and Company, 2008.*
2. *Dov Kominetzky. M. S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001*
3. *Ravishankar. K., Krishnamoorthy. T. S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.*
4. *CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.*
5. *Gambhir. M. L., "Concrete Technology", McGraw Hill, 2013.*

Course Title: Engineering Economics, Estimation & Costing
Course Code: BCE605

L	T	P	Cr.
4	0	0	4

Total: 60 Hours

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

1. Comprehend the method to Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
2. Calculate payback period and capitalized cost on one or more economic alternatives.
3. Comprehend the method to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
4. Interpret the preparation of cost estimation report for any project.

Course Content

UNIT I: **15 Hours**

Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic analysis – Material selection for product design selection for a product – Process planning.

UNIT II: **15 Hours**

Introduction: Purpose of estimating and valuation, Types of estimates. Building Estimate: Main items and their unit of measurement, methods of Measurement-Methods of estimating quantities, Estimating quantities of building. Estimation of quantity of load bearing structure with single room & two rooms, Estimation of quantity single storied residential building, Estimation of quantity Different R.C.C. structures, Estimation of quantity of water supply and sanitary works, Estimation of quantity of culverts and bridges, Road estimating, Estimation of quantity of Trusses. Introduction to estimates of other Civil Engineering Structures.

UNIT III: **15 Hours**

Market Survey: Traditional and modular materials, Market survey of materials of Construction, Wages of labour, Tools plant and equipment of construction. Rate Analysis: Prerequisites, factors affecting rate analysis, overhead expenses, procedure for rate analysis, schedule of rates, Task work: labour requirement for different works, material requirement for different works, Rate analysis of different Items of work.

Abstracting and Billing: Purpose of abstract, preparation of abstract, measurement and billing, checking of bills and final bill

UNIT IV: **15 Hours**

Valuation: Purpose of valuation, types of property- Depreciation, Sinking fund, Lease hold and free hold property, obsolescence, Gross income, Outgoing and Net income, Capitalized value and year's purchase. Rental method of valuations, and typical problems.

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. *Pasrija, HD, Arora, CL and S. Inderjit Singh, "Estimating, Costing and Valuation (Civil)", New Asian Publishers, Delhi,*
2. *Rangwala, S.C, Estimating and Costing", Anand, Charotar Book Stall*
3. *Chakraborti, M, "Estimating, Costing and Specification in Civil Engineering", Calcutta*
4. *Dutta, BN, "Estimating and Costing*
5. *Mahajan Sanjay, "Estimating and Costing" Satya Parkashan, Delhi*
6. *Quality surveying by Gurbakshish Singh; Eagle Prakashan, Jalandhar*

Course Title: Computer Aided Structural Drawing
Course Code: BCE612

L	T	P	Cr.
0	0	4	2

Total: 20 Hours

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

1. Prepare structural drawings of reinforced concrete elements
2. Prepare structural drawings of steel elements

Course Content

1. Structural Drawings of Reinforced Concrete Elements such as Beams, Slabs.
2. Structural Drawings of Steel Elements such as Connections, Tension Members, Compression Members, Beams, Column Base, and Roof Trusses.

COURSE TITLE: Composite Materials
COURSE CODE: BCE614

L	T	P	Credits
3	0	0	3

Total: 45 Hours

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

1. Interpret the behavior of constituents in the composite materials.
2. Classify the different types of reinforcement.
3. Comprehend the properties and manufacturing methods available for composite material.
4. Interpret the properties of sulphur and light weight concrete.

Course Content

UNIT I **15 Hours**

Fiber Reinforced Concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fiber reinforced concrete, Composite Material approach, Application of fiber reinforced concrete.

Fly Ash Concrete: Classification of Indian Fly ashes, Properties of Fly ash, Reaction Mechanism, Proportioning of Fly ash concretes, Properties of Fly ash concrete in fresh and hardened state, Durability of fly ash concrete.

UNIT II **15 Hours**

Polymer Concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.

Ferro Cement: Constituent materials and their properties, Mechanical properties of Ferro cement, Construction techniques and application of Ferro cement.

UNIT III **7.5 Hours**

High Performance Concrete: Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high-performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.

UNIT-IV **7.5 Hours**

Sulpher Concrete and Sulpher Infiltrated Concrete: Process technology, Mechanical properties, Durability and applications of Sulpher concrete, Sulpher infiltrated concrete, Infiltration techniques, Mechanical properties, Durability and applications of Sulpher infiltrated concrete.

Light weight concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight 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. *Concrete, its Properties and Microstructure by P.K. Mehta, and P.J.M. Monterio, 1993.*
2. *Ferro cement by B.K. Paul, and R.P. Pama, 1978.*
3. *Fiber Reinforced Concrete by Bentur and Mindess, 2006.*
4. *Fly ash in Concrete by Malhotra and Ramezanianpour, 1994.*

Course Title: Human Relations at Work
Course Code: BCE608

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 modalities of Human Relations in the Workplace.
2. Evaluate the importance of human relations skills in today's workplace.
3. Analyze the role of Corporate Culture and Organizational Politics and their impact on human relations within today's workplace.
4. Demonstrate the ability to work effectively with others with diverse backgrounds & values.

Course Content

Unit 1: **10 Hours**

Understanding organizations and Organization Behavior; Definition, and Features; Models of Organizational Behavior.

Unit 2: **10 Hours**

The Individual: Ability; Learning; Attitudes; Personality and Values; Perception & Individual Decision making; Motivation- Definition, Nature of Motivation, Early and Contemporary Theories of Motivation

Unit 3: **10 Hours**

Foundations of Group Behavior and Dynamics– Defining and Classifying Groups; Stages of Group Development; Team and Team Building- Purpose, Types and Creating Effective Teams; Communication-Communication network, The Communication Process, Interpersonal and Organizational Communication, Leadership-Trait and Behavioral Theories.

Unit 4: **15 Hours**

Interpersonal Behavior: Power and Politics- Definition, Bases of Power, Dependency and Power Tactics, Unequal Power and Implication for Managers.

Conflict Management- The traditional View, The Human Relation View, The Interactions View, Conflict Process, Negotiation- Bargaining strategies.

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. *Organization Behaviour, Stephen P. Robbins; Timothy A. Judge; Seema Sanghi. 13th Edition, Pearson-Prentice Hall.*

2. Organizational Behaviour- A Modern Approach by Arun Kumar, N Meenakshi, Vikas Publishing.

3. Organization Behaviour, V.S.P. Rao, 1st Edition, , Excel Books.

4. Organization Behaviour, Margie Parikh, Rajen Gupta, 1st Edition, Tata McGraw Hill.

Course Title: Project-I

Course Code: BCE613

L	T	P	Cr
0	0	4	2

Total: 30 Hours

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

1. Use of latest Software in the research lab.
2. Design and construct a multistory Building.
3. Perform work on multidisciplinary problems.
4. Comprehend the recycling of waste material.

Course Content

1. Sustainable construction material recycling.
2. Urban surface/subsurface water management.
3. Landscape architecture considerations relevant to urban design and human health.
4. Waste treatment and bio fuel production.
5. Power generation and safety; Building Information Modeling; and smart cities and sensing.

SEMESTER-VII

Course Title: Design of Steel Structure-II
Course Code: BCE706

L	T	P	Cr.
4	0	0	4

Total: 60 Hours

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

1. Analyze & design the plate and gantry girder
2. Interpret the fundamental of steel structures.
3. Analyze and design the tension, compression & column bases member under axial and combined loading
4. Interpret the pre-engineered buildings, bridges & trusses

Course Content

Unit-I **15 Hours**

Elements of a plate girder, design of a plate girder, curtailment of flanges, various type of stiffeners.

Unit-II **15 Hours**

Design of steel foot bridge with parallel booms and carrying wooden decking, using welded joints.

Unit-III **15 Hours**

Complete design of an industrial shed including:

1. Gantry girder
2. Column bracket
3. Mill bent with constant moment of inertia
4. Lateral and longitudinal bracing for column bent

Unit-IV **15 Hours**

Design of single-track railway bridge with lattice girders having parallel chords (for B.G.)

1. Stringer
2. Cross girder
3. Main girders with welded joints
4. Portal sway bracings
5. Bearing rocker and rollers

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. *Limit state design of steel structures: S K Duggal.*
2. *Design of steel structures: N Subramanian.*
3. *Design of steel structures (Vol. 2): Ram Chandra.*
4. *Design of steel structures: L S Negi.*
5. *IS 800: 2007 (General construction in steel-Code of practice).*
6. *SP: 6(1) (Handbook for structural engineers-Structural steel sections), permitted in Examination.*

Note: Use of relevant Indian Standards is allowed.

Course Title: Foundation Engineering
Course Code: BCE702

L	T	P	Cr.
4	0	0	4

Total: 60 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 for a 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 and Hiley'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 a pile 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 submerged 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*

Course Title: Transportation Engineering-II
Course Code: BCE707

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 railway track components and their functions.
2. Interpret the geometric design, points and crossings, track resistances, signaling and control system.
3. Summarize the advancement in Railway stations, yards, modernization of railways & High-Speed Trains.
4. Acquaint with bridge terminology, types of bridges, bridge hydrology and river training works.

Course Content

Unit-I **10 Hours**

Introduction to Railway Engineering: History of Railways, Development of Indian Railway, Organization of Indian Railway, Important Statistics of Indian Railways. 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 on Indian Railways, Detailed Cross-Section of Single/Double Track on Indian Railways. Components of Railway Track: Rails, Sleepers, Ballast, Subgrade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.

Geometric Design of Railway Track: Alignment, Gradients, Horizontal Curve, Super elevation, Equilibrium Cant, Cant Deficiency, Transition Curves.

Unit-II **15 Hours**

Points and Crossings: Functions, Working of Turnout, Various types of Track Junctions and their layouts, Level-crossing.

Railway Stations & Yards: Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations & Yards

Signaling and Interlocking: Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signaling, Principal of Interlocking.

Modernization of Railway Tracks: High Speed Tracks, Improvement in existing track for high speed, Ballast less Track, MAGLEV, TACV Track.

Unit-III **10 Hours**

Introduction to Airport Engineering: Air Transport Scenario in India and Stages of Development, National and International Organizations.

Airport Planning: Aircraft Characteristics, Factors for Site Selection, Airport Classification, General Layout of an Airport. Obstructions and Zoning Laws, Imaginary Surfaces, Approach Zones and Turning Zones.

Unit-IV **10 Hours**

Runway Orientation and Design: Head Wind, Cross Wind, Wind Rose Diagram, Basic Runway Length, Corrections, Geometric Design Elements, Runway Configuration.

Taxiway and Aircraft Parking: Aircraft Parking System. Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.

Visual Aids: Marking and Lighting of Runway and Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

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. *Chandra S., and Aggarwal, "Railway Engineering", M.M. Oxford University Press, New Delhi, 2007.*
2. *Saxena, S.C., and Arora, S.P., "A Text Book of Railway Engineering", Dhanpat Rai and Sons, Delhi, 1997.*
3. *J. S. Mundrey, "Railway Track Engineering", McGraw Hill Publishing Co., 2009*
4. *Khanna, S.K., Arora, M.G., and Jain, S.S., "Airport Planning and Design", Nem Chand & Bros. Roorkee, 1999.*
5. *Horenjeff, R. and McKelvey, F., "Planning and Design of Airports", McGraw Hill Company, New York, 1994.*
6. *Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, "Airport Engineering: Planning, Design and Development of 21st Century", Wiley Publishers, 2011*

Course Title: Rural water Supply And onsite Sanitation Systems
Course Code: BCE708

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. Comprehend the water quality concepts and their effect on treatment process selection.
2. Appreciate the importance and methods of operation and maintenance of water supply systems.
3. Analyze and evaluate the water supply for rural sanitation and communicate effectively in oral and written presentations to technical and non-technical audiences.
4. Classify various methods for solid waste management.

Course Content

Unit-I **10 Hours**

Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits-National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies.

Unit-II **10 Hours**

Low-Cost Water Treatment: Introduction – Epidemiological aspects of water quality-methods for low-cost water treatment-Specific contaminant removal systems

Unit-III **15 Hours**

Rural Sanitation: Introduction to rural sanitation-Community and sanitary latrines-planning of waste water collection system in rural areas- Ecological sanitation approach – Grey water and storm water management Compact and simple wastewater treatment systems in rural areas-catch basins-constructed wetlands- roughing filters- stabilization ponds - septic tanks – anaerobic baffled reactors-soak pits- low cost excreta disposal systems, Village ponds as sustainable wastewater treatment system-Wastewater disposal

Unit-IV **10 Hours**

Solid Waste Management: Disposal of Solid Wastes- Composting- land filling-incineration- Biogas plants- Other specific issues and problems encountered in rural sanitation.

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. *Eulers, V. M., and Steel, E. W., Municipal and Rural Sanitation, 6th Ed., Mc Graw Hill Book Company.*
2. *Wright, F.B., Rural water Supply and Sanitation, E. Robert Krieger Publishing Company, Huntington, New York.*
3. *Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Viewson Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc).*
4. *Winbald, U., and Simpson-Hebert, M., Ecological Sanitation, SEI, Stockholm, Sweden.*
5. *Kadlec R.H. and Wallace S.D. Treatment Wetlands, CRC Press, Boca Raton*
6. *Wastewater Engineering–Treatment and Reuse, Metcalfand Eddy, Tata Mc Graw Hill.*

Course Title: Solid & Hazardous Waste Management
Course Code: BCE709

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 problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste etc.
2. Interpret the legal, institutional and financial aspects of management of solid wastes.
3. Analyze the environment and health impacts of solid waste mismanagement.
4. Comprehend the engineering, financial and technical options for waste management

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

Suggested Readings:

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.

Course Title: Project-II

Course Code: BCE710

L	T	P	Cr
0	0	10	5

Total: 75 Hours

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

5. Use of latest Software in the research lab.
6. Design and construct a multistory Building.
7. Perform work on multidisciplinary problems.
8. Comprehend the recycling of waste material.

Course Content

6. Sustainable construction material recycling.
7. Urban surface/subsurface water management.
8. Landscape architecture considerations relevant to urban design and human health.
9. Waste treatment and bio fuel production.
10. Power generation and safety; Building Information Modeling; and smart cities and sensing.

COURSE TITLE: Introduction to Civil Engineering
COURSE CODE: BCE711

L	T	P	Credits
2	0	0	2

Total: 30 hours

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

1. Evaluate the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
2. Interpret the different types of buildings, building components, building materials and building construction.
3. Comprehend the importance, objectives and principles of surveying.
4. Summarize the basic infrastructure services MEP, HVAC, elevators, escalators and ramps.

Unit-I **7.5 Hours**

Relevance of Civil Engineering in the overall infrastructural development of the country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering. Introduction to buildings: Types of buildings, selection of site for buildings, components of a residential building and their functions. Building rules and regulations: Relevance of NBC, KBR & CRZ norms (brief discussion only). Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.

Unit-II **7.5 Hours**

Surveying: Importance, objectives and principles.

Construction materials, Conventional construction materials: types, properties and uses of building materials: bricks, stones, cement, sand and timber

Cement concrete: Constituent materials, properties and types.

Steel: Steel sections and steel reinforcements, types and uses.

Modern construction materials: - Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).

Unit-III **7.5 Hours**

Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only).

Load bearing and framed structures (concept only).

Brick masonry: - Header and stretcher bond, English bond & Flemish bond random rubble masonry.

Unit-IV **7.5 Hours**

Roofs and floors: - Functions, types; flooring materials (brief discussion only).

Basic infrastructure services: MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings.

Green buildings: - Materials, energy systems, water management and environment for green buildings. (Brief discussion only).

Transactional Mode:

Video based teaching, Group Discussion, Cooperative teaching, Demonstration, Open Talk

Suggested Readings:

1. Penn, M. and P. Parker, Introduction to Infrastructure (2012), John Wiley & Sons, Inc., New York [ISBN978-0-470-41191-9].

SEMESTER- VIII

Course Title: Construction Equipment & Management
Course Code: BCE802

L	T	P	Cr.
4	0	0	4

Total: 60 Hours

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

1. Derive feasibility of specific equipment in different project conditions
2. Select an automation technique in construction industry.
3. Select suitable Drone technology for surveying and project management
4. Analyze benefits of robotics versus conventional construction equipment

Course Content

Unit I **15 Hours**

INTRODUCTION:

Introduction: Unique features of construction equipment Need of construction Equipment, past history. Construction Equipment: Capacity, Feasibility, owning and operating cost and Productivity of Different Equipment: Excavators, Pavers, Plastering machines; Pre-stressing jacks and grouting equipment; Cranes and Hoists, Concrete Batching Plants, etc.

Unit II **15 Hours**

Automation in Construction Industry: Need and Benefit of automation: Automation in Canal lining, Automation in Construction of Highway, Automation in concrete technology.

Unit III **15 Hours**

Robotics in Construction: Introduction, Benefits of robots in construction industry with respect to time, cost, quality, safety. Use of robots for construction activities like Brick laying, Demolition, Material Handling, Structural steel cutting, Rebar tying/bending, Form work mould making, 3D printing- print complex, layered, parts and objects of homes, buildings, bridges and roads

Unit IV **15 Hours**

Construction Equipments: Tractors, bull dozers, rippers, scrappers power shovels, dragline, hoes. Line diagram of each, sizes, output, uses, factors affecting selection of each equipment, economic life of equipment maintenance and repair cost. Hoisting & transporting equipments: Hosts, Winches, Cranes, Belt conveyors, Ropeways, trucks & Wagons.

Transactional Mode:

Video based teaching, Group Discussion, Cooperative teaching, Demonstration, Open Talk

Suggested Readings:

1. John Pichtel Waste Management Practices CRC Press, Taylor and Francis Group 2005.
2. La Grega, 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.

Course Title: Metro Systems & Engineering
Course Code: BCE803

L	T	P	Cr.
4	0	0	4

Total: 45 Hours

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

1. Comprehend the need metros with basic planning and financials.
2. Classify various construction methods in metro systems.
3. Interpret the safety standards used in the project management
4. Analyze mechanical and rolling stock.

Course Content

Unit I **15 Hours**

OVERVIEW: General: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials.

Unit II **10 Hours**

CONSTRUCTION METHODS: Civil Engineering- Overview and construction methods for elevated and underground stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations;

Unit III **10 Hours**

QUALITY & SAFETY SYSTEMS: Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

Unit IV **10 Hours**

MECHANICAL & ROLLING STOCK: Mechanical & TVS, AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators. ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

Transactional Mode:

Video based teaching, Group Discussion, Cooperative teaching, Demonstration, Open Talk

Suggested Readings:

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.

Course Title: Project-III

Course Code: BCE804

L	T	P	Cr
0	0	10	5

Total: 75 Hours

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

1. Use of latest Software in the research lab.
2. Design and construct a multistory Building.
3. Address the multidisciplinary Problems.
4. Evaluate the recycling of waste material.

Course Content

1. Sustainable construction material recycling.
2. Urban surface/subsurface water management.
3. Landscape architecture considerations relevant to urban design and human health.
4. Waste treatment and bio fuel production.
5. Power generation and safety; Building Information Modeling; and smart cities and sensing.

COURSE TITLE: Introduction to Concrete Technology
COURSE CODE: BCE805

L	T	P	Credits
2	0	0	2

Total: 30 hours

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

1. Comprehend the concepts related Concrete technology which involves types and property of concrete and different adhesive materials and its vital use for safe, economic development for the buildings.
2. Present the foundations of many basic Engineering tools and concepts related to Concrete technology and Civil Engineering.
3. Implementation of engineering concepts which are applied in field of Civil Engineering.
4. Prepare fresh concrete for construction work.

Course Content

Unit-I **7.5 Hours**

Basics: Historical background, composition of concrete, general note on strength mechanism, recent practice and future trends.

Unit-II **7.5 Hours**

Constituent of Concrete:

1. Cement - Chemical composition, hydration, heat of hydration, hydrated structure, various types of cement, testing of cement as per Indian standard.

2. Aggregates - Utility in concrete, classification, effect of geometry & texture, strength, mechanical properties, moisture content, water absorption, bulking of sand, deleterious substances, sieve analysis, various grading and grading requirements, sampling & testing as per Indian Standards.

Unit-III **7.5 Hours**

1. Water - General Requirements & limiting values of impurities.

2**. Admixtures** - Additives and admixtures, types, necessity and benefit Mineral admixture - Fly ash, silica fume, blast furnace slag, and other pozzolanic materials. Chemical admixtures - Accelerator, retarder, water reducing elements, plasticizer and super-plasticizer, their functions and dosage.

Unit-IV **7.5 Hours**

Fresh concrete:

Methods of mixing, transporting and placing of concrete. Workability – Definition and requirement, factors affecting workability, various tests as per IS and ASTM. Segregation and bleeding, stiffening, re-tempering. Curing: necessity and various methods, micro-cracking.

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

Suggested Readings:

1. M S Shetty; Concrete Technology, S. Chand Publication New Delhi.

2. P Kumar Mehta, Monteiro; Concrete Technology, Indian Concrete Institute.

3. A R Santhakumar; Concrete Technology, Oxford University Press.

4. A.M. Neville; Properties of Concrete, Pearson Education 5. M L Gambhir; Concrete Technology, Tata McGraw Hill.