JECRC™
UNIVERSITY
BUILD YOUR WORLD

SCHOOL OF ENGINEERING

SYLLABUS AND COURSE STRUCTURE

B. TECH (CIVIL ENGINEERING)

ACADEMIC YEAR 2015-16

CODE AND SUBJECT SCHEME FOR B.TECH. CIVIL

Semester III

Code	Subject	Contact Hours/week			Total Credits	
		L	T	P		
BAS003A	Multivariate Analysis, Linear Algebra and Special Functions	3	0	0	3	F
BES018A	Engineering Materials	3	0	0	3	F
BCI001A	Building Materials & Concrete Technology	3	0	0	3	C
BCI061A	Solid Mechanics I	3	1	0	4	C
BCI003A	Fluid Mechanics	3	1	0	4	C
BCI004A	Engineering Geology	3	0	0	3	C
BCI024A	Material Testing Lab	0	0	2	2	C
BCI006A	Engineering Geology Lab	0	0	2	2	C
BCI007A	Building Materials & Concrete Technology Lab	0	0	2	2	C
BHS003A	Professional Skills	7	0	0	7	ID
BCI008A	Seminar	0	0	1	1	C
BMC001A	Energy Studies	3	0	0	3	ID
	TOTAL	**28**	**2**	**7**	**37**	

Semester IV

Code	Subject	Contact Hours/week			Total Credits	
		L	**T**	**P**		
BAS005A	Complex Analysis	2	0	0	2	F
BCI009A	Geotechnical Engineering I	3	0	0	3	C
BCI010A	Rock Mechanics	3	0	0	3	C
BCI011A	Design of Steel Structures	3	1	0	4	C
BCI062A	Solid Mechanics II	3	1	0	4	C
BCI013A	Engineering Surveying I	3	0	0	3	C
BCI014A	Hydraulics & Hydraulic Machine	3	0	0	3	C
BEE024A	Basic Simulation Laboratory	0	0	2	2	F
BCI063A	Fluid Mechanics and Hydraulics Lab	0	0	2	2	C
BCI016A	Engineering Surveying Lab I	0	0	3	3	C
BHS004A	Professional Skills	6	0	0	6	ID
BCI017A	Seminar	0	0	1	1	C
	TOTAL	**26**	**2**	**8**	**36**	

Semester V

Code	Subject	Contact Hours/week			Total Credits	
		L	T	P		
BAS006A	Probability and Statistics	2	0	0	2	F
BCI018A	Geotechnical Engineering II	3	0	0	3	C
BCI019A	Engineering Surveying II	3	0	0	3	C
BCI020A	Reinforced Cement Concrete	3	1	0	4	C
BCI064A	Theory of Structures	3	1	0	4	C
	Program Elective – I	3	0	0	3	S
	Open Elective	3	0	0	3	ID
BCI022A	Geotechnical Engineering Lab	0	0	2	2	C
BCI023A	Engineering Surveying Lab II	0	0	3	3	C
BCI065A	CAD Building Drawing Lab	0	0	2	2	C
BHS005A	Professional Skills	6	0	0	6	ID
BCI025A	Seminar	0	0	1	1	C
	TOTAL	**26**	**2**	**8**	**36**	

Program Elective-I (any one of the following)	
BCI026A - Advance Design of Steel Structures	BCI027A – Building Maintenance and Repairs

Semester VI

Code	Subject	Contact Hours/week			Total Credits	
		L	T	P		
BAS007A	Discrete Mathematics	2	0	0	2	F
BCI028A	Irrigation and Hydrology	3	1	0	4	C
BCI029A	Transportation Engineering I	3	0	0	3	C
BCI030A	Environmental Engineering I	3	1	0	4	C
	Program Elective – II	3	0	0	3	S
	Program Elective – III	3	0	0	3	S
	Open Elective	3	0	0	3	ID
BCI031A	STAAD Pro Lab	0	0	2	2	C
BCI032A	Structure Detailing Lab	0	0	2	2	C
BCI033A	Quantity Surveying and Valuation Lab	0	0	3	3	C
BHS006A	Professional Skills	6	0	0	6	ID
BCI034A	Seminar	0	0	1	1	C
	TOTAL	**26**	**2**	**8**	**36**	

Program Elective-II and III (one subject from each group)

PE II		PE III	
BCI035A	Rural Water Supply and Sanitation	BCI037A	Foundation Engineering
BCI036A	Advanced Reinforced Cement Concrete	BCI038A	Prestressed Concrete

Semester VII

Code	Subject	Contact Hours/week			Total Credits	
		L	T	P		
BAS004A	Optimization and calculus of variations	2	0	0	2	F
BCI039A	Water Resource Engineering	3	1	0	4	C
BCI040A	Transportation Engineering II	3	1	0	4	C
BCI041A	Environmental Engineering II	3	1	0	4	C
	Program Elective IV	3	0	0	3	S
	Program Elective V	3	0	0	3	S
	Open Elective	3	0	0	3	ID
BCI042A	Water Resource Engineering Lab	0	0	2	2	C
BCI043A	Transportation Engineering Lab	0	0	2	2	C
BCI044A	Environmental Engineering Lab	0	0	2	2	C
BHS007A	Professional Skills	6	0	0	6	ID
BCI045A	Seminar	0	0	1	1	C
	TOTAL	**26**	**3**	**7**	**36**	

Program Elective-IV and V (one from each group)			
PE IV		**PE V**	
BCI046A	Construction Project Management	BCI048A	Traffic Engineering
BCI047A	Construction Technology	BCI049A	Building Design

Semester VIII

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

Open Elective (Offered by the Department of Civil Engineering)

Code	Subject	Contact Hours/week			Total Credits		Semester
		L	T	P			
BCI051A	Solid Waste Management	3	0	0	3	ID	V
BCI052A	Planning for sustainable development	3	0	0	3	ID	V
BCI053A	Principles of Architecture and Town Planning	3	0	0	3	ID	VI
BCI054A	Disaster Management	3	0	0	3	ID	VI
BCI055A	Remote Sensing and GIS	3	0	0	3	ID	VII

BCI056A	Quality and Safety Management	3	0	0	3	ID	VII

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

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

Semester III

L-T-P	BAS003A - Multivariate Analysis, Linear Algebra and Special Functions	Credits: 3
3-0-0		

Objectives:

- The objective of this course is to familiarize the prospective engineers with techniques in multivariate analysis, linear algebra and some useful special functions.
- It deals with acquainting the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their profession.
- This course introduces vector calculus and its applications, in both differential and integral forms.

Unit 1

Multivariate functions covering, limits, continuity and differentials, partial derivatives, maximum-minimum problems, Laangians, Chain rule; Double integrals, iterated integrals, triple integrals, line integrals, simple connected regions, Green's theorem; Path independence, surface integrals, Stokes theorem; Fourier series and integral, Dirichlet conditions, Parseval's identity. The convolution theorem.

Unit 2

Vectors covering, laws of vector algebra, operations- dot, cross, triple products; Vector function – limits, continuity and derivatives, geometric interpretation

Unit 3

Gradient, divergence and curl – formulae; Orthogonal curvilinear coordinates; Jacobians, gradient, divergence, curl and Laplacian in curvilinear coordinates; Special curvilinear coordinates.

Unit 4

Gama Beta and other Special Functions covering, the Gama function, values and graph, asymptotic formula for T(n)l The Beta function – Dirichlet integral

Unit 5

Special functions – Error function, exponential integral, sine and cosine integrals, Bessel's differential equation and function (first and second kind), Legendre differential equation and polynomials; Some applications.

Outcomes:

- Ability to understand standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications.
- Students learn the use of vector calculus especially in fluid dynamics**.**
- Able to understand the application of Bessel functions to physical problems, particularly in the mechanics of solids and heat transfer

Text Book:

1. Grewal, B.S. - Engineering Mathematics, Khanna Publishers, New Delhi

Reference books:

1. Ramana - Advanced Engineering Mathematics, Tata McGraw Hill (TMH).

2. Guffy, D.G. - Advanced Engineering Mathematics.

3. Sastri, S.S.- Engineering Mathematics, PHI

L-T-P	BES018A - Engineering Materials	Credits: 3
3-0-0		

Objectives:

- To study the fundamental science and Engineering principles relevant to material.
- Understanding the relationship between nano/micro structures, Characterization, Properties and processing and design of materials.
- Have the experimental and Computational skills for a professional career or graduate study in materials.

Unit 1

Crystal Structure, Atomic structure and inter-atomic bonding structure of crystalline solids, Lattices, unit cells; Crystal systems, Bravais lattices; Indexing of directions planes, notations, Inter-planar spacing and angles, Co-ordination number, Packing factors.

Unit 2

Defects in Crystals, Point defects; Dislocations, Types of dislocations, Burger vector and its representation; Planar defects, Stacking faults, Twins, Grain boundaries; Mechanical properties of materials, concepts of stress and strain, Stress-strain diagram, Elastic and plastic deformation, Yield point phenomenon, Strengthening mechanism, Recovery, Re-crystallization and grain growth.

Unit 3

Unary and binary phase diagrams, Solid solutions – substitutional and interstitial, Iron-Iron carbide equilibrium phase diagram, Eutectoid, Eutectic and Peritectic reactions. Classification of Steel and Cast Iron, Effects of alloying on steel (Mn, Si, Cr, Mo, V, Ti & W) properties and applications.

Unit 4

Heat Treatment- Definition, Various types of heat treatment such as Annealing, Normalizing, Quenching, Tempering, Austempering, martempering and Case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening. Time Temperature Transformation (TTT) diagram and CCT diagram, Hardenability, Jominy end quench test.

Unit 5

Non-Metallic Materials- Polymers and its classification, Properties and applications of PE, PP, PS, PVC, PTFE Polymers; Ceramic materials and its classifications – Properties and applications of Al_2O_3, SiC etc; Composite materials - Introduction, Classification, Metal matrix and Ceramic matrix composites. Powder metallurgy, Compacting, Sintering, Vacuum processing. Properties of Powder processed materials, high energy compaction.

Outcomes:

- Able to apply general math, science and engineering skills to the solution of engineering problems.
- Able to select materials for design and construction.
- Understanding of fundamental science and Engineering principles relevant to material.

Text Book:

1. *Callister, W.D. - Materials Science and Engineering, John Wiley & Sons.*

Reference Books:

1. *Askeland, D.R. & Fullay, P.P. - The Science and Engineering of Materials–4th Cengage Learning Publishers*
2. *Callister, W.D., Callister's, Jr. - Materials Science and Engineering, (Adopted by R. Balasubramaniam) Wiley-Eastern*
3. *Edelstein, A.S. & Cammarata, R.C. - Nano Materials: Synthesis, Properties and Applications, Inst. Of Physics Publishing, UK*
4. *Raghavan, V. - Materials Science and Engineering, A First Course, Prentice Hall, India*
5. *Shackelford, J.F. - Introduction to Materials Science for Engineers, Prentice Hall, India.*

L-T-P 3-0-0	BCI001A - Building Materials and Concrete Technology	Credits: 3

Objectives:

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

Unit 1

Building Materials - Classification of Building materials, requirements of building materials and products, functional, aesthetical and economic. Doors and windows- Types, materials used, manufacture of doors and windows,fixtures. Wood varieties and uses, defects in timber, preservative treatments, and wood composites: particle and medium density fibre board's etc. Floors and roofs- Floors; types of floors, floor finishes, suitability. Roofs materials used

Unit 2

Surface Finishes, Pointing types, plastering materials, Cement, hydraulic lime, mortars and concrete, gypsum-concrete products, Paints and Varnishes: types and uses. Bricks and Tiles - Common clay brick, Brick masonry, stone masonry and block masonry.

Unit 3

Portland cement: Types and properties, Tests on Portland cements, aggregates: classification function, and types. Properties and tests on aggregates. Water: its quality and recommendations. Production of concrete: mixing, casting, compacting and curing of Concrete, workability concept, tests, workability factors, Admixtures: Purpose, use and Types

Unit 4

Properties of Ingredients-Properties of coarse and fine aggregates and their influence on concrete, Grades of concrete- physical properties of 33 Grade, 43 Grade, 53 Grade, Concrete for ordinary work, light weight concrete, high density concrete, workability, durability and strength requirements, effect of w/c ratio, laboratory testing of fresh and hardened concrete.

Unit 5

Concrete mix design-Mix design for compressive strength by I.S. methods, mix design for flexural strength. Ready mix concrete: requirements of ready mix concrete, transit mixer details, mix design of RMC, different tests. Admixtures-Plasticizers, retarders, accelerators and other admixtures.

Outcomes:

- Able to understand the suitable building material for particular site.
- Able to understand the sustainability of type of construction.
- Able to understand about the ingredients and the different grades of concrete.

Text Book:

1. *Rangwala - Engineering Materials, Charotar Publication.*

Reference Books:

1. *Ghosh - Materials of Construction, Tata McGraw Hill Publications.*
2. *Relevant IS Codes National Building Code 2003, Indian Standards Institution*
3. *Jain, O.P. & Jaikrishna - Plain & reinforced concrete, Vol. I.*
4. *Shetty, M.S. - Concrete technology, theory and practice.*
5. *Neville - Properties of concrete, El, Society & Pub.*

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

Objective:

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

Unit 1

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

Unit 2

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

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

Unit 3

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

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

Unit 4

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

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

Unit 5

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

Outcome:

- Demonstrated an ability to Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials

Text Books:

1. Bansal, R.K. - Strength of Materials – Laxmi Publications

2. Punmia, B.C. - Strength of Materials & Mechanics of Structures: Vol. I, II - Laxmi Publications

Reference Books:

1. Popov, E.P. - Engineering Mechanics of Solids – Pearson Education

2. Ryder G.H. - Strength of Materials – Macmillan and Co. Ltd

L-T-P	BCI003A – Fluid Mechanics	Credits: 4
3-1-0		

Objectives:

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

Unit 1

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

Unit 2

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

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome

- Categorize solutions to fluids problems by their fundamental assumptions
- List and explain the assumptions behind the classical equations of fluid dynamics
- Identify and formulate the physical interpretation of the mathematical terms used in solutions to fluid dynamics problems

Text book:

1. Bansal, R.K. - Fluid mechanics and hydraulic machines.

References:

1. Streeter, Wylie & Bedford: Fluid Mechanics

2. Natarajan, M.K. - Principles of Fluid Mechanics

3. Garde, R.J. - Fluid Mechanics Thorough Problems

L-T-P	BCI004A – Engineering Geology	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

Petrology-Rock forming processes.

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

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

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

Unit 4

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

Unit 5

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

Outcomes:

- Able to understand about the nature of rocks, structures, composition, and strength.
- Understanding of geological significance for dams, reservoirs, bridge, tunnel etc

Text Books:

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

Reference Books:

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

L-T-P 0-0-2	BCI024A – Material Testing Lab	Credits: 2

Experiments

1. Tensile strength of material with the help of Universal Testing Machine.
2. Compressive strength of material with the help of Universal Testing Machine.
3. Flexure strength of material with the help of Universal Testing Machine.
4. Shear strength of material with the help of Universal Testing Machine.
5. Bending tests on simply supported beam and Cantilever beam.
6. Torsion test
7. Hardness tests with Rockwell's method
8. Tests on closely coiled and open coiled springs
9. Compression test on wood or concrete
10. Charpy and Izod Impact test

L-T-P 0-0-2	BCI006A – Engineering Geology Lab	Credits: 2

Experiments

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

L-T-P 0-0-2	BCI007A – Building Materials and Concrete Technology Lab	Credits: 2

Experiments

Cement

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability.
5. Soundness of cement by Le-chatelier's apparatus.

Fine Aggregate

6. Sieve analysis of sand
7. Silt content of sand
8. Bulking of sand

Bricks:

9. Water absorption & Compressive strength

Concrete

10. Slump test & Compaction factor test
11. Flow table test
12. Compressive strength test

L-T-P	BMC001A – Energy Studies	Credits: 3
3-0-0		

Objectives:

- To know how various energy sources (renewable and nonrenewable) are generated and to enhance their contribution to the socio-economic development.
- To know what are different treaties, energy scenario and Energy policy related to India.
- To study latest trends of energy i.e. Solar and Wind powers.

Unit 1

Energy Sources - Fossil fuels, nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes

Unit 2

Energy Conversion - Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies

Unit 3

Global Energy Scenario- Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European Union Countries.

Unit 4

Indian Energy Scenario- Commercial and non-commercial forms of energy, Utilization pattern in the past, present and also future prediction, and sector wise energy consumption.

Unit5

Energy Policy: Energy policy issues at global level, national level and state level, Energy conservation act 2001, Electricity act 2003, Energy pricing and its impact on global variations.

Outcomes:

- Knowing the various generation processes, energy demand and energy policy; everyone is more inclined to energy conservation and can contact different government agencies for energy projects.
- Understanding role of energy in overall development of country.
- Knowing different energy policies at different levels.

Text Book:

1. *Bukhootsow, B. - Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.*

Reference Books:

1. *Goldenberg, J., Johansson, T. & Reddy, A.K.N. - Energy for Sustainable World, Wiley Eastern, 2005.*
2. *Brown, C.E. - World Energy Resources, Springer Publication, New York, 2002.*
3. *Culp, A.W. - Principles of Energy Conversion, McGraw Hill New York, 2004.*
4. *TEDDY Year Book, The Energy Research Institute (TERI), 2011.*

L-T-P	BHS003A – Professional Skills	Credits: 6
6-0-0		

L-T-P	BCI008A – Seminar	Credits: 1
0-0-1		

Semester IV

L-T-P	BAS005A - Complex Analysis	Credits: 2
2-0-0		

Objectives:

- The objective of this course is to familiarize the students, in some detail, about the analysis on Complex Number field.
- The central idea of analytic functions and the various series and transformations will find ready application in many branches of engineering.
- To develop the basic techniques and theorems of complex analysis that impinges on the solution to boundary value problems associated with the planar Laplace equations.

Unit 1

Complex Numbers covering, Functions Analysis including limits and continuity, derivatives; Cauchy Riemann Equations; Integrals, Cauchy theorem and Cauchy integral formulae;

Unit 2

Analytic Functions; Taylor's series, Singular points and poles; Laurent's Series, Residues, Residue Theorem

Unit 3

Evaluation of definite integrals covering, conformal mapping, Riemann's mapping theorem; Some general transformations, mapping a half plane into a circle; The Schwarz-Christoffel transformation; The solution of Laplace equation by conformal mapping;

Unit4

The complex inverse formula covering, the Bromwich contour, the use of Residue theorem in finding Laplace transforms; A sufficient condition for the integral around T to approach zero;

Unit 5

The case of infinitely many singularities; Application to boundary value problems

Outcomes:

- Would be able to understand about analytic functions and the various series and transformations.
- Concept of evaluating real definite integrals will be developed.
- Conformal mappings can be effectively used by students for construction solutions to the Laplace equation on complicated planar domains that appear in a wide range of physical problems, including fluid mechanics, aerodynamics, thermo-mechanics, electrostatics, and elasticity.

Text book:

1. *Brown & Churchill - Complex Variables and Applications, McGraw-Hill Higher Education*

Reference books:

1. *Rudin, W.* - Real and complex analysis, *2nd ed., McGraw-Hill, New York, St. Louis, San Francisco, 1974.*

L-T-P	BCI009A - Geotechnical Engineering – I	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

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

Unit 2

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

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

Unit 3

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

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

Unit 4:

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

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

Unit 5:

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

Outcomes:

- Develop a basic understanding of the engineering properties of soil, and the use of such properties in the analysis of selected geotechnical engineering problems.
- Understanding of the fundamental behavior of soil and its relevance to civil engineering operations

and applications

- Develop a understanding the behavior of soil in field conditions
- Develop a basic idea how to minimize the soil failure due to natural occurring processes.
- Develop a concept to adopt the best suitable technique for soil strength improvement techniques.
- Develop an idea of engineering behavior soil on the basis of laboratory experiments.

Text Books:

1. *Punamia, B.C. - Soil Mechanics and Foundation Engineering*

Reference Books

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

L-T-P	BCI010A – Rock Mechanics	Credits: 3
3-0-0		

Objectives:

- The objective of the course is to provide basic knowledge of Rock Mechanics and its application.
- To understand the design aspects of various structures in/on rock like tunnels and other underground openings slopes etc.
- Helping to design and construction foundations and other constructions.

Unit 1

Introduction, Importance and application of rock mechanics to engineering problems; Rock Mechanics and its relationship with soil mechanics and engineering geology. Definition of Rock masses. Rock masses as construction material: Main features constituting rock mass. Effect of alteration and weathering.

Unit 2

Engineering properties of rocks, Porosity, Density, Moisture content, Degree of saturation, Coefficient of permeability, Durability, Compressive strength, Tensile strength, Shear strength, elasticity, Plasticity Deformability. Sampling and Samples Preparations – IS Code, Uniaxial Compressive strength, Tensile Strength – Brazilian test, Shear strength test. Plate load test for deformability, Shear test, Test for internal stresses – flat Jack.

Unit 3

Classification - Lithological classification of rocks, Rock mass classification, Rock Quality Designation, Rock Structure rating, RMR classification, Q classification. Inter relation between Q and RMR. Classification of fissures, joints and faults.

Unit 4

Geophysical methods - Seismic Refraction & Electrical Resistivity methods, GPR, rock blasting.

Unit 5

Earthquake: Magnitude and intensity of earthquake. Seismic waves. Seismic zones in India.
Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors - Prevention by rock bolting and rock anchoring, retaining wall, slope treatment, grouting. Case studies.

Outcomes:

- Ability of the students to develop an understanding of the engineering properties of rocks, geological and engineering rock classifications, rock failure theories, in-situ stresses in rock, and the fundamental concepts and principles of rock mechanics.
- Bigger constructions (multistoried) are possible.
- Designs of foundation and construction over them are more stable.

Text Book:

1. *Verma, B.P. - Rock Mechanics for Engineering*

References books:

1. *Jaegar & Cook - Fundamentals of rock mechanics; Wiley international*
2. *Goodman, R .E. - Introduction to rock Mechanics by; John Wiley & Sons*

L-T-P	BCI011A – Design of Steel Structures	Credits: 4
3-1-0		

Objectives:

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

Unit 1

Joints- Introduction to riveted connection, Design of bolted and welded connections, axially and eccentrically loaded joints, simple connection of bracket plates to columns, beam to beam and beam to column connections, design of framed, un-stiffened and stiffened seat connections.

Unit 2

Design of tension members, concept of lug angle, gusset plate and splices.

Unit 3

Design of laterally supported and unsupported beam

Unit 4

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

Unit 5

Design of Plate Girder- Proportioning and design of section and connections, curtailment of flange plates, design of web splices, design of stiffeners.

Outcomes:

- Design of compression members
- Analysis the beams and columns
- Design joints and connections using bolted and welded connection

Text book:

1. Negi, L. - Design of Steel Structures, Tata McGraw Hill, New Delhi

Reference Books:

1. Shah, V.L. & Gore, V. - Limit State Design of Steel Structures IS: 800-2007, Structures Publications, 2010.
2. Bhavikatti, S.S. - Design of Steel Structures, I.K. International Publishing House Limited, 2010
3. Subramanian, N. - Design of Steel Structures, Oxford University Press, 2010
4. Relevant IS Codes

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

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

Unit 5

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

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

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

Outcome:

After learning the course the students should be able to:

- Demonstrated an ability to Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials

Text Books:

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

Reference Books:

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

4. *Laursen, H.I.* - Structural Analysis, McGraw Hill

L-T-P	BCI013A – Engineering Surveying I	Credits: 3
3-0-0		

Objective:

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

Unit 1

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

Unit 2

Prismatic compass - Surveyor's compass - Bearing - Systems and conversions – Local attraction - Magnetic declination - Dip - Traversing - Plotting - Adjustment of errors - Plane table instruments and accessories - Merits and demerits - Methods - Radiation - Intersection - Resection - Traversing.

Unit 3

Level line - Horizontal line - Levels and Staves - Spirit level - Sensitiveness - Bench marks - Temporary and permanent adjustments - Fly and check leveling - Booking - Reduction - Curvature and refraction - Reciprocal leveling - Longitudinal and cross sections - Plotting - Calculation of areas and volumes - Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs.

Unit 4

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

Unit 5

Reconnaissance, preliminary and location surveys for engineering projects - Lay out – Setting out works - Route Surveys for highways, railways and waterways - Curve ranging – Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite - Compound and reverse curves - Transition curves – Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances – Mine Surveying - instruments - Tunnels - Correlation of underground and surface surveys - Shafts - Adits.

Outcomes:

- Able to measure and layout elevations and relative heights between points.
- Able to understand units, significant figures, and filed notes.
- Able to understand the theory of errors in observations.
- Able to carry out profiling and grid leveling, for generation of profiles, contour maps, and earth works computations.
- Able to measure horizontal and vertical angles.
- Able to determine coordinates of traverse (control) and surveyed.

Text book:

1. *Punmia, B.C. - Surveying Vol. I & II.*

References books:

1. *Arora, K.R. - Surveying Vol. I & II.*
2. *Cledenning & Oliver - Surveying Instruments.*

L-T-P	BCI014A – Hydraulics and Hydraulic Machine	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

Unit 2

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

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Ability to understand and control for the benefit of society, the occurrence, movement and use of water, whether it is in lakes, rivers, pipes, drains, percolating through soils or pounding the coastline as destructive waves.
- To understand the functioning of different types of pumps and turbines.

Text book:

1. *Bansal, R. K. - A Text Book of Fluid Mechanics and Hydraulic Machines.*

Reference books:

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

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

Experiments may be carried out using MATLAB/ SCILAB

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

2. Performing Matrix Manipulations - Concatenating, Indexing, Sorting, Shifting, Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis; Creating Arrays X & Y of given size (1 x N) and Performing
(A) Relational Operations - >, <, ==, <=, >=, ~=
(B) Logical Operations - ~, &, |, XOR

3. Generating a set of Commands on a given Vector (Example: X = [1 8 3 9 0 1]) to
(A) Add up the values of the elements (Check with **sum**)
(B) Compute the Running Sum (Check with **sum**), where Running Sum for element j = the sum of the elements from 1 to j, inclusive.
(C) Compute the Sine of the given X-values (should be a vector).
Also, Generating a Random Sequence using **rand() / randn()** functions and plotting them.

4. Evaluating a given expression and rounding it to the nearest integer value using Round, Floor, Ceil and Fix functions; Also, generating and Plots of
(A) Trigonometric Functions - sin(t), cos(t), tan(t), sec(t), cosec(t) and cot(t) for a given duration 't'.
(B) Logarithmic and other Functions – log(A), log10(A), Square root of A, Real nth root of A.

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

$X(n) = (a)^n \quad for \quad (i)\, 0 \le a \le 1 \quad (ii) -1 \le a \le 0 \quad (iii)\, a \le -1 \quad (iv)\, a > 1$

6. Write a MatLab program to generate the signal S(n) = 2 * n * (0.8^n) corrupted by the noise $d(n)$ resulting the signal $X(n)$.

$$X(n) = s(n) + d(n).$$

Also down sample the corrupted signal

7. Creating a vector X with elements, Xn= (-1)n+1/(2n-1) and Adding up 100 elements of the vector, X; And, plotting the functions, x, x3, ex and exp(x2) over the interval 0 < x < 4 (by choosing appropriate mesh values for x to obtain smooth curves), on
(A) A Rectangular Plot
(B) A Semi log Plot
(C) A log-log Plot
8. Generating a Sinusoidal Signal of a given frequency (say, 100Hz) and Plotting with Graphical Enhancements - Titling, Labelling, Adding Text, Adding Legends, Adding New Plots to Existing Plot,

Printing Text in Greek Letters, Plotting as Multiple and Sub- Plots; Also, Making Non-Choppy and Smooth Plot of the functions,

$$f(x) = \sin(1/x) \text{ for } 0.01 < x < 0.1 \; and \; g(x) = (\sin x)/x$$

9. To Plot the following Functions:

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

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

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

Given: - m=4, r=0.1

10. Creating A Structure, An Array of Structures and Writing Commands to Access Elements of the created Structure and Array of Structures; Also, Solving First Order Ordinary Differential Equation using Built-in Functions; And, Creating an M x N Array of Random Numbers using **rand** and setting any value that is $< 0.2 \; to \; 0$ and any value that is ≥ 0.2 to 1 by moving through the Array, Element by Element.

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

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

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

14. Generating normal and integer random numbers $(1-D \; \& \; 2-D)$ and plotting them; Also, Writing a Script (which keeps running until no number is provided to convert) that asks for Temperature in degrees Fahrenheit and Computes the Equivalent Temperature in degrees Celsius. [Hint: Function **is empty** is useful]

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

$$h(T) = (T - 10) \text{ for } 0 < T < 100$$
$$= (0.45\,T + 900) \text{ for } T > 100$$

Exercise: Testing the Scripts written using

(A)$T = 5, h = -5$

(B) $T = 110, h = 949.5$

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

(A) Straight line Fit

(B) Least Squares Fit

16. Interpolation based on following Schemes (A) Linear (B) Cubic (C) Spline Also, Generating the first Ten Fibonacci numbers according to the relation $Fn =$
$Fn-1 + Fn-2$ with $F0 = F1 = 1$, and computing the ratio $Fn / Fn-1$for the first 50 Fibonacci numbers.

L-T-P 0-0-2	**BCI063A – Fluid Mechanics and Hydraulics Lab**	**Credits: 2**

Experiments

1. Determination of friction of pipes.
2. Chezy's & manning's coefficient for open channels**.**
3. Hydraulic coefficient of an orifice meter.
4. Impact of jet or vanes.
5. Performance test on centrifugal and reciprocating pump.
6. Performance test on Palton wheel turbine, Francis turbine and Kaplan turbine.
7. To verify Bernoulli's theorem.
8. To calibrate a Venturimeter and Orificmeter.
9. To determine Metacentric Height.
10. To determine C_d of a mouthpiece
11. To determine C_d of a V-notch.
12. Determination of friction of pipes.
13. Determination of Reynolds no. for flowing water.

L-T-P	BCI016A – Engineering Surveying Lab I	Credits: 3
0-0-3		

Experiments

1. Measurement of distance by ranging and chaining.
2. Locating various objects by chain and cross staff.
3. Determination of area of polygon by chain and cross staff.
4. Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
5. Locating given building and its features by chain and compass traversing.
6. Determination of elevation of various points with dumpy level by collimation plane method and rise and fall method.
7. Measurement of horizontal angles using theodolite
8. Measurement of vertical angle using theodolite
9. Determination of horizontal distance between two inaccessible points with theodolite
10. Locating given building by theodolite traversing.
11. Locating given building by plane table surveying.
12. Three point problem and two point problem in plane table surveying.
13. Study and use of mechanical planimeter

L-T-P	BHS004A – Professional Skills	Credits: 6
6-0-0		

L-T-P	BCI017A – Seminar	Credits: 1
0-0-1		

Semester V

L-T-P	BAS006A – Probability and Statistics	Credits: 2
2-0-0		

Objectives:

- Uncertainty is ubiquitous. It is therefore essential to understand the techniques for handling and modeling it. This paper is designed to acquaint the students with the fundamental statistical techniques.
- To understand the role of statistics for analyzing and interpreting data meaningfully.
- The course is meant to provide a grounding in Statistics and foundational concepts that can be applied in modeling processes and decision making. These would come in handy for the prospective engineers in most branches.

Unit 1

Mathematical statistics covering population, sample space, events, random variables

Unit 2

Definitions of probability, conditional Probability, expectation and higher order moments, distributions, examples of (discrete and continuous) Normal, Poisson, Binomial distributions. Characteristic functions (mean and standard deviation)

Unit 3

Regression covering, OLS (single and multivariate cases), Estimators and their properties (unbiased, consistent), Gauss-Markov Theorem; Limitations of OLS- Hetero-sckedasticity, multi-collinearity; Limit theorems and convergence of random variables.

Unit 4

Hypothesis testing covering, Types of Error, Power of a test, Goodness of a fit, Student t and Chi square, Sufficient Statistic and MLEs.

Unit 5

Limit theorems and convergence of random variables; Elementary concepts related to stochastic processes; Forecasting and modelling applications.

Outcomes:

- Would be able to understand statistics and foundational concepts that can be applied in modeling processes and decision making.
- Concept of testing and Non- Parametric Inference will be developed.
- Students learn the fundamental statistical techniques which will be useful in solving various problems.

Text book:

1. *Gupta, S.C. & Kapoor ,V.K. - Fundamentals of Mathematical Statistics, S Chand & Company, New Delhi*

Reference books:

1. *Hogg, R.V. & Craig, A.T. - Introduction to Mathematical Statistics.*
2. *Mood, A.M. & Graybill, F.A. - Introduction to the theory of Statistics*

L-T-P	BCI018A - Geotechnical Engineering – II	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

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

Outcomes:

- This subject develops a understanding about site investigation and knowledge about different pressure theories.
- Develop the knowledge how to avoid the slope failure in soil and different analysis methods.
- This subject provides the basic concept related to earthquake and its effect on soil behavior.

Text Books:

1. *Punmia, B.C. - Soil Mechanics and Foundation Engineering*

Reference Books

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

L-T-P	BCI019A – Engineering Surveying II	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

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

Unit 5

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

Outcomes:

- Gain a basic understanding of the principles and operation of the Global Positioning System.
- Gain the ability to use modern survey equipment to measure angles and distances.
- To be aware of different types of error in surveying and knowledge about field astronomy.

Text book:

1. *Punmia, B.C. - Surveying and Leveling, Vol I, II, &III, Laxmi Publication.*

Reference Books:

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

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

Limit state of collapse in shear: analysis and design of prismatic sections for shear using LSM.
Limit state of collapse in bond: concept of bond stress, anchorage length and development length, curtailment of reinforcement as per codal provisions.

Unit 4

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

Unit 5

Columns: Short and long columns, their structural behaviour. Analysis and design of axially loaded short columns, using LSM. Analysis of uniaxially eccentrically loaded short columns. Introduction to Pu-Mu interaction curves and their use for eccentrically loaded columns.
Design of Column Footings: Analysis and design of isolated column footing and combined footing for two columns (without central beam) for axial loads using LSM.

Outcomes:

- Understand the concept of shear and shear reinforcement.
- Ability to analyze and design of beams, columns, slab, and footings.

Text book:

1. *Varghese, P.C. - Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt. Ltd., New Delhi.*
2. *IS:456-2000*

References:

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

L-T-P	BCI064A – Theory of Structures	Credits: 4
3-1-0		

Objectives:

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

Unit 1

Stability and Indeterminacy: Stability of structures, Introduction to Determinate and Indeterminate structures, Degrees of freedom per node, Static and Kinematic indeterminacy.

Deflection of determinate beams: Strain energy of Bending – Castigliano's theorem –The unit load method of computation of deflection and slopes in beams, Maxwell's reciprocal theorem.

Unit 2

Slope deflection method: derivation of the slope-deflection equation – analysis of statically indeterminate beams subjected to applied loads - analysis of statically indeterminate beams subjected to uneven support settlement. Analysis of structures using Moment distribution method applied to continuous beams and portal frames with and without inclined members Kani's Method: Analysis of beams and frames with & without sway by Kani's method.

Unit 3

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

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

Unit 4

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

Unit 5

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

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

Outcomes:

- Ability to identify determinate, indeterminate, stable and unstable structures.
- Ability to determine forces and deflections in determinate trusses, beams and frames.
- Able to understand the concept of different methods to analyze the structures.
- Able to draw the ILD.

Text Books:

1. *Punmia, B.C. - Theory of Structures, Laxmi Publication.*

2. *Bhavikatti, S.S.* - Structural Analysis Volume – I, 3rd edition, Vikas Publishers.

Reference Books:

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

L-T-P 0-0-2	BCI022A – Geotechnical Engineering Lab	Credits: 2

Experiments

1. To determine the water content of a soil sample by Oven drying method.
2. To determine the water content of a soil sample by pycnometer method.
3. To determine the specific gravity of a soil sample by pycnometer method.
4. To determine the liquid and plastic limit of a soil specimen.
5. To determine the dry density of the soil Sand replacement method.
6. To determine the compaction characteristics of a soil specimen by Standard proctor's test.
7. To determine the compaction characteristics of a soil specimen by Modified proctor's test.
8. To determine the particle size distribution of a soil by sieve analysis.
9. To determine the particle size distribution of a soil by hydrometer analysis.
10. To determine the shear parameters of a sandy soil specimen by direct shear test.
11. To determine the permeability of a soil sample using Constant Head permeability test method.
12. To determine the permeability of a soil sample using Variable Head permeability test method.
13. To determine the shear strength of soil sample by triaxial test apparatus.
14. To determine the Unconfined Compression Strength of a soil sample.

L-T-P 0-0-3	BCI023A – Engineering Surveying Lab II	Credits: 3

Experiment

1. Determination of tacheometer constant.
2. Determination of elevation of a point by tacheometric surveying
3. Determination of elevation of a point and horizontal distance between them by tacheometric surveying.
4. Locating a building/plot by tacheometric surveying.
5. Determination of elevation of point by trigonometric levelling
6. Setting out a simple circular curve by offset from chord method
7. Setting out simple circular curve by Rankine's method.
8. Collection of field data like point data, line data and area data by using GPS receiver.
9. Image interpretation and GIS lab
10. Demonstration of Total Station

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

Auto CAD 2D –

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

AutoCAD 3D –

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

Program Elective-I (any one of the following)	
BCI026A - Advance Design of Steel Structures	BCI027A - Building Maintenance and Repairs

L-T-P	BCI026A – Advance Design of Steel Structures	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

Unit 2

Design of beam column with axial and eccentric loading.

Unit 3

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

Unit 4

Design for torsion- torsional loading in practice, behaviour of member due to torsion, shear centre, approximate design procedure for torsion, distortion of thin walled member, member stiffening and end restraints, torsional buckling , torsional buckling.

Unit 5

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

Outcomes:

- An understanding of the relationship between structural analysis and design provisions.
- An understanding of the background to the design provisions hot-rolled and cold-formed steel structures, including the main differences between them.
- An understanding of the basic principles of reliability based design on steel structures.

Text book:

1. *Negi, L.S.* - Design of Steel Structures, Tata McGraw Hill, New Delhi

Reference Books:

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

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- An understanding of the different techniques for repairs.
- An understanding of the background of Importance of Maintenance,

Text Books:

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

Reference Books:

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

L-T-P 6-0-0	BHS005A – Professional Skills	Credits: 6

L-T-P 0-0-1	BCI025A – Seminar	Credits: 1

Semester VI

L-T-P	BAS007A – Discrete Mathematics	Credits: 2
2-0-0		

Objectives:

- Able to explain and apply the basic methods of discrete (non-continuous) mathematics.
- Able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.
- Able to use Visual Logics for application to modeling.

Unit 1

Difference equations covering, first order, second order and nth order, with integer argument and their solutions; First order, second order, nth order, with continuous variables and their solutions.

Unit 2

The state space form & Kalman-Bucy filter, Riccati Matrices (Equations) and applications.

Unit 3

Graph theory covering, concepts and definitions, basic results, trees and cut sets.

Unit 4

Definitions and basic results of Lattice theory; Basic Combinatorial analysis.

Unit 5

Introduction to Number theory and applications to cryptography 'Finite Markov chains'.

Outcomes:

- Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers.
- Able to synthesize induction hypotheses and simple induction proofs.
- Diagrammatic Representation development: underlying algebraic structures, theory and algorithms over those structures, together with front-end user-interface development to enhance impact.

Text book:

1. *Kolman et.al - Discrete mathematical Structures, 5th Ed., Pearson Education, New Delhi - 2004.*

Reference books:

1. *Rosen, K.H. - Discrete Mathematics and Its Applications - 4th Ed., Tata McGraw Hill, New Delhi - 2001*
2. *Tremblay et.al - Discrete Mathematical Structures with Applications to Computer Science, TMH, New Delhi – 2004.*

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

Objectives:

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

Unit 1

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

Unit 2

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

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

Unit 3

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

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

Unit 4

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

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

Unit 5

Hydrology: Definition, Hydrologic cycle, Application to Engineering problems, measurement of rainfall, rain gauge, peak flow, flood frequency method, catchment area formulae, Flood hydrograph, Rainfall analysis, Infiltration, Run off, Unit hydrograph and its determination, Estimation of runoff.

Outcomes:

- Understanding and judgment to relevant water resources planning and design problems with an emphasis on intelligent engineering decision making.
- Understanding of different types of canal structures.

Text Book:

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

Reference Books:

1. *Asawa, G.L. - Irrigation Engineering, Wiley Eastern*
2. *Garg, S.K. - Irrigation Engineering & Hydraulic Structures, Khanna Publishers*

3. *Modi, P.N. - Irrigation Engineering & Hydraulic Structures*
4. *Zimmerman, J.D. - Irrigation, John Wiley & Sons*
5. *Varshney, Gupta & Gupta - Theory and Design of Irrigation Structures, Nem Chand & Bros.*

L-T-P	BCI029A – Transportation Engineering I	Credits: 3
3-0-0		

Objectives:

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

Unit 1

Introduction: Importance and Role of Transportation Systems, Technological and Operating Characteristics of Transportation Systems, Components of transportation Systems, Transportation Coordination, Transportation Modes and their comparison. Highway Planning: Highway Planning Process, specifically in India, Transport or Highway related Agencies in India,

Unit 2

Classification of Roads and Road Development Plans, Road Patterns, Controlling Factors and Surveys for Highway Alignment. Highway Materials and Construction: Desirable Properties, Testing Procedures, Standards and standard values relating to Soil, Stone Aggregates, Bitumen and Tar, fly-ash/pond-ash. Methods of constructing different types of roads viz. Earth roads, Stabilized roads, WBM roads, fly ash embankments, Bituminous roads and Concrete roads. Specific features of rural roads.

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Given basic information, prepare a horizontal and vertical alignment, including super-elevation.
- Understand the relationship between the environment and transportation infrastructure and the importance the environment plays in project development of transportation projects.
- Prepare well written design narratives documenting the various parameters and standards used in the design process so another individual could review the work and understand what decisions and assumptions were used and why.
- Understand the mathematics behind the development of tables and charts for determining highway design criteria.

Text Book:

1. *Kadiyali, L.R. & Lal, N.B. - Principles and practice of highway engineering, Khanna Publications, 2005*

Reference Books:

1. *Morlok, E.R. - An Introduction to Transportation Engineering and Planning, McGraw Hill, NY, 1970*

2. *Hay, W.W. - Introduction to transportation Engineering, John Wiley & Sons, NY, 1988.*
3. *Papacostas, C.S. - Fundamentals of transportation Engineering, Prentice Hall of India, 1987.*
4. *Chakroborty, P. - Principles Of Transportation Engineering, , PHI Learning, 1st edition*
5. *Mannering, F.L., Washburn, S.S. & Kilareski, W.P. - Principles of Highway Engineering and Traffic Analysis, 4th Edition, , John Wiley*

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

Objectives:

- Demonstrate the importance of interdisciplinary nature of environmental and health risk assessment.
- To study the Aesthetics of metropolitans.
- Facilitates to plan urban area's removing the environmental issues.

Unit 1

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

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Able to design a water supply scheme for a particular section of community.
- To know the different water treatment technologies.
- Basic knowledge of storage, transmission and distribution system.

Text book:

1. Garg, S.K. - Water Supply Engineering (Environmental Engineering Vol. – I)

References books:

1. Peavy, Rowe & Tchobanoglous - Environmental Engineering

2. *Metcalf & Eddy - Wastewater Engineering*
3. *Garg, S.K. - Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).*
4. *Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi*
5. *Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi*

L-T-P 0-0-2	BCI031A – STAAD Pro Lab	Credits: 2

Experiment

Design of Concrete Structures as per all major international codes

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

L-T-P 0-0-2	BCI032A – Structure Detailing Lab	Credits: 2

Experiment

1. Design of gantry girder
    a. Using I beam as a main member
    b. Using truss as a main member
    c. Chart prepare of detailing
2. Design a G+1 building
    a. Slab
    b. Primary and secondary beam
    c. Column: axial and eccentric loaded
    d. Chart prepare of detailing
3. Design a cantilever
    a. Beam
    b. Slab
4. Design a tank
    a. Water tank
    b. Elevated tank
    c. Circular dome
5. Report prepare

L-T-P 0-0-3	BCI033A – Quantity Surveying and Valuation Lab	Credits: 3

Experiments

1. To find out the approximate estimate of a multistoried building by approximate method.
2. Detailed estimate of the following with the required material survey for the same.
   a. ground plus three storied building (RCC)
   b. bridge with minimum 2 spans
   c. factory building
   d. road work
   e. cross drainage work
   f. load bearing structure
3. Preparation of valuation report in standard Government form.
4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Bar bending schedule.

Program Elective-II (one subject from group)	
BCI035A - Rural Water Supply and Sanitation	BCI036A – Advanced Reinforced Cement Concrete

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

Objectives:

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

Unit 1

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

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

Unit 2

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

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

Unit 3

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

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

Unit 4

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

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

Unit 5

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

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

Outcomes:

- Student could be able to understand about rural sanitation.
- Student could be able to understand water treatment and different schemes of rural water supply in Rajasthan.

Text/Reference books:

1. Low cost on site sanitation option, Hoffman & Heijno Occasional Nov.1981 paper No.
2. 21, P.O. Box 5500 2280 HM Rijswijk, the Netherlands offices, J.C. Mokeniaan, 5
3. Rijswijk (the Haque). Wagner, E.G. and Lanoik, J.N. water supply for rural areas and small communities, Geneva: W.H.O.1959.
4. Manual of water supply and treatment, 3rd edition, CPHEEO, GOI, New Delhi.

L-T-P	BCI036A – Advanced Reinforced Cement Concrete	Credits: 3
3-0-0		

Objective:

- Design of various structural members.

Unit 1

Silos and Bunkers: Lateral Pressures in bunkers as per Rankine's and Coulomb theories, Lateral pressures in silos as per Janssen's and Airy's theories, design considerations for square, rectangular and circular shapes of silos, design of hoppers and supporting structures of bins. IS Code Provisions for design of Silos and Bunkers.

Unit 2

Design of R.C.C. Chimney: I.S. Code provisions, principles of design under various types of loadings, behaviour of chimneys and stack structures under wind.
Torsion: Analysis and Design of beams for torsion as per codal method.
Continuous and Curved Beams: Analysis and Design of continuous beams using coefficients (IS Code), concept of moment redistribution. Analysis and design of beams curved in plan.

Unit 3

Circular Domes: Analysis and design of Circular domes with u.d.l. and concentrated load at crown.
Water Tanks and Towers: Water Tanks and Water Towers-design of rectangular, circular and Intze type tanks, column brace type staging.

Unit 4

Yield Line Theory: Introduction to Yield line concept, Application of Y.L.T. to slabs with simple support conditions.
Retaining walls: Analysis and design of Cantilever Retaining Walls: Introduction to counterfort and buttress type retaining walls, their structural behaviour and stability analysis.

Unit 5

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

Outcome:

- Student could be able to design Retaining wall, Silos, Bunker, Foundations and Water tank.

Text book:

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

Reference

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

Program Elective-III (one subject from group)	
BCI037A – Foundation Engineering	BCI038A – Prestressed Concrete

L-T-P	BCI037A – Foundation Engineering	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

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

Unit 5

Stresses in Soil under surface loading: bossinesq's and westergaard's analysis for vertical pressure and its distribution in a soil mass. vertical stresses due to concentrated loads, horizontal and shear stresses due to concentrated loads. Isobar diagram, vertical stress distribution on a horizontal plane. influence diagram. Vertical stresses at point under line load and strip load. vertical stresses at a point under circular and rectangular loaded area. Approximate methods of obtaining vertical pressure due to surface loading.

newmark's chart, fensk's chart. Pressure bulb and its significance in foundation exploration. Contact pressure below foundations.

Outcomes:

- Analysis of shallow foundation and pile foundation.
- Basic idea about machine foundation.
- Use of well foundation in water front structure.

Text Books:

1.Punmia, B.C. - Soil Mechanics and Foundation Engineering

Reference Books

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

L-T-P	BCI038A – Prestressed Concrete	Credits: 3
3-0-0		

Objectives:

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

Unit 1

General principles of prestressed concrete: classification and types, stages of loading, advantages of prestressed concrete over reinforced concrete, partial prestressing, design codes for prestressed concrete.
Materials: Strength requirements of concrete, strain characteristics of concrete, steels for prestressing, steel wires, steel strands, steel bars, fiber glass tendons, grouts.

Unit 2

Prestressing systems and end anchorages: pretensioning system and end anchorages, tensioning methods in posttensioning, posttensioning anchorages utilizing wedge action, posttensioning anchorages for wires, posttensioning anchorages for bars.
Loss of prestress: Significance, Lump sum estimate, elastic shortening of concrete, time dependent losses, loss due to creep of concrete, loss due to shrinkage of concrete, loss due to steel relaxation, loss due to anchorage take up, loss or gain due to bending of members, practical considerations for frictional loss, theoretical considerations for frictional loss, total amount of losses elongation of tendons.

Unit 3

Analysis of sections for flexure: Stresses in concrete due to prestress, stresses in concrete due to loads, stresses in steel due to loads, discussion on moment curvature relationship of a prestressed concrete beam.
Design of sections for flexure: Preliminary design, general concepts of elastic design, elastic design with no tension in concrete, elastic design allowing tension, elastic design allowing and considering tension, ultimate design, arrangement of steel and prestressing in stages

Unit 4

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

Unit 5

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

Outcome:-

- Analyze and design for vertical and horizontal shear in prestressed concrete.
- Analyze transfer and development length as well as prestress losses.

Text book:

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

Reference

1. *Lin, T.Y. & Burns, N.H. - Design of prestressed concrete structures, John Wiley & Sons, New York.*
2. *Jain & Jaikrishna: Plain and Reinforced Concrete Vol. I.*

L-T-P	BHS006A – Professional Skills	Credits: 6
6-0-0		

L-T-P	BCI034A – Seminar	Credits: 1
0-0-1		

Semester VII

L-T-P	BAS004A – Optimization and Calculus of Variations	Credits: 2
2-0-0		

Objectives:

- This course deals with the extremely important topics under the broad umbrella of Optimization.
- This is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

Unit 1

First and second order conditions for local interior optima (concavity and uniqueness), Sufficient conditions for unique global optima; Constrained optimization with Lagrange multipliers; Sufficient conditions for optima with equality and inequality constraints; Kuhn Tucker conditions, duality;

Unit 2

Linear programming covering, Basic LPP–solution techniques (Simplex, Artificial Basis); Complimentary Slackness Theorem,

Unit 3

Fundamental theorem of Duality; Degenerate solutions, cycling; Applications; Elements of Dynamic Programming including Hamiltonian, Bellman's Optimality Principle

Unit 4

Calculus of Variations covering, Basic definition, Simplest problem, Isoperimetric problem, Problems with Higher order derivatives, Euler Lagrange Equation,

Unit 5

Weierstrass-Erdmann conditions; Pontryagin Maximum Principle; Transversality condition; Applications;

Out comes:

- Understanding about Fundamental theorem of Duality; Degenerate solutions, cycling; Applications; Elements of Dynamic Programming.
- Knowledge of solution techniques.

Text book:

1. *Sharma, J.K. - Operations Research: Theory and Applications 5th Edition (English), Publisher: Laxmi publications, New Delhi*

Reference books:

1. *Sharma, S. - Operations Research : Theory, Methods & Applications, Publisher: Kedar Nath Ram Nath, Meerut*

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

Objectives:

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

Unit 1

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

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

Unit 2

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

Unit 3

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

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

Unit 4

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

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

Unit 5

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

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

Outcomes:

- Understanding and judgment to relevant water resources planning and design problems with an emphasis on intelligent engineering decision making.
- Understanding of different types of Hydraulic structures like spillways, dams, diversion head works, regulators.

Text Book:

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

Reference Books:

1. *Asawa, G.L. - Irrigation Engineering, Wiley Eastern*
2. *Garg, S.K. - Irrigation Engineering & Hydraulic Structures, Khanna Publishers*
3. *Modi, P.N. - Irrigation Engineering & Hydraulic Structures*

4. *Zimmerman, J.D. - Irrigation, John Wiley & Sons*
5. *Varshney, Gupta & Gupta - Theory and Design of Irrigation Structures, Nem Chand & Bros.*

L-T-P	BCI040A – Transportation Engineering II	Credits: 4
3-1-0		

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Solve engineering problems, develop designs.
- To communicate the significance of the problems and designs.
- Solving typical traffic problems.

Text Books:

1. *Saxena, S.C. & Arora, S.P. - A Course of Railway Engineering, Dhanpat Rai, New Delhi*
2. *Khanna & Arora - Airport Planning & Design, Nemchand Bros, Roorkee*

Reference Books:

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

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Would be able to explain the different aspects of quality of water and treatment of waste water.
- Understanding different theory of filtration.
- Understanding anaerobic digestion of sludge and disposal of waste water.

Text book:

1. *Metcalf & Eddy - Wastewater Engineering*

Reference Books:

1. *Garg, S.K. - Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).*

2. *Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi*
3. *Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi*

L-T-P 0-0-2	BCI042A – Water Resource Engineering Lab	Credits: 2

Experiments

1. Drawing and layout of canal distribution system.
2. Case study of major canal distribution in India.
3. Design of rectangular canal.
4. Design of trapezoidal canal.
5. Design of canals as per lacey's and Kennedy's theory.
6. Study of water management and water laws.
7. Measurement of rain-fall.
8. Calculation of unit Hydrograph.
9. Design of different types of Falls
10. Design of different types of Dam structures

L-T-P 0-0-2	BCI043A – Transportation Engineering Lab	Credits: 2

Experiments

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

L-T-P 0-0-2	BCI044A – Environmental Engineering Lab	Credits: 2

Experiments

1. (a) To determine the pH of the given sample of water.
   (b) To determine the pH of the given sample of waste water.
2. (a) To determine the turbidity of the given sample of water.
   (b) To determine the turbidity of the given sample of waste water.
2. To determine the Total Dissolved Solids of the given water sample.
3. To find out conductivity of the given water sample.
4. Determination of the iron and fluoride content in drinking water.
5. Determination of Biochemical oxygen demand of waste water.
6. To find out chloride of the given water sample.
7. To find out fluoride of the given water sample.
8. To determine alkalinity of the given water sample.
9. To determine hardness of the given water sample.
10. To determine the optimum dose of alum by Jar test.
11. Determine the dissolved oxygen in water by winkler method.
12. Determine the colour and odour of a given sample of water

Program Elective-IV (one subject from group)	
BCI046A – Construction Project Management	BCI047A – Construction Technology

L-T-P	BCI046A – Construction Project Management	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Ability to ensure that construction projects are completed on-time and within budget.
- Able to apply different techniques for planning.
- Able to apply PERT for predicting probability and time of completion of project.

Text book:

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

Reference Books:

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

L-T-P	BCI047A – Construction Technology	Credits: 3
3-0-0		

Objectives:

- To study the different types of construction methods
- To study the different types of construction equipments

Unit 1*:*
Construction Equipment-Standard types of equipment , special equipment, costof owning and operating equipment, depreciation costs, investment and operating costs, economic life, sources of construction equipment, factors affecting selection of construction equipment, balancing of equipment. Study of equipment with reference to available their types and their capacities, factors affecting their performance.

Unit 2
Tunnelling- Geo-technical investigations, selection of alignment, methods oftunneling in soft soils and in hard rock, sequence of operations for drilling and blasting method, mechanical moles, boomers, tunnel boring machines, mucking, ventilation of tunnels, dust control, types of tunnel supports, sequence of lining operation, lining with pneumatic placers and by pump crete method.

Unit 3
Bridge Construction- Geo-technical investigation, Site selection, Launching ofbridges by incremental launching, using false work, and balanced cantilever construction method.

Unit 4
Steel construction- planning for field operations, selection of equipments anderection tools and method of welding, tools and methods of cutting and joining, safety measures during fabrication and erection.

Unit 5
Concrete Construction- Concreting under water, concreting in different weatherconditions, mass concreting, vacuum concreting, Self Compacted Concrete, Roller Compacted Concrete.

Outcomes:
After completion of this course student could be able to

- Use of New and advanced technology used for construction
- They could be able to design of different types of steel and concrete structure by utilizing of advanced equipments and techniques.

Text Books:

1. *Varma Mahesh , Construction Equipment and its Planning & Applications*
2. *R.L. Purifoy & Ledbetter - Construction Equipment and its Planning , McGraw hill*

Reference Books:

1. *JagdishLal , Construction Equipment*
2. *Thomas baron , Erection of Steel Structures*
3. *Stubbs, Handbook of Heavy Construction*
4. *Dr. P. Purushothama Raj, Ground Improvement Techniques , Laxmi Publications*
5. *Punnoswami, Bridge Construction*
6. *Wadell , Concrete Construction Handbook*

Program Elective -V (one subject from group)	
BCI048A – Traffic Engineering	BCI049A – Building Design

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

Objectives:

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

Unit 1
Introduction: Role of traffic engineer, vehicle, highway and traffic factors. Traffic characteristics, vehicular road users. Introduction of traffic noise and air pollution and remedial measures.

Unit 2
Traffic flow: Interrupted and Un-interrupted Traffic Flow, Highway capacity: Urban, rural and intersection, Capacity of transit system, Traffic flow theory: CarFollowing and Queuing Theory.

Unit 3
Traffic Studies: Traffic volume studies, speeds studies, Speed and Delay Studies,Origin and Destination studies, Accident studies, capacity studies, parkingstudies.

Unit 4
Traffic Control: regulations and other operational controls, Traffic Signal andmarking, street lighting, Traffic Safety: Barricades, delineators.

Unit 5
Design of Intersections: Canalizing islands, Design of Rotaries, Intersection andTerminal Design, Parking facilities.

Outcomes:
After completion of this course student could be able to

- Design of traffic signals and intersections.
- They could be able to traffic control.

Text Books:
1. Introduction to Transportation Engineering: William w. Hay.
2. Introduction to Transportation Engineering planning =- E.K. Mortak

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

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

Objectives:

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

Unit 1
Design Loads: Design loads for different types of buildings. (IS-875 part 1 & 2). Load distribution & concept of load flow to different structural components.
Structural Systems: Assumption of integrity aspect ratios & over turning resistance, strength & stiffness of buildings, symmetry and Asymmetry in building forms, Vertical and lateral load resting elements, shear walls, framed tubes and various multistory configurations.

Unit 2
Lateral loads: Wind loads & calculation of wind load on structures (IS: 875-Part 3).

Unit 3
Lateral loads: Earthquake loads & calculations of earthquake loads on buildings masonry & framed structures. (IS: 1893 – Part 1).

Unit 4
Masonry and Framed Buildings: Design of masonry buildings and framed buildings, Earthquake resistant construction of buildings, and various provisions as per IS codes; IS-4326, IS-13827, IS-13828, IS-13920, IS-13935.

Unit 5
Mass Housing: Prefabricated construction for mass housing.
Special Roofs: Introduction to folded plates, cylindrical shells, north-light shell roofs, grid and ribbed floors.

Outcomes:

- Analysis of different loads acts on buildings.
- Basic idea about mass housing and special roofs.

Text Books:
IS : 875, Part I, II and III.
IS : 1893
IS : 4326
IS : 13920

L-T-P	BHS007A – Professional Skills	Credits: 6
6-0-0		

L-T-P	BCI045A – Seminar	Credits: 1
0-0-1		

Semester VIII

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

Open Elective (Offered by the Department of Civil Engineering)

Code	Subject	Contact Hours/week			Total Credits		Semester
		L	T	P			
BCI051A	Solid Waste Management	3	0	0	3	ID	V
BCI052A	Planning for sustainable development	3	0	0	3	ID	V
BCI053A	Principles of Architecture and Town Planning	3	0	0	3	ID	VI
BCI054A	Disaster Management	3	0	0	3	ID	VI
BCI055A	Remote Sensing and GIS	3	0	0	3	ID	VII
BCI056A	Quality and Safety Management	3	0	0	3	ID	VII

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

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

L-T-P	BCI051A – Solid Waste Management	Credits: 3
3-0-0		

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Able to identify different solid wastes, and their types.
- Ability to explain the various aspects of solid waste management.
- Able to identify hazardous wastes, their transportation and disposal.

Text book:

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

Reference Books:

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

L-T-P	BCI052A – Planning for Sustainable Development	Credits: 3
3-0-0		

Objective:

- To study the various major sustainable development policies and the institutional frameworks of policy making.
- To study Innovation for sustainable development.
- To study Governance for sustainable development and Capacity development for innovation.

Unit 1

Sustainable Development-explains and critically evaluates the concept of sustainable development, Environmental degradation and poverty Sustainable development: its main principles, the evolution of ideas about sustainability, strategies for promoting sustainable development, resistances to the concept, and some alternative approaches. Examine some important current issues and areas of debate in relation to sustainable development.

Unit 2

Innovation for sustainable development - Environmental management and innovation strategies

Unit 3

Societal transformations, Institutional theory

Unit 4

Governance for sustainable development. Policy responses to environmental degradation.

Unit 5

Capacity development for innovation. Research methods.

Outcomes:

- Able to explain various major sustainable development policies.
- To identify means sustainable development.
- Examine some important current issues and areas of debate in relation to sustainable development.

Text Book:

1. *Harris, J.M.: (2204) Basic Principles for Sustainable Development, Global Development and Environment Institute, working paper 00-04. Available at: http://ase.tufts.edu/gdae/publications/Working_Papers/Sustainable%20Development.PDF*

Reference Books:

1 *Robinson, J.: (2004) Squaring the circle? Some thoughts on the idea of sustainable development Ecological Economics 48(4): 369-384.*

Hjorth, P. and A. Bagheri: (2006) Navigating towards Sustainable Development: A System Dynamics Approach, Futures 38: 74-92.

L-T-P 3-0-0	BCI053A – Principles of Architecture and Town Planning	Credits: 3

Objectives:

- To give the knowledge about Town planning so that may be aware with deficiencies in the surrounding plannings.
- To give the subject knowledge of Building plannings and designings.
- To make aware with the architectural principles and formalities to be done before construction.
- To make aware of vaastushastra and their rules.

Unit- 1

Principles of town planning, Land use patterns, Population survey, Density concepts, and transportation planning.

Unit- 2

Concept of habitat including environmental pollution, problems of metropolis, Satellite town concepts, Garden city movement, Neighbourhood planning, brief history of architecture.

Unit-3

Impact of development of materials through ages, Evolution of architectural forms, Anesthetics and functional proportions.

Unit- 4

Principles of architecture Design, Building Bye-Laws, Scale, Forms, Texture, Colour, Balance, Composition of Space, Role of architects and town planners.

Unit- 5

Architectural Drawing, Different symbols used in building industry, Design of typical buildings such as school, hospital, residential and commercial complex etc.

Outcomes:

- Would be able to understand Architectural Drawing,
- Able to identify different symbols used in building industry and different aspects of building planning and designing.
- Able to locate vaastushastra and consideration of it while architectural drawing.

Text/Reference Books:

1. *Raj.P.SinghKushwah: Introduction of Architecture and Town Planning with VaastuShastra, "KATSONS" Katariya and Sons dariyaganj New Delhi.*
2. *Rangwala: Town Planning, Charotar publications.*

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Able to understand the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
- Able to predict the disaster impact and different issues of disaster.
- Factors affecting vulnerability such as impact of developmental projects and environmental modifications.

Text book:

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

Reference Books:

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

L-T-P 3-0-0	BCI055A – Remote Sensing and GIS	Credits: 3

Objective:

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

Unit 1:
Basic concepts of GIS- Information systems, spatial and non-spatial information, geographical concepts and terminology, advantages of GIS, basic components of GIS, commercially available GIS hardware and software, organization of data in GIS.

Unit 2:
GIS data- Field data, statistical data, Maps, aerial photographs, satellite data, points, lines and areas features, vector and raster data, advantages and disadvantages, data entry through keyboard, digitizers and scanners, digital data, pre-processing of data- rectification and registration, interpolation techniques.

Unit 3:
Data management- DBMS, various data models, run-length encoding, quadtrees, data analysis-data layers, analysis of spatial and non-spatial data, data overlay and modelling, data processing: raster based and vector based, data presentation –hardcopy devices, softcopy devices.

Unit 4:
Remote sensing and GIS integration- Principles of electromagnetic remote sensing, imaging characteristics of remote sensing systems, extraction of metric and descriptive information from remotely sensed images, integration of remote sensing and GIS.

Unit 5:
Applications of GIS- Map revision, land use, agriculture, forestry, archaeology, municipal geology, water resources, soil erosion, land suitability analysis, change detection

Outcomes

- Apply the fundamental concepts in analyzing and solving practical problems

Text/Reference Books:

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

L-T-P 3-0-0	BCI056A – Quality and Safety in Construction	Credits: 3

Objective:

- To study the various factors and aspects of construction safety and quality
- To study innovation in construction safety and quality

Unit 1

Total quality Management (TQM) to the construction industry: Evolution, philosophy and principles for building client, the Deming Philip Crosby, J.M. Juran contribution to TQM Quality as a management process, contractual options and integration.

Unit 2

TQM to construction Projects: General application, TQM in precontract, post contract, commissioning and maintenance phase, project quality management

Unit 3

Auditing: First party auditing second party auditing, contraction management adjudication.

Unit 4

Accidents: Types causes, direct and indirect cost of accidents, objective of accident prevention programmes.

Unit 5

Preventative measures: personal protective equipments, job requirements, tool equipments and fire protection measures. Projection from radioactive /toxic materials, laser and x-ray equipment.

Outcomes:

- Able to explain various quality and safety concepts.
- To identify the measures to check quality and ensure safety.
- Examine some important issues and areas in relation to construction safety and quality.

Text Book:

1. Gahlot, P.S., and Dhir, B.M., Construction Planning and Management, New Age International

Reference Books:

1. Baden, Ron. Total Quality in Construction Projects, Thomas Telford, London
2. Kubal, Micheal T. Engineered Quality in Construction, McGraw Hill

L-T-P 3-0-0	BCI058A – Special Data Analysis and Applications	Credits: 3

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Able to integrate the spatial data in solving practical problems
- Able to analyze

Text/Reference Books:

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

JECRC™ UNIVERSITY

BUILD YOUR WORLD

SCHOOL OF ENGINEERING

SYLLABUS AND COURSE STRUCTURE

M. TECH (STRUCTURAL ENGINEERING)
ACADEMIC YEAR 2015-16

M.Tech. (Structural Engineering)

Code & Subject Scheme

Semester I

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

Semester II

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

Semester III

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

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

Semester IV

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

SEMESTER-I

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

Objective:

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

Unit1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome:

- An understanding of space structures by discussing vibration problems unique to large flexible structures.

Text Book:

1. "Dynamics of Structures: Applications to Earthquake Engineering" by A. K. Chopra

Reference book:

1. "Dynamics of Structures" by R.W. Clough and J. Penzien

2. Fundamentals of Structural Dynamics, 2nd Edition, by Roy R. Craig, Andrew J. Kurdila

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

OBJECTIVES

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- To get exposed to behavioural aspects of concrete and to get exposed to different types of concretes and their characteristics and applications.

Text Book

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

Refrence Book

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

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

Objectives

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

Design and Analysis of folded plates by various approximate method

Unit 5

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

Outcomes

- Able to design plate and shell structure for different kind of loading and different kind of support condition

TEXT BOOK

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

REFERENCES:

1. Santhakumar.A.R and Senthil.R, "Proceedings of International Conference onSpace Structures", Anna University, Chennai, 1997.
2. Subramanian.N ,"Principles of Space Structures", Wheeler Publishing Co.1999.
3. Ramasamy, G.S., "Design and Construction of Concrete Shells Roofs", CBSPublishers, 1986.
4. ASCE Manual No.31, "Design of Cylindrical Shells".

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

Objective:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Able to design different type of bridge member

Text Book:

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

Reference book:

1. J.E. Long, "Bearings in Structural Engineering", Newnes Butterworth & Co., 1974.
2. R.E. Rowe, "Concrete Bridge Design", 1st Edition, Elsevier Science and Technology, 1962.
3. L.G. Hendry and A.W. Jaeger, "The Analysis of Grid Frameworks and Related Structures", Chatto&Windus, 1958.

L-T-P 0-0-2	MCI028A – Structure Engineering Lab	Credits: 2

List of Experiments:

1. Fabrication, casting and testing of simply supported reinforced concrete beam for strength and deflection behaviour.
2. Testing of simply supported steel beam for strength and deflection behaviour.
3. Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading.
4. Dynamic testing of cantilever steel beam
    a. To determine the damping coefficients from free vibrations.
    b. To evaluate the mode shapes.
5. Static cyclic testing of single bay two storied steel frames and evaluate
    a. Drift of the frame.
    b. Stiffness of the frame.
    c. Energy dissipation capacity of the frame.
6. Determination of in-situ strength and quality of concrete using
    i) Rebound hammer and
    ii) Ultrasonic Pulse Velocity Tester

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

List of Experiments:

1. Compressive strength of Cement
2. Mix Design of Concrete and Casting of Specimen.
3. Young's Modulus of Concrete
4. Non destructive test on concrete.
5. Mix design of high strength concrete including casting and testing of specimens.
6. Mix design of fly ash concrete including casting and testing of specimens.
7. Determination of coefficient of permeability of concrete.
8. Determination of drying shrinkage of concrete.
9. Bending test on a RCC beam under.
    a) Single point load
    b) Three point load

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

SEMESTER-II

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

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

Text Books:

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

Reference Books:

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

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

Objective:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome:

- Able to prepare detailed structural drawings of steel structures.

Textbooks:

1. N. Subramanian: Design of steel structure.

References:

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

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

Objective:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5:

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

Outcome: Upon completion of this course, the student will be able to

- Know the concepts, methods and materials of pre stressing systems.
- Design the pre stressed concrete members and calculate the deflections in pre stressed concrete members.
- Design anchorage zones and composite pre stressed concrete members.

Text Book:

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

Reference Books:

1. Rajagopal.N, (2005), Prestressed Concrete, Second Edition, Narosa Publishing House.
2. Dayarathnam P, (2004), Prestressed Concrete Structures, S.Chand Publishers.
3. Sinha.N.C and Roy.S.K, (2000), Fundamentals of Pre-stressed Concrete, S.Chand& Company limited.

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

Objective:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

.

Unit 5

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

Outcome:

- Analyze the stresses and strains for two dimensional and three dimensional elements.
- Understand the equilibrium and compatibility conditions.
- Solve the problems on Torsion for different shaped bars.
- Understand the concept of plasticity.

Text Book:

1. Theory of Elasticity by Timeshanko, McGrawhill Publications.

REFERENCES

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

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

Experiment

Linear and non linear Analysis of structures

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

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

List of Experiments:

1. Computer programming for analysis of continuous beam
2. Computer programming for analysis of Plane trusses
3. Computer programming for analysis of Plane frame
4. Computer programming for analysis of Grid
5. Computer Programming for analysis of space truss

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

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

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

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

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

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

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

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

Semester III

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome:

- At the end of this course, the students will be able to analyze of structure, design of connections, and deflections.

Text book:

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

References:

1. Design of steel structure, S. Subramanyam.
2. Plastic Analysis, B.G.Neal.
3. Plastic Analysis, Horve.

L-T-P	MCI036A - Expansive and shrinkable soils	Credits: 4
4-0-0		

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome

- At the end of this course, the students will be aware about new materials and they able to its utilization in constructions.

Text book:

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

References:

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

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

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

Elective I

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

Objective:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome:

- Ability to analyze the structure for different kind of loading

TEXT BOOK

1. Theory of elastic Stability by Timshenko& Gere-Mc Graw Hill

REFERENCES

2. Stability of metallic structures by Blunch- Mc Graw Hill
3. Theory of Beam- Columns Vol I by Chem. &Atste Mc. Graw Hill

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

Objective:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome

- Able to design different type of structural member to resist earthquake forces.

Text BOOKS:

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

REFERENCE BOOK and CODES:

1. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.
2. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
3. Masory and Timber structures including earthquake Resistant Design –Anand S. Arya, Nemchand & Bros
4. IS: 1893 (Part-1) -2002. "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
5. IS: 4326-1993, "Earthquake Resistant Design and Construction of Building", Code of Practice B.I.S., New Delhi.
6 IS: 13920-1993, "Ductile detailing of concrete structures subjected to seismic force" – Guidelines, B.I.S., New Delhi.

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcomes:

- Understand various theories involved in soil structure interaction
- Understand capabilities of various models used to simulate the interaction
- Understand the features of methods of analysis and apply them in real life applications

Text Book

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

References

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

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

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

Elective II

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

Objective:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome:

- Ability to understand field monitoring and non-destructive evaluation of concrete structures.

Text Books:

1. Diagnosis and treatment of structures in distress by R.N.Raikar, Published by R&D Centre of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.
2. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.

Reference Books:

1. Shetty, M.S. (2005), Concrete Technology Theory and Practice, S.Chand and company, New Delhi.
2. Santha Kumar, A.R., (1996), Concrete chemical Theory and Applications, Indian society for construction engineering and technology, madras.

3. Garas, F.K,.Clarke, J.L, Armer, GST (1997), Structural assessment, Butterworths, UK.
4. R.T. Allen and S.C.Edwards, (1998), Repair of Concrete Structures, Blakie and Sons, UK.

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome

- Understand the concepts of shallow foundations.
- Design the retaining walls and sheet piles.
- Know the types well foundations.
- Design pile foundation.

Text book:

1. B. M Das, *Principles of Foundation Engineering*, Thomson Brooks/Cole
2. Gopal Ranjan and ASR Rao, (2002), Basic and applied Soil Mechanics, Wiley Eastern Ltd.

References:

3. N.P. Kurien, Design of Foundation Systems : Principles & Practices, Narosa, New Delhi 1992
4. H. F. Winterkorn and H Y Fang, Foundation Engineering Hand Book, GalgotiaBooksource

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

Objectives:

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

Unit 1

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

Unit 2

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

Unit 3

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

Unit 4

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

Unit 5

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

Outcome

- Know the types of tall buildings.
- Analyze the plane frame systems by different methods.
- Design the shear wall system and in filled frame systems.
- Do the three dimensional analysis.

Text book:

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

References:

1 SarwarAlamRaz, (2001), Analytical methods in Structural Engineering, Wiley Eastern Private Limited, New Delhi.

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

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