Curriculum Structure and Detailed Syllabus:

B.Tech. Model Curriculum Structure

SEMESTER-III

S. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	BAST-301	ESC	Engineering Science Course [ESC]/(Maths-III)	3	1	0	30	20	50		100		150	4
2	HSMC-302	HSC	Universal Human values	2	1	0	30	20	50		100		150	3
3	BCET-301	DC	Solid Mechanics	3	0	0	30	20	50		100		150	3
4	BCET-302	DC	Fluid Mechanics	3	1	0	30	20	50		100		150	4
5	BCET-303	DC	Surveying and Geomatics	3	1	0	30	20	50		100		150	4
6	BCEP-301	DLC	Solid Mechanics Lab			2				25		25	50	1
7	BCEP-302	DLC	Fluid Mechanics Lab			2				25		25	50	1
8	BCEP-303	DLC	Surveying and Geomatics Lab			2				25		25	50	1
9	BCEP-304	DLC	Mini Project or Internship Assessment*	0	0	2			50				50	1
10	NC	NC	Computer System Security/Python Programming	2	0	0	15	10	25		50			
			Total	16	4	6							950	22

*The Mini Project or internship (3-4weeks) conducted during summer break after II semester and will be assessed during III semester

SEMESTER-IV

S. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	HSMC-401	HSC	Technical Communication	3	0	0	30	20	50		100		150	3
2	BCET-401	DC	Material Testing & Evaluation	3	0	0	30	20	50		100		150	4
2	BCET-402	DC	Transportation Engineering-I	3	1	0	30	20	50		100		150	4
3	BCET-403	DC	Hydraulics Engineering	3	1	0	30	20	50		100		150	3
4	BCET-404	DC	Structure – I	3	1	0	30	20	50		100		150	4
5	BCEP-401	DLC	Material Testing & Evaluation Lab			2				25		25	50	1
6	BCEP-402	DLC	Transport Engineering Lab			2				25		25	50	1
7	BCEP-403	DLC	Hydraulics Engineering Lab			2				25		25	50	1
8	NC	NC	Python Programming/Computer System Security	2	0	0	15	10	25		50			
			Total	17	3	6							900	21

BAST	Bachelor of Applied Science Theory
BCET	Bachelor of Civil Engineering Theory
BCEP	Bachelor of Civil Engineering Practical
DC	Departmental Course
DEC	Departmental Elective Course
DLC	Departmental Lab Course
HSMC	Humanities & Social Science including Management Course
MC	Mandatory Course
NC	Non Credit Course

BAST-301	Mathematics – III	3L-1T-0P	4 Credits

COURSE OBJECTIVES

The objective of this course is to familiarize the students with Laplace Transform, Fourier Transform, techniques in numerical methods & some statistical techniques.
The students will learn:
1: The idea of Laplace transform of functions and their applications. 2:
The idea of Fourier transform of functions and their applications. 3: To
evaluate roots of algebraic and transcendental equations.
4: Interpolation, differentiation, integration and the solution of differential equations.
5: The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.

COURSE OUTCOMES

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

1. Remember the concept of Laplace transform and apply in solving real life problems.
2. Apply the concept of Fourier transform to evaluate engineering problems
3. Understand to evaluate roots of algebraic and transcendental equations.
4. Solve the problem related interpolation, differentiation, integration and the solution of differential equations.
5. Understand the concept of correlation, regression, moments, skewness and kurtosis and curve fitting.

COURSE CONTENT

Module 1: Fourier Transforms:

Fourier integral, Fourier Transform, Complex Fourier transform, Inverse Transforms, Convolution Theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations. **(8 Lecture hours)**

Module 2: Laplace Transform:

Definition of Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve linear differential equations.

(8 Lecture hours)

Module 3: Solution of Algebraic and Transcendental equations & Interpolation

Number and their accuracy, Solution of algebraic and transcendental equations: Bisection method, Iteration method, Newton-Raphson method and Regula-Falsi method. Rate of convergence of these methods (without proof), Interpolation: Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formula. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formula. **(8 Lecture hours)**

Module 4: Numerical differentiation, Integration & Solution of ODE

Numerical Differentiation, Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8 rule Runge-Kutta method of fourth order for solving first order linear differential equations. Milne's predicator-corrector method. **(8 Lecture hours)**

Module 5: Statistical Techniques

Introduction: Measures of central tendency, Moments, Moment generating function (MGF) Skewness, Kurtosis, Curve Fitting: Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves. Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non-linear regression.

(8 Lecture hours)

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics; John Wiley & Sons
2. B.V. Ramana: Higher Engineering Mathematics; Tata McGraw- Hill Publishing Company Limited, New Delhi.
3. Peter V.O' Neil. Advanced Engineering Mathematics, Thomas (Cengage) Learning
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. T.Veerarajan: Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.
6. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House,New Delhi.
7. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
8. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
9. N.P. Bali and Manish Goyal, Computer Based Numerical and Statistical Techniques, LaxmiPublications, Reprint, 2010.
10. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
11. D. N. Elhance, V. Elhance & B.M. Aggarwal: Fundamentals of Statistics; Kitab Mahal Distributers, New Delhi.

HSMC-302	UNIVERSAL HUMAN VALUES	3L:0T:0P	3 Credit

OBJECTIVE: The objective of the course is four fold:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

OUTCOME OF THE COURSE: By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to- day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundational input. It would be desirable to follow it up by

a) faculty-student or mentor-mentee programs throughout their time with the institution
b) Higher level courses on human values in every aspect of living. E.g. as a professional

COURSE TOPICS: The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Introduction - Value Education

Universal human values; self-exploration, natural acceptance an experimental validation; Human aspirations, right understanding, relationship and physical facility, current scenario; Understanding and living in harmony at various levels.

Module 2: Harmony in the Human Being

Understanding human being, needs of self(I) and body; body as an instrument of 'I'; characteristics and activities of 'I' and harmony in 'I'; harmony of I with the Body: Sanyam and Health, Physical needs an prosperity; Programs to ensure Sanyam and Health.

Module 3: Harmony in the Family and Society

Values in human-human relationship; nine universal values in relationships; justice, truth, respect, trust; Difference between intention and competence; Respect and differentiation, Harmony in society: resolution, prosperity, fearlessness and coexistence; Universal harmonious order in society.

Module 4: Harmony in the Nature and Existence

Harmony in the nature. Four orders of nature; existence as co-existence, harmony at all levels of existence.

Module 5: Harmony in the Professional Ethics

Natural acceptance of human values**,** Definitiveness of Ethical Human Conduct**;** Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case studies; transition from the present state to Universal Human Order: at individual level and societal level.

READINGS: Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karam chand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

BCET-301	Solid Mechanics	3L:0T:0P	3 Credit

COURSE OBJECTIVES

1. To know the concept of stresses and strains.
2. To know the concept of shear force and bending moment.
3. To calculate deflection in beams and trusses.
4. To determine the buckling and crushing load of compression members.
5. To study the rigid and deformable solids.
6. To give an ability to apply the knowledge of strength of materials on engineering applications and design problems

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components.
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods.
3. Analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear centre of thin wall beams.
4. Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members.

CATALOGUE DESCRIPTION

Students learn the concept of stresses and strains, elastic constants, principal stresses and strains and torsion. Students learn the concept of shear force diagram and bending moment diagram. Students also learn to calculate deflection of beams by different methods and the concept of strain energy. Students understand different formulas to calculate critical load on columns. Upon completion, students should be able to calculate stresses, strains, shear force and bending moment for beams, deflections in beams by different methods and critical load on columns.

COURSE CONTENT:

Module 1: Simple Stresses and Strains- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain –Elastic modules and the relationship between them –Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience– Gradual, sudden, impact and shock loadings – simple applications.

(10 Lecture hours)

Module 2:Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain. **(8 Lecture hours)**

Module 3: Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra-flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments. **(8 Lecture hours)**

Module 4: Flexural Stresses and Shear Stresses -Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. **-** Derivation of Shear Stresses formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections **(8 Lecture hours)**

Module 5: Slope, deflection and Torsion- Relationship between moment, slope and deflection, Moment area method, Macaulay's method, Use of these methods to calculate slope and deflection for determinant beams. Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close coiled helical springs. **(8 Lecture hours)**

Text Books

1. Ramamrutham S. and Narayanan R. (2008), Strength of Materials, 3rd Edition, Dhanpat Rai Publications Company, ISBN: 9788187433545.

Reference Books

1. Gere J. M. and Thimoshenko S. P. (2008), Mechanics of Materials, 8th Edition, CBS Publishers & Distributors, ISBN: 9780534417932.
2. Popov E. P. (2009), Engineering Mechanics of Solids, 2nd Edition, Prentice Hall Publisher, ISBN: 9788120321076.
3. Bansal R. K. (2010), Strength of Materials, 4th Edition, Laxmi Publications, ISBN: 9788131808146.
4. S S Rattan, "Strength of Materials", McGraw Hill Education.
5. M L Gambhir, "Fundamentals of Solid Mechanics", Prentice Hall India Learning Private Limited.
6. James M. Gere, Barry J. Goodno, "Mechanics of Materials", 8th edition, Cenage Learning.
7. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
8. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
9. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
10. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd edition. New York, NY: McGraw Hill, 1979
11. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf– TMH 2002.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-302	Fluid Mechanics	3L:1T:0P	4 Credit

COURSE OBJECTIVES

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system.
2. Develop competence with mass, energy and momentum balances for determining resultant interactions of flows and engineered and natural systems.
3. The development of boundary layers and advancement of practical hydraulics and understanding the concept of advanced fluid mechanics.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Calculation of conjugate depth in a flow and to analyse the model and prototype.
2. Find the dependent and independent parameters for a model of fluid flow.
3. Understand the broad principles of fluid statics, kinematics and dynamics
4. Understand definitions of the basic terms used in fluid mechanics
5. Understand classifications of fluid flow
6. Be able to apply the continuity, momentum and energy principles
7. Be able to apply dimensional analysis

CATALOGUE DESCRIPTION

The course provides a first level exposure to the students to fluid statics, kinematics and dynamics. Measurement of pressure, computations of hydrostatic forces on structural components and the concepts of Buoyancy all find useful applications in many engineering problems. A training to analyse engineering problems involving fluids – such as those dealing with pipe flow, open channel flow, jets, turbines and pumps, dams and spillways, culverts, river and groundwater flow - with a mechanistic perspective is essential for the civil engineering students. The topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology in later semesters.

COURSE CONTENT

Module 1: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

(10 Lecture hours)

Module 2: Fluid Statics - Fluid Pressure: Pressure at a point, Pascal's law, and pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer,

Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal,

vertical and inclined surfaces. Buoyancy and Stability of floating bodies.

(8 Lecture hours)

Module 3: Fluid Kinematics- Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates. **(8 Lecture hours)**

Module 4: Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

(8 Lecture hours) Module 5: **Boundary Layer Analysis** - Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients, Separation and Control. **(8 Lecture hours)**

Text Books

1. R. K. Bansal (2010), A Textbook of Fluid Mechanics and Hydraulic Machines 9th Ed. Laxmi Publication, ISBN-9788131808153.

Reference Books

1. P. N. Modi and S. M. Seth (2011), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications. ISBN- 9788189401269.
2. D.S. Kumar (2004), Fluid Mechanics and Fluid Power Engineering, Katson Publishing House, ISBN - 9788185749181.
3. V.L. Streeter, (2001), Fluid Mechanics, McGraw Hill Book Co. ISBN – 9780071156004
4. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
5. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
6. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
7. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET 303	Surveying and Geomatics	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).
2. Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.
3. Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.
4. Develop skill to carry out tachometry, geodetic surveying wherever situation demands.
5. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station.
6. Operate a total station to measure distance, angles, and to calculate differences in elevation.
7. Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion,
8. Calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

COURSE CONTENT

Module 1: Introduction to Surveying*:* Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes. **(10 Lecture hours)**

Triangulation and Trilateration: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation - network- Signals. Baseline -choices - instruments and accessories - extension of base lines - corrections - Satellite station - reduction to Centre-Intervisibility of height and distances - Trigonometric leveling - Axis single corrections.

(6 Lecture hours)

Module 2: **Curves** Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves.

(5 Lecture hours)

Module 3: **Modern Field Survey Systems:** Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station-Accessories-Advantages and Applications Field Procedure for total station survey, Errors in Total Station Survey.

(10 Lecture hours)

Module 4: **Errors** Treatment of random errors, Normal law of errors, Most Probable Value, Weight of observations, Propagation of errors and variances, Principle of Least Squares, Observations and correlative Normal Equations, Adjustment of triangulation figures and level nets. **(8 Lecture hours)**

Module 5: Field Astronomy: Astronomical terms, co-ordinate systems, Spherical trigonometry, Astronomical triangle, Relationship between coordinates. **(5 Lecture hours)**

Text Book:

1. B C Punmia : Surveying & Leveling

Reference Books:

1. S K Duggal : Surveying Vol 1 & 2 , TMH
2. Surveying, 5th Edition, Mc Cormac, Wiley India
3. R Subramanian : Surveying & Leveling , Oxford University Press
4. C Venkatramaih : Text Book of Surveying , University Press
5. H. Kanitkar : Surveying & Levelling
6. Arora, K.R., "Surveying", Vol. I & II, Standard Book House, Delhi.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCEP-301	Solid Mechanics Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness.

COURSE OUTCOMES

On completion of this course, the students will be able to,

1. Conduct tension and compression tests on the components.
2. To determine hardness, impact strength, fatigue strength of the specimens.
3. Measure strain and load using specific gauges.
4. Measure torsion in mild steel.
5. Compression and tension test on helical springs.

CATALOGUE DESCRIPTION

Students learn the concept of stresses and strains. Students learn the concept of tension test, double shear test, impact test. They also understand deflection test, fatigue test and torsion test. Upon completion, students will know the importance of this course.

List of Experiments

1. Tension test on a mild steel rod, thin and twisted bars.
2. Bend test steel bar.
3. Compression test on Bricks, Concrete blocks.
4. Determination of shear forces in beams.
5. Measurement of strain in a bar.
6. Determination of bending moments in beams,
7. Measurement of deflections in statically determinate beam.
8. Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation,
9. Measurement of forces on supports in statically determinate beam,
10. Double shear test on Mild steel and Aluminium rods.
11. Impact test on metal specimen (Charpy test and Izod test).
12. Hardness test on metals (Steel, Copper and Aluminium) - Brinnell Hardness Number.
13. Hardness test on metals (Steel, Copper and Aluminium) - Rockwell Hardness Number.

14. Deflection test – Verification of Maxwell theorem.
15. Compression and tension test on helical springs.
16. Fatigue test on Steel.
17. Torsion test on mild steel
18. Bending tests on simply supported beam and Cantilever beam.

Text Books

1. Ramamrutham S. and Narayanan R. (2008), Strength of Materials, 3rd Edition, Dhanpat Rai Publications Company, ISBN: 9788187433545.

Reference Books

1. Gere J. M. and Thimoshenko S. P. (2008), Mechanics of Materials, 8th Edition, CBS Publishers & Distributors, ISBN: 9780534417932.

2. Popov E. P. (2009), Engineering Mechanics of Solids, 2nd Edition, Prentice Hall Publisher, ISBN: 9788120321076.

3. Bansal R. K. (2010), Strength of Materials, 4th Edition, Laxmi Publications, ISBN: 9788131808146.

BCEP-302	Fluid Mechanics Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system.
2. Develop competence with mass, energy and momentum balances for determining resultant interactions of flows and engineered and natural systems.
3. The development of boundary layers and advancement of practical hydraulics and understanding the concept of advanced fluid mechanics.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. To find frictional losses in a pipe when there is a flow between two places.
2. Calculation of conjugate depth in a flow and to analyse the model and prototype.
3. Find the dependent and independent parameters for a model of fluid flow.
4. Explain the various methods available for the boundary layer separation.

CATALOGUE DESCRIPTION

Fluid mechanics including fluid statics and dynamics; conservation of mass, momentum, and energy; incompressible inviscid flow; flow of a real fluid--including laminar and turbulent flow; dimensional analysis and similitude; applications to engineering problems.

List of Experiments

1. Measurement of viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli's Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of jets
9. Flow Visualisation -Ideal Flow
10. Length of establishment of flow
11. Velocity distribution in pipes
12. Laminar Flow

BCEP-303	Surveying & Geomatics Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

1. To teach the students basics of surveying and expose different techniques of surveying.
2. To help the students to learn the field applicability of the different survey methods.
3. To teach students about types of errors encountered in different types of surveying.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Learn about basics involved in different types of surveying like tape, compass, leveling, and theodolite (total station).
2. Demonstrate skills in performing measurement of distance, angles, leveling, and curve setting.
3. Develop skills for estimating distance between given points, area of a given plot and earthwork involved in cuttings and fillings.
4. Develop skill to carry out tachometry, geodetic surveying wherever situation demands.
5. Develop skills to apply error adjustment to the recorded reading to get an accurate surveying output.

CATALOGUE DESCRIPTION

Surveying is the most useful and necessary part in Civil Engineering. In the present curriculum the following topics are discussed. Introduction to the care and use of optical surveying instruments, Transits, Total Stations and Auto Levels, use of cloth tapes, steel tapes and electronic distance machines, reduction of slope measurements to horizontal and vertical components, Measurement, field data reduction and adjustment of a closed traverse, Horizontal and Vertical curves, earthwork, and coordinates, Extensive field work, field notes and electronic data collection, introduction to geodetic surveying and Triangulation surveying.

List of Experiments

1. Study of different types of topographical maps and to prepare conventional symbols chart.
2. Chain Survey- Determination of area by perpendicular offsets
3. Chain Survey- Measurement of distance by chaining & ranging
4. Compass Survey- Plotting & adjustment of closed traverse
5. To study parts of a vernier / Electronic theodolite and practice for taking angle measurements.
6. Theodolite Survey- Measurement of horizontal angles by method of repetition
7. To measure horizontal angle by method of reiteration
8. Measurement of Vertical Angles and Determination of Height of an Object

9. Plane Table Survey- Radiation method
10. To find out reduced levels of given points using dumpy/Auto level.
11. To perform fly leveling with a Auto /tilting level.
12. Levelling- Rise & Fall method

13. Levelling- Height of collimation method
14. Trigonometrical Levelling- Single plane method
15. Curve Surveying- Setting out a simple circular curve by Rankine's method
16. To Layout a building and a culvert on the ground.
17. Contouring- To determine the contours for a given location
18. GPS Survey- Coordinates & Distance measurement using GPS
19. GIS demonstration and study of its applications.
20. To study various parts and practice with Wild T-2 micro-optic theodolite and EDM (Distomat DI-1600).
21. Study and use of different types of micro-optic theodolites and total stations.
22. To carry out Triangulation and Trilateration of a given area.
23. Total Station- Measurement of Altitude of Given Elevated Points
24. Total Station- Measurement of distance & coordinates of given points
25. Stereoscope- Use of stereoscope for 3D viewing
26. Stereoscope- Determination of height of objects from a stereo pair using the parallax bar

Text Books

1. Punmia B.C. (2005), Surveying, Volume 1, 16th Edition Laxmi Publications. ISBN: 9788170080794
2. Satheesh Gopi (2010), GPS Principles and Applications, Tata Mc Graw Hill publishing company Ltd. ISBN: 9780070141704

Reference Books

1. Subramaniyan R. (2010), Surveying and Levelling, Oxford University Press. ISBN: 9780195684247.
2. Kanetkar T.P. (2006), Surveying and Levelling, Vol I, Pune. ISBN: 9788185825113.
3. Kanetkar T.P. (2008), Surveying and Levelling, Vol II, Pune. ISBN: 9788185825007

HSMC 401	Technical Communication	2L:1T:0P	3 Credits

COURSE CONTENTS:

Module 1: Fundamentals of Technical Communication:

Technical Communication: Introduction, Features; Distinction between General and Technical Communication; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication, Importance of communication

Module 2: Forms of Technical Communication:

Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Module 3: Technical Presentation: Strategies & Techniques

Presentation: Forms; interpersonal Communication; Class Room presentation; style; method, Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections

Module 4: Technical Communication Skills

Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances, exposition, narration and description

Module 5: Kinesics & Voice Dynamics:

Kinesics: Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation, pronunciation, articulation, vowel and consonants sounds

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
6. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S.
7. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

Course Outcomes

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for the work place as Engineers.
2. Students will **utilize** the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
3. Students would imbibe inputs by presentation skills to **enhance** confidence in face of diverse audience.
4. Technical communication skills will **create** a vast know-how of the application of the learning to promote their technical competence.
5. It would enable them to **evaluate** their efficacy as fluent & efficient communicators by learning the voice-dynamics.

BCET-401	Material, Testing and Evaluation	3L:1T:0P	4 Credits

COURSE OBJECTIVES

The objective of this Course is to deal with an experimental determination and evaluation of mechanical characteristics and advanced behaviour of metallic and non-metallic structural materials. The course deals with explanation of deformation and fracture behaviour of structural materials. The main goal of this course is to provide students with all information concerning principle, way of measurement, as well as practical application of mechanical characteristics.

1. Make measurements of behavior of various materials used in Civil Engineering.
2. Provide physical observations to complement concepts learnt
3. Introduce experimental procedures and common measurement instruments, equipment, devices
4. Exposure to a variety of established material testing procedures and technique
5. Different methods of evaluation and inferences drawn from observations

COURSE OUTCOMES

1. Different materials used in civil engineering applications
2. Planning an experimental program, selecting the test configuration, selecting the test specimens and collecting raw data
3. Documenting the experimental program including the test procedures, collected data, method of interpretation and final results
4. Operating the laboratory equipment including the electronic instrumentation, the test apparatus and the data collection system
5. Measuring physical properties of common structural and geotechnical construction materials
6. Interpreting the laboratory data including conversion of the measurements into engineering values and derivation of material properties (strength and stiffness) from the engineering values Observing various modes of failure in compression, tension, and shear
7. Observing various types of material behavior under similar loading conditions

CATALOGUE DESCRIPTION

The course reviews also the current testing technology and examines force applications systems, force measurement, strain measurement, important instrument considerations, equipment for environmental testing, and computers applications for materials testing provide an introductory treatment of basic skills in material engineering towards (i) selecting material for the design, and (ii) evaluating the mechanical and structural properties of material, as well as the knowledge necessary for a civil engineer. The knowledge acquired lays a good foundation for analysis and design of various civil engineering structures/systems in a reliable manner.

COURSE CONTENT

Module 1: **Introduction to Engineering Materials covering**, Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these. **(10 Lecture hours)**

Module 2: **Introduction to Material Testing covering**, What is the "Material Engineering"?; Mechanical behaviour and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress –strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep-fundaments and characteristics; Brittle fracture of steel-temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics.

(8 Lecture hours)

Module 3: **Standard Testing & Evaluation Procedures covering**, Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep. Comparison for environmental impact and safety. **(8 Lecture hours)**

Module 4: Components and Construction Principle: Components of building area considerations, Construction Principle and Methods for layout, Damp proofing ant termite treatment, Vertical circulation means staircases ramp design and construction. Different types of floors, and flooring materials (Ground floor and upper floors). Bricks and stone masonary construction. Cavity wall hollow block and Waffle slab construction. Doors, Windows and Ventilations, Construction details types and relative advantages & disadvantages. Roofs types and treatments, Lintels and Chhajja Functional efficiency of Buildings. Natural Ventilation, Water Supply and Sanitary fittings (Plumbing), Electricity. Heating Ventilation & Air conditioning, Mechanical Lifts and Escalators, Fire Fighting, Acoustics. Plastering different types, pointing, Distempering, Colour washing, Painting etc. Principles & Methods of building maintenance.

(8 Lecture hours)

Module 5: **New Techniques in construction**-Introduction, 3 D printing, photo catalytic admixture, self-healing concrete, zero cement concrete, hemp lime, wood glass epoxy composites, bamboo.

(8 Lecture hours)

Text/Reference Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann

2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
4. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
5. E.N. Dowling (1993), Mechanical Behaviour of Materials, Prentice Hall International Edition
6. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)
7. Related papers published in international journals

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-402	Transportation Engineering-I	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. To teach the students about the different transportation systems.
2. To familiarise with various components involved in their respective modes and their basic design concepts.
3. To study various traffic surveys, to understand the traffic signal timing design and traffic flow theories.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Design various geometric elements of highways.
2. To carry out surveys involved in planning and highway alignment
3. To carry out traffic studies and implement traffic regulation and control measures and intersection design and traffic management.
4. Estimate earth work from longitudinal and cross-section details
5. Characterize the pavement materials
6. Test the highway materials as per IS/IRC guidelines.
7. Do structural design of flexible and rigid pavements.
8. Know various highway constructions techniques and its maintenance.

CATALOGUE DESCRIPTION

The importance of transportation engineering is very useful in our daily life. So the basics knowledge of transportation modes are important. The basic modes are railways, aircraft etc. So we will go through the introduction, characteristics, design and safety of railway, airport, dock and harbour. The understanding of the geometrical part of the transportation is more important.

Module 1: **Highway development and planning**-Classification of roads, road development in India, Introduction to Transportation modes – Highway alignment and field surveys – Master Plan Transport economics – Traffic Studies – Volume, speed, origin and destination studies.
Introduction to Multi-modal Transportation, Automated Transport systems, High urban transport, Impact of transport on environment. Current road projects in India; highway alignment and project preparation.

(8 Lecture hours)

Module 2: **Geometric design of highways**-: Introduction; highway cross section elements; camber, sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems

Module 3: **Traffic engineering & control**- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems **(6 Lecture hours)**

Module 4: **Pavement materials**- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems **(8 Lecture hours)**

Module 5: Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements-components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems **(8 Lecture hours)**

Text Books

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017

Reference Books

1. Kadiyali.L.R, and Lal.N.B, (2005), Principles and Practice of Highway Engineering, Fourth Edition, Khanna Publishers, ISBN- 9788174091659.
1. Chakroborthy Partha, and Das Animesh, (2003), Principles of Transportation Engineering, Eighth Printing, Prentice-Hall of India, ISBN-9788120320840.
2. Rao.G.V, (1996), Principles of Transportation and Highway Engineering, Tata McGraw-Hill Co, ISBN-9780074623633.
3. Khisty.C.J, and Lall.B.K, (2003), Transportation Engineering, Indian Edition, Prentice-Hall of India, ISBN-9788120322127.
4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
5. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-403	Hydraulics Engineering	3L:0T:0P	3 Credits

COURSE OBJECTIVES:

To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.

COURSE OUTCOMES: At the end of the course, the student will be able to:

1. To relate the theory and practice of problems in hydraulic engineering
2. Derive the governing equations of transients in pipes and channels
3. Apply method of characteristics and finite difference methods to solve unsteady flow problems in pipes and channels
4. Analyze transients in pumping and hydropower systems
5. Analyze dam break problem

Module 1: **Laminar Flow and Turbulent Flow -** Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram. **(10 Lecture hours)**

Module 2: **Boundary Layer Analysis Dimensional Analysis and Hydraulic Similitude** -Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

(8 Lecture hours)

Module 3: Open Channel Flow, Uniform Flow and Non-Uniform Flow -Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n". Most economical section of channel. Computation of Uniform flow, Normal depth. Non-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical,

numerical and analytical approaches. Direct Step method, Graphical Integration method and direct integration method.

(8 Lecture hours)

Module 4: Hydraulic Jump and Flow through Pipes - Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, and moments of momentum equation. Flow through Pipes: Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.

(8 Lecture hours)

Module 5: Computational Fluid Dynamics: Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web based modelling in water resources engineering.

(8 Lecture hours)

Text/Reference Books:

1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
3. Open channel Flow, K. Subramanya, Tata McGraw Hill.
4. Open Channel Hydraulics, Ven Te Chow, Tata McGraw Hill.
5. Burnside, C.D., “Electromagnetic Distance Measurement,” Beekman Publishers, 1971.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-404	Structural Analysis -I	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. To understand the concept of static indeterminacy.
2. To know the different techniques available for the analysis of statically indeterminate structures.
3. To identify the best suitable method of analysis.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Identify the method of analysis for statically indeterminate structures.
2. Understand the difference between statically determinate structures and statically indeterminate structures.
3. Use the influence line diagram for analysing beam.
4. Understand strain energy method to analyse arches.
5. Apply moment distribution method.

CATALOGUE DESCRIPTION

Structural analysis is the determination of the effects of loads on physical structures and their components. Structures subject to this type of analysis include all that must withstand loads, such as buildings, bridges, vehicles, machinery, furniture, attire, soil strata, prostheses and biological tissue. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests. Structural analysis is thus a key part of the engineering design of structures.

Module 1. Truss Analysis

Analysis of determinate truss- Methods of joints and sections. Degree of static and kinematic determinacies, Introduction to force and displacement methods **(8 Lecture hours)**

Module 2. Moving loads and influence lines.

Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams - analysis for different types of moving loads - single concentrated load - several concentrated loads, uniformly distributed load on shorter and longer than the span. **(10 Lecture hours)**

Module 3. Cables and Suspension Bridges

Analysis of forces in cables under concentrated and uniformly distributed loads - Anchor Cables Un-stiffened suspension bridges, maximum tension in the suspension cable and backstays, pressure on towers.

(8 Lecture hours)

Module 4. Arches: Theory of arches – Eddy's theorem - analysis of three hinged arches-Support reactions-normal thrust and Radial shear at any section of a parabolic and segmental arch due to simple cases of loading. Moving loads on three hinged arches **(8 Lecture hours)**

Module 5. Elastic theorems and energy principles - strain energy due to axial load, bending moment, shear and torsion - strain energy method, Castigliano's method for deflection, Unit load method-Betti's theorem –Maxwell's law of reciprocal deflections - principle of least work - application of unit load method and strain energy method for determination of deflection of statically determinate beams, frames - pin jointed trusses.

(8 Lecture hours)

Text Books:

1. Gere and Timoshenko, Mechanics of materials, CBS. Publishers
2. Kenneth Leet,Chia M Uang& Anne M Gilbert., Fundamentals of Structural Analysis, McGraw Hill
3. R.Vaidyanathan and P.Perumal, Comprehensive Structural Analysis Volume I & II, Laxmi Publications (P) Ltd
4. Wang C.K., Intermediate Structural Analysis, McGraw Hill

References:

1. AslamKassimali., Structural Analysis, Cenage Learning
2. Chandramouli P N, Structural Analysis I –Analysis of Statically Determinate Structures, Yes DeePublishingPvt Ltd.,Chennai,Tamil Nadu.
3. DevdasMenon, Structural Analysis, Narosa Publications
4. Hibbeler., Structural Analysis, Pearson Education
5. Kinney S., Indeterminate Structural Analysis, Oxford & IBH
6. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India
7. Reddy C.S., Indeterminate Structural Analysis, Tata McGraw Hill
8. Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCEP-401	Material Testing and Evaluation	0L:0T:2P	1 Credits

List of Experiment/Practicals:

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

BCEP-402	Transportation Engineering Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVE

1. To impart the knowledge in testing of different highway materials as per IS/IRC guidelines.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand about aggregate crushing value test and aggregate impact test.
2. Perform Los Angeles Abrasion Test and Shape Test.
3. Understand different procedures for testing bitumen.
4. Test the highway materials as per IS/IRC guidelines.
5. Carry out Spot Test and California Bearing Ratio Test.

CATALOGUE DESCRIPTION

Highway Engineering is a prominent aspect of surface transport. With basic knowledge of materials and soil mechanics, highway engineering deals with planning, design, construction, operation and maintenance of all types of roads. During the course, the students learn all aspects of Highway Engineering in detail. Upon completion, the student shall possess the basic knowledge of Highway Engineering along with an overview of advanced concepts like multi modal transport and Intelligent Transport Systems. The students should be able to perform the basic duties of a Highway Engineer.

List of experiments/Apparatus

A. Test of bitumen

1. Specific gravity test of bitumen
2. Ductility test of bitumen
3. Flush point and fire point test of bitumen
4. Float test of bitumen
5. Penetration test of bitumen
6. Softening test of bitumen
7. Viscosity test of bitumen
8. Water content test of bitumen

B. Test of Aggregate

1. Abrasion test of aggregate
2. Shape test (flakiness and elongation) of aggregate
3. Impact value test of aggregate
4. Specific gravity test of aggregate
5. Compressive strength test of aggregate

C. Test of Tar

1. Viscosity of tar

D. Test of bituminous mix

1. Marshal test for stability and flow value

BCEP-403	Hydraulics Engineering Lab	0L:0T:2P	1 Credits

List of Experiment/Practical Work:

1. Flow Visualization
2. Studies in Wind Tunnel
3. Boundary Layer
4. Flow around an Aerofoil / circular cylinder
5. Uniform Flow
6. Velocity Distribution in Open channel flow
7. Venturi Flume
8. Standing Wave Flume
9. Gradually Varied Flow
10. Hydraulic Jump
11. Flow under Sluice Gate
12. Flow through pipes
13. Turbulent flow through pipes
14. Flow visualization
15. Laminar flow through pipes
16. Major losses / Minor losses in pipe

BCEP-404	Structural Analysis Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

1. To know the concept and procedure of different type of method to find slope and deflection for different type of structures.
2. To understand the advantage and disadvantage of different types of methods used for find slope.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand different methods used for finding slope and deflections.
2. Determine the deflection of indeterminate structures and will be able to calculate deflection of different types of structures.
3. Determine the slope of indeterminate structures and will be able to calculate slope of different types of structures.

CATALOGUE DESCRIPTION

Through this course students will learn various methods for finding slope and deflection of indeterminate structures. They will learn also difference between the methods used for find slope and deflections. They will understand advantage and disadvantage of different methods for solving indeterminate structures for design purposes.

List of Experiments

1. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
2. To determine the Flexural Rigidity of a given beam.
3. To verify the Moment - area theorem for slope and deflection of a given beam.
4. Deflection of a fixed beam and influence line for reactions.
5. Deflection studies for a continuous beam and influence line for reactions.
6. Study of behaviour of columns and struts with different end conditions.
7. Experiment on three hinged arch.
8. Experiment on two hinged arch.
9. Deflection of a statically determinate pin jointed truss.
10. Unsymmetrical Bending of curved beam.

Third year:

B.Tech. Model Curriculum Structure

SEMESTER-V

S. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	BCET-501	DC	Geotechnical Engineering	3	1	0	30	20	50		100		150	4
2	BCET-502	DC	Environmental Engineering-I	3	1	0	30	20	50		100		150	4
3	BCET-503	DC	Transportation Engineering - II	3	1	0	30	20	50		100		150	4
4	BCET-51X	DEC	Departmental Elective-I	3	0	0	30	20	50		100		150	3
5	BCET-52Y	DEC	Departmental Elective-II	3	0	0	30	20	50		100		150	3
6	BCEP-501	DLC	Geotechnical Engineering Lab			2				25		25	50	1
7	BCEP-502	DLC	Fluid Mechanics Lab			2				25		25	50	1
8	BCEP-503	DLC	Structural Engineering Lab			2				25		25	50	1
9	BCEP-504	DLC	Mini Project or Internship Assessment*	0	0	2				50			50	1
10	NC	MC	Constitution of India / Essence of Indian Traditional Knowledge	2	0	0	15	10	25		50			
			Total	17	3	8							950	22

*The Mini Project or internship (3-4weeks) conducted during summer break after IV semester and will be assessed during V semester

Departmental Elective Course-1				Specialization
1	BCET-511	DEC	Quantity Survey and Costing	Surveying
2	BCET-512	DEC	Fluid Mechanics	Hydraulics
3	BCET-513	DEC	Traffic Engineering & management	Transportation Engineering
4	BCET-514	DEC	Construction Techniques & Practices	Construction Engineering & Management
Departmental Elective Course-2				**Specialization**
1	TCE-521	DEC	Structure - II	Structural Engineering
2	TCE-522	DEC	Ground Improvement Techniques	Geotechnical Engineering
3	TCE-523	DEC	Hydropower Engineering	Hydrology & Water Resources Engineering
4	TCE-524	DEC	Infrastructure Planning and Designing	Transportation Engineering

SEMESTER-VI

S. No.	Subject Codes	Category	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	BCET-601	DC	Design of RCC-I	3	1		30	20	50		100		150	4
2	BCET-602	DC	Environment Engineering - II	3	1		30	20	50		100		150	4
4	BCET-603	DC	Foundation Engineering	3	1		30	20	50		100		150	4
3	BCE-63X	DC	Departmental Elective-III	3	0		30	20	50		100		150	3
5	HSMC-601	HSC	POM	3	0		30	20	50		100		150	3
6	BCEP-601	DLC	RCC Detailing			2				25		25	50	1
7	BCEP-602	DLC	Environment Lab			2				25		25	50	1
8	BCEP-603	DLC	CAD Lab			2				25		25	50	1
9	NC	NC	Essence of Indian Traditional Knowledge / Constitution of India	2	0	0	15	10	25		50			

			Total	**17**	**3**	**6**							**900**	**21**

Departmental Elective Course-3				Specialization
1	BCET-631	DEC	Design of Steel Structures	Structural Analysis
2	BCET-632	DEC	Hydraulic Structure	Hydraulics
3	BCET-633	DEC	Construction Project Planning & System	Construction Engineering & Management
4	BCET-634	DEC	Urban Transportation Planning	Transportation Engineering

BCET	Bachelor of Civil Engineering Theory
BCEP	Bachelor of Civil Engineering Practical
DC*	Departmental Course
DEC*	Departmental Elective Course
DLC*	Departmental Lab Course
HSMC*	Humanities & Social Science including Management Course
MC*	Mandatory Course
NC*	Non Credit Course

BCET-501	Geotechnical Engineering	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. To impart the fundamental concepts of soil mechanics.
2. To understand the bearing capacity.
3. To know the importance of index properties like grain size, consistency limits, soil classification.
4. To understand the concept of compaction and consolidation of soils.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Give an engineering classification of a given soil.
2. Understand the principle of effective stress, and then calculate stresses that influence soil behavior.
3. Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement.
4. Specify soil compaction requirements.
5. Conduct laboratory tests, and obtain soil properties and parameters from the test observations and results.

CATALOGUE DESCRIPTION

Basics of soil mechanics is very essential for a civil engineers, its properties can be easily understand by weight volume relations and classification of soil by index properties. Effect of water and air within the soil has given the lot of scope for research, and results compressibility and consolidation respectively. The most important parameters of soil which affects the shear strength of soil are its cohesion and friction angles. Concept of stress distribution in soils has been analyzed by Boussinesq's equation, Westergaard's equation and earth pressure is also analyzed for various cases.

COURSE CONTENT

Module 1: Weight volume relations and Index properties (12 lecture hours)

Distribution of soil in India, Soil - Types, 3-phase diagram, Weight-volume relations, Classification, Index properties (Atterberg's limits), Unified soil classification system, IS soil classification system, field identification tests. Importance of geotechnical engineering.

Module 2: Soil water and Permeability (8 lecture hours)

Soil water - Effective and neutral stresses, **Capillarity** – Flow of water through soils -Permeability -Darcy's law -Seepage and flow-nets - Quick sand conditions.

Module 3: Stress distribution in soils (8 lecture hours)

Vertical pressure distribution- Boussinesq's equation for point load and uniformly distributed loads of different shapes– Newmark's influence chart -Westergaard's equation -Isobar diagram -Pressure bulb -Contact pressure, Earth Pressures Theories.

Module 4: Compressibility and Consolidation (8 lecture hours)

Theory of compaction ,Compressibility – e-log p curve – Pre-consolidation pressure - Primary consolidation – Terzaghi's consolidation theory - Laboratory consolidation test – Determination of C_v by Taylor's and Casagrande's methods.

Module 5: Shear strength of soils (9 lecture hours)

Stress analysis by Mohr's circle - Mohr's strength theory – Shear strength of soils – Mohr-Coloumb strength envelope – Laboratory shear tests – Direct shear test – Triaxial compression – Unconfined compression test – Vane shear test – Shear strength of saturated cohesive soils – Shear strength of cohesion less soils -conditions for liquefaction.

Text Books

1. K.R.Arora (2011), Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, ISBN: 978-81-801-4112-6.

2. Arun Kr. Jain, B.C. Punmia, Ashok Kr. Jain (2005), Soil Mechanics and Foundations, Sixteenth Edition, Laxmi Publications. ISBN: 978-81-700-8791-5.

Reference Books

1. Gopal Ranjan, A.S.R Rao (2000), Basic and Applied Soil Mechanics 2nd Edition, New Age International. ISBN: 978-81-224-1223-9.

2. William Powrie, Soil Mechanics: Concepts and Applications, Second Edition, Spon Press. ISBN: 978-04-153-1156-4.

3. Karl Terzaghi, Soil Mechanics in Engineering Practice, Warren Press. ISBN: 978-14-465-1039-1.

4. Aysen (2004), Problem Solving in Soil Mechanics, Taylor & Francis Group. ISBN: 978-04-153-8392-9.

5. Holtz, R.D. Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall.

6. Couduto, D.P., "Geotechnical Engineering- Principles and Practices", Prentice Hall of India.

7. Murthy, V.N.S., "Text Book of Soil Mechanics and Foundation Engineering", CBS Publishers

8. Lambe, T.W. and Whitman, R.V., "Soil Mechanics", John Wiley and Sons.

9. Das, B.M., "Principles of Geotechnical Engineering", Thomson Asia.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-502	Environmental Engineering-I	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. Understand the basic principles and concepts of unit operations and processes involved in water treatment.
2. Design of unit operations and processes involved in water treatment.
3. Evaluation of the performance of water treatment plants.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. The type of unit operations and processes involved in water treatment plants.
2. Unit operations and processes required for satisfactory treatment of water.
3. The design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
4. To study unit operations & advanced Processes in Water treatment its disinfection and aeration and softening.
5. The design of water treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.

CATALOGUE DESCRIPTION

Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pretreatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society.

Module-1 Water supply: 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; intakes and their design for lakes, streams and rivers, impounding reservoir and canal; determination of the capacity of impounding reservoir. **(7 Lecture hours)**

Module -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.

(4 Lecture hours)

Module -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. Water supply, plumbing systems in buildings and houses: water connections, different cocks and pipe fittings, hot water installation. Institutional and industrial water supply. **(6 Lecture hours)**

Module -4 Wastewater collection: Systems of sanitation and wastewater collection, estimation of wastewater flows and variations in wastewater flows. Storm water collection and estimation of storm water by different formulae. **(6 Lecture hours)**

Module -5 Flow in sewers: Flow in full and partially full sewers and design of sewers; types of sewers, materials and construction of sewers, joints and sewer appurtenances, layout and construction of sewer lines; small bore sewer systems. Planning of sewerage systems. Institutional and industrial wastewater management. **(6 Lecture hours)**

Text Books

1. Garg S.K. (2010), Environmental Engineering Vol. I Water Supply Engineering, Khanna Publishers. ISBN: 9788174091208
2. H.S.Peavy, D.R.Rowe & George Tchobanoglous (2005), Environmental Engineering, McGraw-Hill Company, New Delhi. ISBN: 9789380358246

Reference Books

1. Nathanson, Jerry A. (2007), Basic Environmental Technology: Water Supply, Waste Management, and Pollution Control, 5th ed., PHI Learning Private Limited ISBN: 978-81-203-3836-4
2. Rangwala (1999), Water supply & Sanitary Engineering, Charotar Publishing House, Anand-16th Edition. ISBN: 9788185594590
3. Metcalf and Eddy (2003), Wastewater Engineering, Treatment and reuse, Tata McGraw-Hill Edition, Fourth edition. ISBN:9780070495395
4. Nazaroff, Environmental Engineering Science, Wiley India
5. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
6. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
7. Fair and Geyer: Water Supply and Wastewater Disposal

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-503	Transportation Engineering-II	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. To teach the students about the different transportation systems.
2. To familiarise with various components involved in their respective modes and their basic design concepts.
3. Understand the various concepts in railway design and components of railway track.
4. Analyse the construction process, maintenance and operation of railway track.
5. Evaluate the design of airport, cost estimation and geometric design of airports.
6. Understand the various components of airports, planning concepts and air traffic controls.
7. Understand the various terms in harbour engineering and its classification.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Demonstrate the ability to identify the components of railway track, their functions, alignment and the station yards.
2. Recognize and identify the requirement of an airport and the principle involved in it.
3. Learn to classify the harbours and demonstrate the ability to identify the components of a dock.

CATALOGUE DESCRIPTION

The importance of transportation engineering is very useful in our daily life. So the basics knowledge of transportation modes are important. The basic modes are railways, aircraft etc. So we will go through the introduction, characteristics, design and safety of railway, airport, dock and harbour. The understanding of the geometrical part of the transportation is more important.

COURSE CONTENT

MODULE 1: Introduction to Railway Engineering **(9 lecture hours)**

History and administrative setup of Indian Railways; rail gauges, permanent way – functions, requirements, sections in embankment and cutting, stresses in different components of track, Types of joints and fastenings.

MODULE 2: Track Geometrics and Safety **(9 lecture hours)**

Requirements of Railway alignment, vertical alignment and horizontal alignment, points and crossings – terminologies, Turnouts – Types and design aspects, Signals classification and their functions, train operation control systems, interlocking of tracks.

MODULE 3: Introduction to airports and Aircraft Characteristics **(9 lecture hours)**

Air transport development in India, national and international organizations in air transport, aircraft characteristics and their impact on planning of an airport, selection of site for an airport, airport obstruction, imaginary surfaces, runway orientation clam period and wind coverage.

MODULE 4: Geometric Designs and Airport Traffic control Aids **(9 lecture hours)**

Runway and taxiway geometric designs, exit taxiway, its design and fillet curves, runway configuration, separation clearance, design of apron and their layout. Visual aids, marking and lighting of runway and apron area, wind and landing direction indicator.

MODULE 5: Docks and Harbour Engineering **(9 lecture hours)**

Historical development in India , tides, winds & waves, docks, harbours, break waters, jetties, landing stages & wharves, dry docks, transit sheds, cargo handling, , inland water transport. Maintenance.

Text Books

1. Chandra.S., and Agarwal. M.M., (2007), Railway Engineering, Oxford University Press India, ISBN-9780195687798.
2. Rangwala.S.C., Rangwala.P.S., (2008), Airport Engineering, Charotar Publishing House Pvt. Limited, ISBN-9788185594972.
3. Oza.H.P., and Oza. G.H., (2011), Dock and Harbour Engineering, Sixth Edition, Charotar Publishing House Pvt., ISBN-9789380358383.
4. Bindra, S.P., A course in Docks and Harbour Engineering, Dhanpat Rai and Sons, New Delhi, 1993.

Reference Books

2. Arora.S.P., and Saxena. S.C., (2001), A Textbook of Railway Engineering, Sixth Edition, Dhanpat Rai Publications.
3. Khanna.S.K, and Arora.M.G. (1971), Airport Planning and Design, Nem Chand & Bros.
4. Mundey, J.S., A course in Railway Track Engineering.
5. Oza and Oza, Elements of Dock and Harbour Engineering, Charotar Publishing House, 1992.

Chandola. S.P., A text book of Transportation Engineering, S. Chand & Company Ltd,New Delhi, 1st

Edition,2001.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCEP-501	Geotechnical Engineering Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

1. To impart the fundamental concepts of soil mechanics.
2. To understand the bearing capacity.
3. To know the importance of index properties like grain size, consistency limits, soil classification.
4. To understand the concept of compaction and consolidation of soils.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Give an engineering classification of a given soil.
2. Understand the principle of effective stress, and then calculate stresses that influence soil behavior.
3. Determine soil deformation parameters, and calculate settlement magnitude and rate of settlement.
4. Specify soil compaction requirements.
5. Conduct laboratory tests, and obtain soil properties and parameters from the test observations and results.

CATALOGUE DESCRIPTION

Basics of soil mechanics is very essential for a civil engineers, its properties can be easily understand by weight volume relations and classification of soil by index properties. Effect of water and air within the soil has given the lot of scope for research, and results compressibility and consolidation respectively. The most important parameters of soil which affects the shear strength of soil are its cohesion and friction angles. Concept of stress distribution in soils has been analyzed by Boussinesq's equation, Westergaard's equation and earth pressure is also analyzed for various cases.

List of Experiments:

1. To determine moisture content of soil
2. To determine the specific gravity of soil fraction passing 4.75mm I.S sieve by density bottle/Pycnometer bottle
3. To determine the grain size distribution curve for given soil sample by sieve analysis and hydrometer analysis.
4. To determine the consistency limits (i.e Liquid limit, Plastic limit & Shrinkage limit)of given samples
5. To determine in-situ density of compacted soils by using core cutter & pouring cylinder methods.
6. To determine the relative density of given coarse grained materials
7. To determine the maximum dry density and optimum moisture content for the given soil sample.
8. To determine coefficient of permeability of given soil sample by constant head and variable head method.
9. To determine unconfined compressive strength of a given soil sample

10. To determine shear strength of a given soil specimen using vane shear apparatus
11. To determine shear strength of a given soil specimen using direct shear apparatus
12. To determine the shear parameters of soil by Undrained Triaxial Test

BCEP-502*	Fluid Mechanics Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system.
2. Develop competence with mass, energy and momentum balances for determining resultant interactions of flows and engineered and natural systems.
3. The development of boundary layers and advancement of practical hydraulics and understanding the concept of advanced fluid mechanics.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. To find frictional losses in a pipe when there is a flow between two places.
2. Calculation of conjugate depth in a flow and to analyse the model and prototype.
3. Find the dependent and independent parameters for a model of fluid flow.
4. Explain the various methods available for the boundary layer separation.

CATALOGUE DESCRIPTION

Fluid mechanics including fluid statics and dynamics; conservation of mass, momentum, and energy; incompressible inviscid flow; flow of a real fluid--including laminar and turbulent flow; dimensional analysis and similitude; applications to engineering problems.

Lab Experiments

1. Measurement of viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli's Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of jets
9. Flow Visualisation -Ideal Flow
10. Length of establishment of flow
11. Velocity distribution in pipes
12. Laminar Flow

BCEP-502*	**Quantity Survey & Costing Lab**	**0L:0T:2P**	**1 Credits**

List of Experiments:

1. Preparation of detailed estimate.
2. Detailed estimate for services of plumbing and water supply or Electrification work.
3. Detailed estimate for earth work for the road construction or arched culvert.
4. Rate analysis for at least 8 items of construction.
5. Preparation of DPR of Civil Engineering Project.

BCEP-503	**Structural Analysis Lab**	**0L:0T:2P**	**1 Credits**

LIST OF PRACTICALS/APPARATUS

1. Redundant Joint apparatus
2. Elasticity coupled beam apparatus
3. Deflection of truss apparatus
4. Three hinged arch apparatus
5. Beam model
6. Two hinged arch apparatus
7. Elastic properties of deflected beam apparatus
8. Column apparatus
9. Portal frame Apparatus
10. Curved Member Apparatus

DEPARTMENTAL ELECTIVE-I

BCET-502	**Quantity Survey & Costing**	**3L:0T:0P**	**3 Credits**

COURSE OBJECTIVES

1. To understand the types of estimates.
2. To identify the methods of quantity estimation used for different structural components.
3. To understand rate analysis and process of preparation of bill of quantity.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Prepare a detailed estimate for different types of structures.
2. Prepare valuation reports and cost quality control.
3. Estimates the quantity of items and analyse its rates considering material, labour and machinery cost with the help of software
4. Evaluate contracts and tenders in construction practices

CATALOGUE DESCRIPTION

Through this course the student will learn about various types of estimates and different estimating procedures for different structural elements. They also learn rate analysis and making bill of quantities.

Course Content

Module-1: Estimation of building **(10 lecture hours)**

Estimation of building works – Procedure of estimating, Types of estimates, detailed estimate of buildings including sanitary & electrical fittings.

Module-2: Estimate of R.C.C and Steel works **(9 lecture hours)**

Estimate of R.C.C and Steel works - Scheduling - Slab - beam - column & trusses, Road – earthwork fully in banking, cutting, partly cutting & partly filling - Detailed estimate for WBM, Bituminous road.

Module-3: Rate analysis & preparation of bills **(8 lecture hours)**

Rate analysis - preparation of bills – Data analysis of rates for various items of works – abstract estimates for Building projects – Introduction to software for Bill of Quantities & estimates.

Module-4: Valuation **(9 lecture hours)**

Valuation- rent fixation, tenders, - contracts –accounting procedure, measurement book, stores, cost & quality control – PWD & CPWD practice.

Module-5: Detailed specifications and Schedule of Rates **(9 lecture hours)**

Specifications of various items of works - Schedule of Rates.

Text Books

1. B.N. Datta (2010), Estimating and costing, USBPD. ISBN 9788174767295.

Reference Books

1. Rangwala (2011), Specifications of Estimating, Costing and Valuation, Charotar Publishing House Pvt. Ltd. ISBN 9789380358543.
2. Vazirani, V. N. (2013), Civil Engineering Estimating Costing & Valuation, Khanna publishers. ISBN 9788174091277.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-512	Fluid Mechanics	3L:1T:0P	4 Credit

COURSE OBJECTIVES

1. Introduce concepts, laws, observations, models of fluids at rest and in motion and understanding fluid behavior for engineering design and control of fluid system.
2. Develop competence with mass, energy and momentum balances for determining resultant interactions of flows and engineered and natural systems.
3. The development of boundary layers and advancement of practical hydraulics and understanding the concept of advanced fluid mechanics.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Calculation of conjugate depth in a flow and to analyse the model and prototype.
2. Find the dependent and independent parameters for a model of fluid flow.
3. Understand the broad principles of fluid statics, kinematics and dynamics
4. Understand definitions of the basic terms used in fluid mechanics
5. Understand classifications of fluid flow
6. Be able to apply the continuity, momentum and energy principles
7. Be able to apply dimensional analysis

CATALOGUE DESCRIPTION

The course provides a first level exposure to the students to fluid statics, kinematics and dynamics. Measurement of pressure, computations of hydrostatic forces on structural components and the concepts of Buoyancy all find useful applications in many engineering problems. A training to analyse engineering problems involving fluids – such as those dealing with pipe flow, open channel flow, jets, turbines and pumps, dams and spillways, culverts, river and groundwater flow - with a mechanistic perspective is essential for the civil engineering students. The topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology in later semesters.

COURSE CONTENT

Module 1: Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

(10 Lecture hours)

Module 2: Fluid Statics - Fluid Pressure: Pressure at a point, Pascal's law, and pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal,

vertical and inclined surfaces. Buoyancy and Stability of floating bodies.

(8 Lecture hours)

Module 3: Fluid Kinematics- Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates. **(8 Lecture hours)**

Module 4: Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

(8 Lecture hours) Module 5: **Boundary Layer Analysis** - Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients, Separation and Control. **(8 Lecture hours)**

Text Books

1. R. K. Bansal (2010), A Textbook of Fluid Mechanics and Hydraulic Machines 9th Ed. Laxmi Publication, ISBN-9788131808153.

Reference Books

1. P. N. Modi and S. M. Seth (2011), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Publications. ISBN- 9788189401269.
2. D.S. Kumar (2004), Fluid Mechanics and Fluid Power Engineering, Katson Publishing House, ISBN - 9788185749181.
3. V.L. Streeter, (2001), Fluid Mechanics, McGraw Hill Book Co. ISBN – 9780071156004
4. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
5. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
6. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
7. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-513	Traffic Engineering & Management	3L:0T:0P	3 Credits

COURSE OBJECTIVES

To give an overview of Traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.

COURSE OUTCOMES

On completing this course, the Students will be able to

1. Analyse traffic problems and plan for traffic systems various uses
2. Design Channels, Intersections, signals and parking arrangements
3. Develop Traffic management Systems

Module 1. Fundamentals of Traffic Flow & Capacity Analysis: Traffic flow elements, time-space diagram, flow density relationship, gap and gap acceptance. HCM 2000 and IRC guidelines, two-lane highway, multilane highway, basic freeway sections. **(8 Lecture hours)**

Module 2. Design of Intersections, Parking Areas and Terminals: Design of at-grade intersection, roundabout, grade-separated intersection, on-street parking, off-street parking, parking for disable, truck terminal, container terminal. **(6 Lecture hours)**

Module 3. Road Safety Engineering &Traffic Forecasting: Statistical analysis of accidents, accident modeling, remedial measures, road safety audit, transportation system management (TSM) techniques, achievable speed reductions, estimate of accident reductions and benefits. Forecast based on past trends and extrapolation, forecast and mathematical models, period for forecasting, time series approach.

(10 Lecture hours)

Module 4. Survey Execution & Forecasting Travel Demand: Defining data requirements, secondary sources, choice of survey instrument, design of sampling strategy, the survey plan, cross-sectional and time series surveys, training and administration, participatory transport surveys. Demand forecasting approaches, trip generation, trip distribution, mode choice, traffic assignment, and other methods for forecasting demand.

(10 Lecture hours)

Module 5. Planning for Public Transport: Selection of public transport technology, MRTS, LRTS, BRTS, ITS Modules, driver information and guidance, public transport travel information and ticketing, freight and fleet management, system integration. **(8 Lecture hours)**

Name of books/ Authors

1. Flaherty C.A., "Transport Planning and Traffic Engineering", Butterworth-Heineman.

2. Slin, M., guest, P. and Matthews, P., "traffic Engineering Design: Principles and Practice", 2nd Ed., Butterworth-Heinemann.

3. Garder, N.J. and Hoel, L.A., "traffic Engineering", 3rd Ed., Brooks/Cole, Pacific Grove.
4. Kadiyali, L.R., "traffic Engineering and Transport Planning", 6th Ed., Khanna Publishers.
5. McShane, William R. and Roses, Roger, P., "traffic Engineering", Prentice Hall.
6. Virhic, Vikan, R., "Urban Transit Operations, Planning and Economics", JohnWiley.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-514	Construction Techniques & Practices	3L:0T:0P	3 Credits

COURSE OBJECTIVE

The main objective of this course is to make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities.

COURSE OUTCOMES

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

1. Know the different construction techniques and structural systems
2. Understand various techniques and practices on masonry construction, flooring, and roofing.
3. Plan the requirements for substructure construction.
4. Know the methods and techniques involved in the construction of various types of super structures.
5. Select, maintain and operate hand and power tools and equipment used in the building construction sites.

Module 1. CONSTRUCTION TECHNIQUES (10 Lecture hours)

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism – floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials – responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Meaning - Building automation - Energy efficient buildings for various zones-Case studies of residential, office buildings and other buildings in each zones.

Module 2. CONSTRUCTION PRACTICES (8 Lecture hours)

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring –damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection.

Module 3. SUB STRUCTURE CONSTRUCTION (8 Lecture hours)

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement- Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation.

Module 4. SUPER STRUCTURE CONSTRUCTION (8 Lecture hours)

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

Module 5. CONSTRUCTION EQUIPMENT **(8 Lecture hours)**

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting Equipment for material handling and erection of structures – types of cranes - Equipment for dredging, trenching, tunnelling.

TEXTBOOKS:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.

2. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.

3. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

REFERENCES:

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.

2. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers New Delhi, 2002.

3. Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi, 2012.

4. Mahesh Varma, “Construction Equipment and its Planning and Application”, Metropolitan Book Company, New Delhi, 1983.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

DEPARTMENTAL ELECTIVE-II

BCET-521	**Structural Analysis-II**	**3L:0T:0P**	**3 Credits**

COURSE OBJECTIVES

1. To enable the students to understand the behaviour of indeterminate structures.
2. To help the students to know the concepts of elastic analysis and plastic analysis. To teach students about the concepts of matrix analysis of structures.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand the concept of kinematic indeterminacy, static indeterminacy and plastic analysis.
2. Analyse continuous beams, plane frames and pin jointed plane trusses.
3. Calculate flexibility matrix and stiffness matrix for different types of structures, shape factor and plastic moment of resistance for beam sections.

CATALOGUE DESCRIPTION

Students learn the behavior of indeterminate structures, concepts of static indeterminacy and kinematic indeterminacy, use of slope deflection method, moment distribution method and theorem of three moments for analyzing structures. Students also learn the plastic analysis of structures. Students understand the use of matrix methods for analyzing structures. Upon completion, students should be able to analyze structures by slope deflection method, flexibility matrix method and stiffness matrix method.

Module-1: Influence Line Diagrams: Influence line for forces for determinate beams; Influence lines for indeterminate beams using Muller Breslau principle. Influences lines for Arches and stiffening girders.

(10 Lecture hours)

Module-2: Indeterminate Structural System: Pin-jointed and rigid jointed structural system; Deformation of redundant structures- sway and non-sway frames, elastic curves; static equilibrium and deformation compatibility checks; Effects of support settlement and lack of fit; Fixed-end moments- member loading, sinking of supports, temperature; Analysis of redundant beam, frames using following methods: Slope deflection method; Moment distribution method; Rotation Contribution methods(Kani's Method).

(8 Lecture hours)

Module-3: Method of consistent deformation for analysis of indeterminate beams; Three moment theorem and its application to analysis of continuous beams**.**

(8 Lecture hours)

Module-4: Plastic Analysis of Beams and Frames: Plastic bending of beams, Relation between load factor and factor of safety, Shape factor, Concept of plastic hinge, Application of principle of virtual work in plastic theory, Moment balancing Method.

(8 Lecture hours)

Module-5: Matrix methods of structural analysis: Force and displacement method, basic principles, application to planar structures-trusses, beams and frames.

(8 Lecture hours)

Text Books

1. Ashok K. Jain, (2009), Advanced Structural Analysis with Finite Element & Computer Applications, Nem Chand & Brothers, ISBN 978-81-852-4081-7.
2. Hibbeler, R. C. (2005), Structural Analysis (5th Ed.), Pearson Education India, ISBN-10: 0131470892.
3. S. S. Bhavikatti, (2005), Structural Analysis, 2nd edition, Vikas Publishing House, ISBN: 812-59-171-60.

Reference Books

1. R. L. Jindal (1996), Indeterminate Structures, Tata McGraw Hill Publishing House.
2. Negi L. S. (2002), Theory & Problems in Structural Analysis, Tata McGraw Hill Publishing House.

G. S. Pandit & Gupta S. P. (1998), Structural Analysis (A matrix approach), Tata McGraw Hill Publishing Ltd.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-522	Ground Improvement Techniques	3L:0T:0P	3 Credits

COURSE OBJECTIVES

1. To understand problems related to expansive soils.
2. To identify preventive measures for mitigating effect of soil expansion on structures founded on expansive soil.
3. To find out proper methods of ground improvement.
4. To understand various soil engineering problems.
5. To use geo-textiles and stabilizers for soil improvement.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Know the physical & mineralogical properties of expansive soil.
2. Conduct tests for identification of swelling soil.
3. Design suitable method for improving properties of expansive soil.
4. Choose correct method for ground improvement.
5. Design grouting process for various soil engineering problems.

CATALOGUE DESCRIPTION

Expansive soils are soils that expand when water is added, and shrink when they dry out. This continuous change in soil volume causes homes built on this soil to move unevenly and crack. Each year in the United States, expansive soils cause $2.3 billion in damage to houses, other buildings, roads, pipelines, and other structures. This is more than twice the damage from floods, hurricanes, tornadoes, and earthquakes combined.

Ground improvement techniques are one of the important aspects for soil stabilization. It can be done by adding materials, stone column, sand drains etc. Compaction is required for the Ground improvement techniques and its type vary with the type of soils. Sometime grouting and geo-textiles materials are also used for Ground improvement.

COURSE CONTENT

Module 1: Origin, Occurrence and Identification of Expansive Soils (10 Lecture hours)

Occurrence and distribution in India - Moisture equilibrium - Soil, structure, environmental interaction - Distress symptoms case histories - Soil Structure - Clay mineralogy Swell potential - Field exploration - laboratory tests for identification.

Module 2: Chemical stabilization and Special Foundation (8 Lecture hours)

Mechanical alteration – Sand cushion technique - CNS concept – Chemical stabilization with lime, fly ash and cement – Special foundations – Under-reamed piles – Straight-shafted drilled piers - Belled piers – Granular pile-anchors.

Module 3: Introduction to Ground Improvement Techniques (8 Lecture hours)

Need and objectives of ground improvement, classification of ground modification techniques, suitability and feasibility, emerging trends in ground improvement, methods of de-watering, sumps and interceptor ditches, single, multi stage well points, vacuum well points, Horizontal wells, foundation drains, blanket drains, criteria for selection of fill material around drains, Electro-osmosis.

Module 4: Stabilization (8 Lecture hours)

Soil improvement by adding materials, lime, flyash, cement and other chemicals and bitumen, sand column, stone column, sand drains, prefabricated drains, lime column, soil-lime column, stabilization of soft clay or silt with lime, bearing capacity and settlement of treated soils, improvement in slope stability, control methods.

Module 5: Grouting (8 Lecture hours)

Introduction, suspension grout, solution grout, grouting equipments and methods, grouting, design and layout granular piles – ultimate bearing capacity and settlement, method of construction, load test.

Text Books

1. Swami Saran (2008), Analysis and Design of sub structures 2nd edition, Limit State Design, Oxford & IBH Publishing Co. Pvt Ltd., 66, Janpath, New Delhi. ISBN: 978-81-204-1700-7.
2. F.H.Chen (1995), Foundations in Expansive Soils, Elseivier Publications. ISBN: 978-04-444-3036-6.
3. Nihar Ranjan Patra (2012), Ground improvement techniques, 1st Edition, Vikas Publishing House. ISBN: 978-93-259-6001-5.
4. Nelson, John D. Nelson, Ron Miller (1997), Expansive Soils: Problems and Practice in Foundation and Pavement Engineering New edition, Wiley-Interscience. ISBN: 978-04-711-8114-9.

Reference Books

1. R.E.Peck, W.E. Hansen &T.H. Thornburn (2004), Foundation Engineering, John Wiley. ISBN: 978-04-716-7585-3.
2. Varghese P.C (2009), Foundation Engineering 1st Edition, Prentice-Hall of India Private Limited. ISBN: 978-81-203-2652-1.
3. P. Purushothama Raj (1999), Ground Improvement Techniques 1st Edition, Laxmi Publications. ISBN: 978-81-318-0594-7.
4. Rao (1990), Engineering with Geo-synthetics, Mcgraw-hill Education. ISBN: 978-00-746-0323-9.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

BCET-523	Hydropower Engineering	3L:0T:0P	3 Credits

COURSE OBJECTIVE: To get an overview of hydropower systems along with its various units.

COURSE OUTCOMES

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

1. Analyze various processes involved in the planning and designing of hydropower projects.
2. Define and describe various types of hydropower plants
3. Understand various terms associated with running of hydro turbines
4. Describe components of underground power stations
5. Design various components of the hydropower systems.

Module 1. Introduction: Power resources, Conventional and Nonconventional, Need & advantages, Hydropower development in India, hydropower potential, basin wise development of hydropower, constraints. **(10 Lecture hours)**

Module 2. Hydropower Plants: Types of hydropower plants, Storage power plant, Runoff River plant, Pumped storage plant, Reversible pump turbines, types of turbines, hydraulics of turbines, cavitation in turbine, and efficiency of pumped storage plants. **(8 Lecture hours)**

Module 3.Stream flow or Electrical load on hydro turbines: Load curve, Load factor, power factor, capacity factor, utilization factor, Diversity factor, Load duration curve, Firm power, Secondary power, storage and pondage, Prediction of load **(8 Lecture hours)**

Module 4. Water conveyance system and hydraulic transient: Intakes, location and types, losses in intakes, air entrainment at intake, inlet aeration, fore bay, canals, Tunnels and Penstocks, classification of penstocks, design criteria of penstock, economical diameter of penstock, Anchor blocks, Conduit valves, types of valves, bends and manifolds, Water hammer, channel surges, surge tanks types and design consideration. **(8 Lecture hours)**

Module 5. Power house and turbine: Powerhouse structure, location and types of underground power stations, Components of an underground power house, Advantages and limitation of underground power house. Environmental impact of hydel project. Types of turbine, characteristics and efficiency of turbines, selection of turbines, cavitations casing draft tubes, tail, trace and their hydraulic design.

(8 Lecture hours)

Text Books:

1. Varshney, R. S., Hydro Power Structures, Nem Chand Brothers, Roorkee (2001).

2. Modi, P N. Irrigation Water Resources and Water Power Engineering, Standard Book House (2008)

Reference Books:

1. Dandekar, M. M. and Sharma, K. H., Water Power Engineering, Vikas Publishing House, New Delhi. (2013).

2. Warnick, C C, Hydropower Engineering, Prentice-Hall (1984)

Supplementary Website for references:

2. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

BCET-524	Infrastructure Planning and Management	3L:0T:0P	3 Credits

COURSE OBJECTIVES: To understand various concepts of infrastructure planning and management.

COURSE OUTCOMES: After the completion of this course the students would be able to

1. Design integrated framework for infrastructure planning and management.
2. Analyse the strategies for infrastructure project implementation
3. Perform infrastructure modelling and life cycle analysis techniques.

Module 1. **An overview of Basic Concepts Related to Infrastructure:** Introduction to Infrastructure, an overview of the Power Sector in India., an Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation Sectors in India. , an overview of the Telecommunications Sector in India. ,an overview of the Urban Infrastructure in India, an overview of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and Players in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an overview of Infrastructure Project Finance. **(10 Lecture hours)**

Module 2. **Private Involvement in Infrastructure:** A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

(8 Lecture hours)

Module 3. **Challenges to Successful Infrastructure Planning and Implementation**: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks: The Case study for Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

(8 Lecture hours)

Module 4. **Strategies for Successful Infrastructure Project Implementation:** Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects, Sustainable Development of Infrastructure, Information Technology and Systems for Successful Infrastructure Management, Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions. **(8 Lecture hours)**

Recommended Books:

1. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).
2. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).
3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).
4. Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June (1990).
5. World Development Report 1994: Infrastructure for Development (1994).
6. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September (2000).

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

BCET-601	Design of RCC-I	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. To teach the students about the design of beams, columns, slabs by working stress method.
2. To enable the students to understand the limit state method of design of beams, columns and slabs.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand the behavior of structural members and the concept of design.
2. Calculate moment of resistance for different types of RC beam sections.
3. Design any type of RC beam.
4. Understand the difference between one way slab and two way slab.
5. Know the concept of short column and long column.

CATALOGUE DESCRIPTION

Students will learn the concept of working stress method and limit state method, tee beam and ell beam sections, under reinforced sections, balanced sections and over reinforced sections. Students will also learn the concept of designing one way slab and two way slab, short column and long column, axially and eccentrically loaded columns. Upon completion, students should be able to design beams, slabs and columns by different methods.

Module 1. (10 Lecture hours)

Basic Principles of Structural Design: Assumptions, Mechanism of load transfer, Various properties of concrete and reinforcing steel, Introduction to working stress method and limit state methods of design, partial safety factor for load and material. Calculation of various loads for structural design of singly reinforced beam, Partial load factors. Design loads on buildings, wind and earthquake loads.

Module 2. (8 Lecture hours)

Design of Beams: Doubly reinforced rectangular & Flanged Beams, Lintel, Cantilever, simply supported and continuous beams, Beams with compression reinforcement: Redistribution of moments in continuous beams, Circular girders: Deep beams. Design of beam for shear and bond. Design of T-beams bridge, standard specifications and general design considerations.

Module 3. (8 Lecture hours)

Design of Slabs: Slabs spanning in one direction. Cantilever, simply supported and continuous slabs, Slabs spanning in two directions, Circular slabs, Waffle slabs, Flat slabs, Yield line theory.

Module 4. (8 Lecture hours)

Columns & Footings: Effective length of columns, Short and long columns- Square, Rectangular and Circular

columns, Isolated and combined footings, Strap footing, Columns subjected to axial loads and bending moments (sections with no tension), Raft foundation.

Module 5. **(8 Lecture hours)**

Staircases: Staircases with waist slab having equal and unequal flights with different support conditions, Slabless tread-riser staircase. Design of overhead water tanks, general design consideration for circular & Intze tanks

Pre-stressed concrete, Materials, pre-stressing systems, stress analysis & losses of prestress, design of simple beams.

Text Books

1. Gambhir, M.L., (2011), "Fundamentals of Reinforced Concrete Design", Prentice-Hall of India. ISBN: 9788120330481.
2. S Unnikrishna Pillai & Devdas Menon, (2005), Reinforced Concrete Design, Tata Mcgraw Hill, ISBN: 9780070141100.
3. Varghese, P.C., (2009), Limit State Design of Reinforced Concrete, 2nd ed. ISBN: 9788120320390

Reference Books

1. Varghese (2005), Advanced Reinforced Concrete Design, Prentice-Hall of India.
2. Gurcharan Singh (2005), Design of R.C.C. Structures in S. I. Units, Standard Publishers Distributors.
3. B. C. Punmia (2003), Design of reinforced concrete structures, Lakshmi Publishers.
4. IS:456 (2000) & SP:16
5. Jain A.K., "Reinforced Concrete", Limit State Design, 5th Ed., Nem Chand & Bros.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. IS:456 (2000) & SP:16
2. IS: 1893:2002

BCET-602	Environmental Engineering-II	3L:1T:0P	4 Credits

COURSE OBJECTIVES

1. To teach students the basic principles and concepts of unit operations and processes involved in wastewater treatment.
2. To develop student's skill in the basic design of unit operations and processes involved in wastewater treatment.
3. To develop a student's skill in evaluating the performance of wastewater treatment plants.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Demonstrate an ability to recognize the type of unit operations and processes involved in wastewater treatment plants.
2. Demonstrate an ability to choose the appropriate unit operations and processes required for satisfactory treatment of wastewater.
3. Demonstrate an ability to design individual unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
4. Demonstrate ability in design of wastewater treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.
5. Recognize the importance of wastewater treatment to protect the water resources.

CATALOGUE DESCRIPTION

Proper treatment of wastewater reduces health risks to humans and animals and prevents surface and groundwater contamination. Inadequate treatment of wastewater allows bacteria, viruses, and other disease-causing pathogens to enter groundwater and surface water. This course provides an overview of type of units operations and processes involved in wastewater treatment and disposal including design of primary and secondary treatment units. On completion of this course students will be able to identify the need for primary and secondary treatment of wastewater in a cost-effective and sustainable way. The students will also learn the importance of wastewater treatment to protect water resources.

COURSE CONTENT

Module 1: Wastewater Treatment **(8 Lecture hours)**

Physical, chemical and biological principles involved in wastewater treatment and designing of unit-operations and processes. Permissible standards for wastewater disposal.

Module 2: Pre and Primary Treatment **(10 Lecture hours)**

Objectives-Unit operations and processes-Principles, functions and design of flash mixers, screens, sedimentation tanks and sand filters-Disinfection-Aeration, grit chambers and primary sedimentation tanks.

Module 3: Secondary Treatment **(8 lecture hours)**

Secondary Treatment-Activated Sludge Process and Trickling filters; other treatment methods-Stabilization Ponds and Septic Tanks-Advances in Sewage Treatment

Module 4: Sewage Disposal and Sludge Management **(8 lecture hours)** Methods-Dilution-Self-purification of surface water bodies-Oxygen Sag Curve-Land disposal-Sewage Farming-Deep well injection-Soil dispersion system-Thickening-Sludge digestion-Bio-gas recovery, Drying beds-Conditioning and Dewatering-Sludge disposal. Introduction to solid waste management, landfills and EIA

Module 5: Waste Disposal System (8 lecture hours)

Reuse systems, wastewater disposal on land and water bodies, disposal of sludge. Collection, characterization, transport, treatment & disposal. Liquid, solid, atmospheric and hazardous wastes: Characterization and treatment.

Text Books

1. Garg.S.K, (2010), Environmental Engineering-Sewage Disposal and Air Pollution Engineering, 1st Edition, Khanna Publishers, ISBN- 978-81-740-9230-4.
2. Metcalf & Eddy, (2002), Wastewater Engineering Treatment & Reuse, Tata McGraw-Hill Education, ISBN: 978-00-704-9539-5

Reference Books

1. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, (2001), Environmental Engineering, Tata McGraw-Hill Education, ISBN No: 978-00-710-0231-8.
2. Hammer & Hammer Jr., Water and Wastewater Technology, 7th Edition, ISBN-978-81-203-4601-7.
3. Rakesh Kumar, R.N.Singh, (2009), Municipal Water and Wastewater Treatment, Teri Press, ISBN: 978-81-799-3188-2.
4. Dr.P.N.Modi, (2008), Sewage Treatment Disposal and Wastewater Engineering, 2nd Edition, ISBN-978-81-900-8932-4.
5. Shyam. R.Asolekar, Soli. J.Arceivala, Wastewater Treatment for Pollution Control and Reuse, 3rd Edition, Tata McGraw-Hill Education, ISBN: 978-00-706-2099-5.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

BCET-603	Foundation Engineering	3L:1T:0P	4 Credits

COURSE OBJECTIVE

1. Students will learn how to design shallow and deep foundations, retaining walls, and slopes.
2. Students will learn how to utilize their knowledge in soil mechanics to perform various types of engineering calculations.
3. Consolidation analysis for foundations, and stability analysis of slopes and retaining walls.

COURSE OUTCOMES

1. Determine the earth pressures on foundations and retaining structures
2. Analyze shallow and deep foundations
3. Calculate the bearing capacity of soils and foundation settlements
4. Understand soil exploration methods

COURSE CONTENT

Module 1. Foundations: Types of foundations, mechanism of load transfer in shallow and deep foundations, shallow foundations, Terzaghi's bearing capacity theory, computation of bearing capacity in soils, effect of various factors, use of field test data in design of shallow foundations, stresses below the foundations, settlement of footings and rafts, proportioning of footings and rafts, sheeting and bracing of foundation excavation. (**10 Lecture hours)**

Module 2. Pile Foundation: Types and method of construction, estimation of pile capacity, capacity and settlement of group of piles, proportioning of piles **(6 Lecture hours)**

Module 3. Earth Pressure and Retaining Walls : Earth pressure at rest, active and passive earth pressure, Rankine and Coulomb's earth pressure theories, earth pressure due to surcharge, retaining walls, stability analysis of retaining walls, proportioning and design of retaining walls. (**10 Lecture hours**)

Module 4. Slopes & Soil Exploration : Mode of failure- mechanism, stability analysis of infinite slopes, methods of slices, Bishop's simplified method, Methods of soil exploration; boring, sampling, penetration tests, correlations between penetration resistance and soil design parameters. **(6 Lecture hours)**

Module 5. Advanced foundation: Well Foundations Methods of construction, tilt and shift, remedial measures, bearing capacity, settlement and lateral stability of well foundation, Machine Foundations**:** Types of machine foundations, mathematical models, response of foundation – soil system to machine excitation, cyclic plate load test, block resonance test, criteria for design. **(10 Lecture hours)**

Name of Books / Author

1 Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age.
2 Das, B.M., "Principles of Foundation Engineering", PWS.

3 Som, N.N. and Das, S.C., "Theory and Practice of Foundation Design", Prentice-Hall.
4 Couduto, Donald P., "Geotechnical Engineering – Principles and Practices", Prentice-Hall.
5 Peck, R.B., Hanson, W.E. and Thornburn, T.H., "Foundation Engineering",John Wiley.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

HSMC- 601	Principles of Management	2L-1T-0P	3Credits

OBJECTIVE: To understand the principles of management and their application to the functioning of an organization

COURSE OUTCOME:
Upon completion of this course, the students will get a clear understanding of management functions in an organization

Contents:

UNIT I: Overview of management

Definition of management, science or art, manager vs entrepreneur; Types of managers-managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.

UNIT II: Planning

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.

UNIT III: Organizing

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

UNIT IV: Directing:

Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT V: Controlling:

Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.
2. Stoner JAF, Freeman RE and Gilbert DR, Management, 6th ed., Pearson Education, 2004.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill, 1999.

BCEP-601	RCC Detailing Lab	0L:0T:2P	1 Credits

1. General considerations, design principle of R.C.C. sections, limit state method of design. Loads and stresses to be considered in the design as per I.S. code provision.
2. Design & detailing of a
   - i) Simply supported R.C.C. Beam.
   - ii) Continuous T- Beam.
3. Design & detailing of a
   - i) Simply supported one way slab
   - i) One way continuous slab.
4. Design of different units
   - –Slab, beam column, roofing and staircase from floor plan of a multi-storeyed frame building
   - – Two way action of floor slab.
5. Design of Columns
6. Design of Footing

BCEP-602	Environmental Engineering Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

1. Understand the basic principles and concepts of unit operations and processes involved in water treatment.
2. Design of unit operations and processes involved in water treatment.
3. Evaluation of the performance of water treatment plants.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. The type of unit operations and processes involved in water treatment plants.
2. Unit operations and processes required for satisfactory treatment of water.
3. The design of unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles.
4. To study unit operations & advanced processes in water treatment its disinfection and aeration and softening.
5. The design of water treatments units in a cost effective and sustainable way and evaluate its performance to meet the desired health and environment related goals.

CATALOGUE DESCRIPTION

Water supply and its treatment system are attached with the life cycle of every human being. To identify the problems associated with the treatment of the water and its supply it is essential to have the knowledge this course. Students learn Effect of population dynamics on water demand, Physicochemical Principles applied in water treatment, Unit operations, principles and processes for pretreatment and treatment of raw water, Principles, functions and design of different treatment units and processes. Upon completion, students should be able to design and construct the water treatment plant for the single unit, residential area or for society.

List of Experiments:

1. To determine the pH of a given water sample.
2. To determine the total solids, suspended solids, dissolved solids and volatile solids in wastewater.
3. To determine the turbidity and specific conductivity of the given water samples.
4. To determine the Alkalinity of given water sample.
5. To determine total hardness, permanent hardness and temporary hardness for given water sample.
6. To determine the chloride concentration of a given water sample.
7. To determine amount of sulphates in a given sample
8. To determine the dissolved oxygen content in a given water sample.
9. To determine BOD of the given wastewater sample.
10. To determine the COD of given sample.

11. Measurement of sound level with sound level meter.
12. Measurement of air pollutants with high volume sampler.

BCEP-603	CAD Lab	0L:0T:2P	1 Credits

COURSE OBJECTIVES

1. To teach the students to understand the details of STAAD – PRO software package.
2. To enable the students to know the behaviour of RCC and Steel structures.
3. To enable the students to design different components of structures

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Understand the details of STAAD – PRO software package.
2. Know the behavior of RCC and Steel structures.
3. Know the bending moment diagram drawn in tension face and shear force diagram.
4. Design different components of structures.

CATALOGUE DESCRIPTION

Students will learn the details of STAAD - PRO software package and know the behaviour of RCC and Steel structures. Students will understand the bending moment diagram, drawn in tension face and shear force diagram. Upon completion, students should be able to design different components of RCC and Steel structures

List of experiments:

1. Analysis and design of simply supported RCC beam.
2. Analysis and design of cantilever RCC beam.
3. Analysis and design of continuous RCC beam.
4. Analysis and design of simply supported Steel beam.
5. Analysis and design of continuous Steel beam.
6. Analysis and design of RCC columns with different end conditions.
7. Analysis and design of Steel columns with different end conditions.
8. Analysis and design of steel trusses.
9. Analysis and design of RCC portal frames.
10. Analysis and design of steel portal frames.

DEPARTMENTAL ELECTIVE-III

BCET-531	**Design of Steel Structure**	**3L:0T:0P**	**3 Credits**

COURSE OBJECTIVES

1. To understand the concepts of steel design.
2. To know the analysis and design of plate girder and gantry girder and its applications.
3. To know different types of roofs, calculation of forces and design of roof trusses.

COURSE OUTCOMES

On completion of this course, the student will be able to

1. Understand the concept of plate girders, gantry girders and roof trusses.
2. Calculate moment of resistance for different types of beam sections, load carrying capacity of column sections.
3. Design simple beam, built up beam and plate girders.
4. Analyze and design roof trusses.
5. Understand the concept of design of overhead water tanks.

COURSE CONTENT

Module 1: Design of Connection (9 lecture hours)

Design of Connections – Riveted - Welded - Bolted – Solution of simple problems.

Module 2: Design of beams (9 lecture hours)

Simple and built-up beams – design of laterally supported and unsupported beams - concept of shear.

Module 3: Design of Compression Members (9 lecture hours)

Design of column – built up section – single and double lacing - batten.

Module 4: Plate Girders (9 lecture hours)

Plate girders - design of plate girders - curtailment of flange plates - design of stiffeners and splices - gantry girder.

Module 5: Roof Trusses (9 lecture hours)

Roof Trusses - Calculation of dead load, live load and wind load - Design of joints – supports - members for pitched roof truss - purlins.

Name of Books / Author

1 Arya, A.S. and Ajmani, J.L., "Design of Steel Structures", Nem Chand & Bros.
2 Duggal, S.K., "Design of Steel Structures", Tata McGraw-Hill.
3 Negi, L.S., "Design of Steel Structures", Tata McGraw-Hill.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in /)

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. IS:456 (2000) & SP:16
2. IS: 1893:2002

BCET-632	Hydraulic Structure	3L:0T:0P	3 Credits

COURSE OBJECTIVE

1. The objective of this subject is to focus on designing of various hydraulic structures like canal, weir/barrage, canal fall, canal head regulator, canal outlet and cross drainage works.
2. To impart knowledge regarding the design of the various minor irrigation structures
3. To convey the knowledge on the causes of failure, design criteria and stability analysis of different types of dams

COURSE OUTCOME

1. Design lined and unlined channels for distribution water
2. Learn the function, components and design of headworks
3. Learn the function, components and design of canal regulation works and related hydraulic structures.
4. Learn different types of cross drainage works and their design aspects

Module 1. Reservoir Planning: Investigations, Capacities, Zones of storage, Mass Inflow and Mass Demand curves, Life of Reservoir. Earth Dams: Types, causes of failure and design criteria, soils suitabllity for earth dam construction, construction methods, foundation requirements, typical earth dam sections, estimation of seepage through and below the dam, seepage control, stability of slopes by slip circle method of analysis, pore pressures, sudden draw down, steady seepage and construction pore pressure condition.

(10 Lecture hours)

Module 2. Gravity dams: Design Criteria, forces acting on gravity dams, elementary profile, low and high gravity dams, stability analysis, practical profile, evaluation of profile by method of zoning, foundation treatment, construction joints, galleries in gravity dams. **(8 Lecture hours)**

Module 3. Spillways: Ogee spillway and its design, details of syphon, shaft, chute and side channel spillways, emergency spillways. design of outlets and rating curves Energy dissipators: Principles of energy dissipation Energy dissipators based on tail water rating curve and jump height curves Spillway crest gates -vertical lift and radial gates, their design principles. Design of canal regulating structures, Design of Channel transitions, Design of Sarda type Falls, Design of cross drainage works viz Syphon aquaduct and Canal syphon. **(8 Lecture hours)**

Module 4. Structures on Pervious formations: Bligh's creep theory, limitations, Khoslas's theory of independent variable, Khosla's corrections, Design of Weir and Barrages: design of waterways and crest levels, design of impervious floors and protection works. **(8 Lecture hours)**

Module 5. Canal Structures and Hydropower Plants: Design of canal falls, Regulators, Cross drainage works, Design principles for subcritical and supercritical flows. Introduction of Hydropower development, general features of hydro-electric schemes, selection of turbines. **(8 Lecture hours)**

Name of books/ Authors/ Publisher

1. Singh, B., “Fundamentals of Irrigation Engineering”, 9th Ed. Nem Chand & Bros.
2. Asawa G.L.,” Irrigation Engineering”, 2nd Ed., New Age International.
3. Ranga Raju, K.G., “Flow through Open Channels”, Tata McGraw-Hill.
4. Subramanya, K., “Flow in open Chanels”, 2nd Ed. Tata McGraw-Hill.
5. Chow V.T., “Open Channel Hydraulics”, McGraw-Hill

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

BCET-633	Construction Planning & Management	3L:0T:0P	3 Credits

COURSE OBJECTIVES

1. To understand the principles of management and their application to the functioning of an organization.
2. To know about system approaches for planning.

COURSE OUTCOMES

1. Understand the roles and responsibilities of a project manager
2. Prepare schedule of activities in a construction project
3. Prepare tender and contract document for a construction project
4. Understand safety practices in construction industry
5. Identify the equipment used in construction.

COURSE CONTENT

Module 1. Preliminary and detailed investigation methods: Methods of construction, form work and centering. Schedule of construction, job layout, principles of construction management, modern management techniques like CPM/PERT with network analysis. **(10 Lecture hours)**

Module 2. Construction equipment: Factors affecting selection, investment and operating cost, output of various equipment, brief study of equipment required for various jobs such as earth work, dredging, conveyance, concreting, hoisting, pile driving, compaction and grouting. **(8 Lecture hours)**

Module 3. Contracts: Different types of controls, notice inviting tenders, contract document, departmental method of construction, rate list, security deposit and earnest money, conditions of contract, arbitration, administrative approval, technical sanction. **(8 Lecture hours)**

Module 4. Specifications & Public Works Accounts: Importance, types of specifications, specifications for various trades of engineering works. Various forms used in construction works, measurement book, cash book, materials at site account, imprest account, tools and plants, various types of running bills, secured advance, final bill. **(8 Lecture hours)**

Module 5. Site Organization & Systems Approach to Planning: Accommodation of site staff, contractor's staff, various organization charts and manuals, personnel in construction, welfare facilities, labour laws and human relations, safety engineering. Problem of equipment management, assignment model, transportation model and waiting line modals with their applications, shovel truck performance with waiting line method.

(8 Lecture hours)

Reference Books:-

1. Construction Equipment by Peurify
2. CPM by L.S. Srinath
3. Construction Management by S. Seetharaman
4. CPM & PERT by Weist & Levy
5. Construction, Management & Accounts by Harpal Singh
6. Tendering & Contracts by T.A. Talpasai

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

BCET- 634	Urban Transportation Planning	2L-1T-0P	3Credits

COURSE OBJECTIVES:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

COURSE OUTCOMES:

After studying this course, students will be able to:

1. Design, conduct and administer surveys to provide the data required for transportation planning.
2. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
3. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
4. Adopt the steps that are necessary to complete a long-term transportation plan.

COURSE CONTENT

Module 1. Urban transport planning: (10 Lecture hours)

Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

Module 2. Data Collection & Inventories: (8 Lecture hours)

Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population –Employment – Vehicle Owner Ship.

Module 3. Trip Generation & Distribution: (8 Lecture hours)

UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. Problems on above

Module 4. Trip Distribution: (8 Lecture hours)

Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis.

Module 5. Traffic Assignment: (8 Lecture hours)

Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Introduction to land use planning models, land use and transportation interaction.

Text Books:

1. Kadiyali. L.R., 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi.
2. Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
3. Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
4. Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

Reference Books:

1. Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
2. Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
3. Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

SEMESTER-VIII														
S.No.	**Subject Codes**	**Category**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**Total**	**PS**	**TE**	**PE**		
1	BCET-801	DC	Hydraulic Structure	**3**	1	0	30	20	50		**50**		150	3
2	HSMC-801	HSMC	Civil Engineering Societal & Global Impact	3	1	0	30	20	50		100		150	3
3	BCET-03X	OE	Open Elective-III	3	1	0	30	20	50		100		150	3
4	BCET-04X	OE	Open Elective-IV	3	1	0	30	20	50		100		150	3
5	BCEP-801	DLC	Project	0	0	12				100		150	250	6
6	BCEP-802	DLC	Open Source Lab			2						50	50	1
			Total	**12**	**4**	**14**							**900**	**19**

Open Elective Course-III			
S.No.	**Course Code**	**Course Title**	**Specialization**
1	BCET-031	Disaster Preparedness and Planning	Engineering & Management
2	BCET-032	Professional Practice law and ethics	Law & Legal
3	BCET-033	Environment Management and Sustainable Development	Environmental Engineering & Management
4	BCET-034	Quality Management	Management

Open Elective Course-IV			
S.No.	**Course Code**	**Course Title**	**Specialization**
1	BCET-041	Metro System and Engineering	Engineering & Management
2	BCET-042	Fundamental of Entrepreneurship	Law & Legal
3	BCET-043	Solid and Hazardous Waste Management	Environmental Engineering & Management
4	BCET-044	Non-Conventional Energy Sources	Environmental Engineering

BCET*	Bachelor of Civil Engineering Theory
BCEP*	Bachelor of Civil Engineering Practical
DC*	Departmental Course
DLC*	Departmental Lab Course
HSMC*	Humanities & Social Science including management course
DE*	Departmental Elective
OE*	Open Elective

BCET-801	Hydraulic Structure	3L:0T:0P	3 Credits

COURSE OBJECTIVE

1. The objective of this subject is to focus on designing of various hydraulic structures like canal, weir/barrage, canal fall, canal head regulator, canal outlet and cross drainage works.
2. To impart knowledge regarding the design of the various minor irrigation structures
3. To convey the knowledge on the causes of failure, design criteria and stability analysis of different types of dams

COURSE OUTCOME

1. Design lined and unlined channels for distribution water
2. Learn the function, components and design of headworks
3. Learn the function, components and design of canal regulation works and related hydraulic structures.
4. Learn different types of cross drainage works and their design aspects

Module 1. Reservoir Planning: Investigations, Capacities, Zones of storage, Mass Inflow and Mass Demand curves, Life of Reservoir. Earth Dams: Types, causes of failure and design criteria, soils suitability for earth dam construction, construction methods, foundation requirements, typical earth dam sections, estimation of seepage through and below the dam, seepage control, stability of slopes by slip circle method of analysis, pore pressures, sudden draw down, steady seepage and construction pore pressure condition.

(10 Lecture hours)

Module 2. Gravity dams: Design Criteria, forces acting on gravity dams, elementary profile, low and high gravity dams, stability analysis, practical profile, evaluation of profile by method of zoning, foundation treatment, construction joints, galleries in gravity dams. **(8 Lecture hours)**

Module 3. Spillways: Ogee spillway and its design, details of syphon, shaft, chute and side channel spillways, emergency spillways. Design of outlets and rating curves Energy dissipators, Principles of energy dissipation Energy dissipators based on tail water rating curve and jump height curves Spillway crest gates -vertical lift and radial gates, their design principles. Design of canal regulating structures, Design of Channel transitions, Design of Sarda type Falls, Design of cross drainage works viz Syphon aquaduct and Canal syphon. **(8 Lecture hours)**

Module 4. Structures on Pervious formations: Bligh's creep theory, limitations, Khoslas's theory of independent variable, Khosla's corrections, Design of Weir and Barrages: design of waterways and crest levels, design of impervious floors and protection works. **(8 Lecture hours)**

Module 5. Canal Structures and Hydropower Plants: Design of canal falls, Regulators, Cross drainage works, Design principles for subcritical and supercritical flows. Introduction of Hydropower development, general features of hydro-electric schemes, selection of turbines. **(8 Lecture hours)**

Name of books/ Authors/ Publisher

1. Singh, B., “Fundamentals of Irrigation Engineering”, 9th Ed. Nem Chand & Bros.
2. Asawa G.L.,” Irrigation Engineering”, 2nd Ed., New Age International.
3. Ranga Raju, K.G., “Flow through Open Channels”, Tata McGraw-Hill.
4. Subramanya, K., “Flow in open Chanels”, 2nd Ed. Tata McGraw-Hill.
5. Chow V.T., “Open Channel Hydraulics”, McGraw-Hill

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

HSMC-801	Civil Engineering Societal & Global Impact	3L:0T:0P	3 Credit

Course Objective:

1. Describe about recent civil engineering breakthroughs & innovations
2. Explain the awareness of various codes & standards governing infrastructure development
3. Describe about environmental metrics & monitoring
4. Explain the sustainability of structure and environment
5. Explain the innovations and methodologies for ensuring sustainability during project development

Course Outcome: Student will able to understand

1. The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively.
2. The extent of Infrastructure, its requirements for energy and how they are met: past, present and future
3. The Sustainability of the Environment, including its Aesthetics,
4. The potentials of Civil Engineering for Employment creation and its Contribution to the GDP
5. The Built Environment and factors impacting the Quality of Life
6. The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial.
7. Applying professional and responsible judgement and take a leadership role

Module 1

Role of civil engineering in agricultural, IT and industrial revolutions, Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Evaluating future requirements for various resources, Human Development Index and Ecological Footprint of India vs other countries and analysis. **(8 Lecture hours)**

Module 2

Understanding the importance of Civil Engineering in shaping and impacting the world, The ancient and modern Marvels and Wonders in the field of Civil Engineering, Future Vision for Civil Engineering, Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions

(8 Lecture hours)

Module 3

Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop); Energy generation (Hydro, Solar, Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.

(8 Lecture hours)

Module 4

Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non- stationary; Green building concept, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures.

(9 Lecture hours)

Module 5

Civil Engineering Projects–Waste (materials, manpower, equipment), avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment (projects, facilities management), Quality of products, Health & Safety aspects for stakeholders.

(9 Lecture hours)

Text/Reference Books:

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht

2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition

3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.

4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.

5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options

6. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx

7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014

8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. P 129-130

9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.

10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63

11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research**.** Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.

12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30

13. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.

14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.

15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.

16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

OPEN ELECTIVE-III

BCET-031	**Disaster preparedness and planning**	**3L:0T:0P**	**3 Credit**

Course Objective

1. To increase the knowledge and understanding of the disaster phenomenon and, its factors.
2. Understand the relationship of hazard, risk and vulnerability
3. To obtain the skills in role of education and training in disaster prevention.
4. To ensure skills in post disaster management activities
5. To get the knowledge in understanding various prone zones in India

Course Outcomes: At the end of completion of subject:

1. Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
2. Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.
3. Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
4. Capacity to manage the Public Health aspects of the disasters.
5. Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.
6. Capacity to design and perform research on the different aspects of the emergencies and disaster events while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.

Module 1

Disaster-historical overview, disaster and hazards, definition of basic terms such as-vulnerability, risk, capacity, impact, prevention, mitigation. ecological fragility, 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.

(9 Lecture hours)

Module 2

Classification of Disaster: natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides,

coastal erosion, soil erosion, forest fires etc.), Causes and concern of natural disasters, manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc), Causes and concern of manmade disasters **(9 Lecture hours)**

Module 3

Disaster Impacts: Disaster impacts- Global (Climate change), regional (urban disasters) and local-environmental impacts (physical, social, ecological, economical, political, etc.), health impacts, psychosocial issues; demographic aspects (gender, age, special needs), Impact evaluation and analysis.

(8 Lecture hours)

Module 4

Disaster Risk Reduction: Disaster management cycle phases; prevention, mitigation, preparedness, relief and recovery; structural and nonstructural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response, 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.

(8 Lecture hours)

Module 5

Disasters management and control: Management of natural disasters (Earthquake, flood and drought), various components and their functions, Man-made disasters (Industrial and nuclear disaster)-management and control, preventives measures, regulatory aspects.

(8 Lecture hours)

Text Books:

1. D.B.N. Murthy , Disaster Management: Text and Case Studies, Deep & Deep Publications Pvt. Ltd.

2. Parag Diwan, “A Manual on Disaster Management”,Ritomate International, Noida Special

Reference Books:

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

2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.

3. White, Gilbert F. and J. Eugene Hass, 1975, Assessment of Research on Natural Hazards, Cambridge, the MIT Press, MA

4. Larry R. Collins, “Disaster Management and Preparedness”, CRC press

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

BCET-032	Professional Practice law and ethics	3L:0T:0P	3 Credit

COURSE OBJECTIVES:

1. Instill the moral values that ought to guide their profession.
2. Resolve the moral issues in the profession.
3. Infer moral judgment concerning the profession.
4. Correlate the concepts in addressing the ethical dilemmas.
5. Judge a global issue by presenting an optimum solution.

COURSE OUTCOMES: On completion of this course, the students will be able to

1. Distinguish between ethical and non-ethical situations.
2. Practice moral judgment in conditions of dilemma.
3. Relate the code of ethics to social experimentation.
4. Develop concepts based on moral issues and enquiry.
5. Resolve moral responsibilities in complications.
6. Defend one's views in supporting the moral concerns.
7. Apply risk and safety measures in various engineering fields.
8. Develop cognitive skills in solving social problems.
9. Apply ethics in society.
10. Discuss the ethical issues related to engineering.
11. Realize the responsibilities and rights in the society.

Module 1

Human Values: Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue –Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management. **(9 Lecture hours)**

Module 2

Engineering Ethics: Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy –Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories **(9 Lecture hours)**

Module 3

Engineering as Social Experimentation: Engineering as Experimentation-Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. **(8 Lecture hours)**

Module 4

Safety, Responsibilities And Rights: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination **(8 Lecture hours)**

Module 5

Global Issues: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility **(8 Lecture hours)**

Text books:

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

References:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2009
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” McGraw Hill education, India Pvt. Ltd., New Delhi 2013
6. World Community Service Centre, „ Value Education“, Vethathiri publications, Erode, 2011

BCET-033	**Environmental Management & Sustainable Development**	**3L:0T:0P**	**3 Credit**

Course Objectives

1. To provide the engineering graduates (all disciplines) with technical expertise in Environmental Management which will enable them to have a career and professional accomplishment in the public or private sector
2. To develop, implement, monitor and maintain environmental strategies, policies, programmes and systems that promote sustainable development oversee the environmental performance including compliance with environmental legislation across the organisation, and coordinating all aspects of pollution control, waste management, environmental health and conservation
3. Lead the implementation of environmental policies and practices and raise awareness, at all levels of an organisation, about the emerging environmental issues

Course Outcomes: By the time of their graduation, the students are expected to be able to:

1. Understand the environmental, social and economic framework in which environmental management decisions are made understand the life cycle perspective, systems approach and environmental technologies for converting process, products and service related industrial environmental problems into opportunities to improve performance
2. Anticipate, recognize, evaluate, and control environmental issues in a variety of sectors and industries and liaison with federal, state, and local agencies and officials on issues pertaining to environmental protection
3. Recognize, evaluate, and control factors in the workplace and the environment that cause health and environmental hazards and utilize quantitative knowledge and skills and modern tools and technologies to assess, analyze, plan, and implement environmental management systems
4. Obtain, update, and maintain plans, permits, and standard operating procedures.
5. Prepare, review, and update environmental monitoring and assessment Reports and Monitor progress of environmental improvement programs
6. Identify, formulate, analyze, and develop management systems and formulate solutions that are technically sound, economically feasible, and socially acceptable.
7. Assess the potential environmental impact of development projects and design mitigation measures
8. Audit, analyse and report environmental performance to internal and external clients and regulatory bodies
9. Communicate proficiently in writing and speaking for promoting and coordinating public consultations on environmental matters and for negotiating environmental service agreements and managing associated costs and revenues
10. Collaborate with environmental engineers, planners, technicians, and other specialists, and experts in to address environmental problems.
11. Find professional level employment or pursue higher studies and pursue research for contributing to the betterment of humanity and in shaping a sustainable society.

Module 1

Introduction and scope, inter-linkages of energy-environment and economy from engineering infrastructure perspective. Concepts of ecology, systems approach and sustainability engineering. **(10 Lecture hours)**

Module 2

Interaction between energy and environmental resources, environmental quality standards and indices (Indian and International). **(7 Lecture hours)**

Module 3

Environmental monitoring, analysis, statistics and data interpretation. Environmental management system, ISO 14000 Series. **(10 Lecture hours)**

Module 4

Impact assessment, life cycle assessment and risk analysis of scientific and technological developments. **(6 Lecture hours)**

Module 5

Environmental legislations, ethics and social responsibility. Sustainable development within the context of global economy, technology and climate change. **(9 Lecture hours)**

Name of Books / Authors/ Publishers Year of Publication

1. Baker, S., "Sustainable Development", Taylor & France‟s. 2006

2. Krishnamoorthy, B., "Environmental Management", Prentice Hall of India 2005

3. Friedman, F.B., "Practical Guide to Environmental Management", Environmental Law Institute. 2003

4. Environmental Management Plans Demystified: A Guide to ISO 14001 – Span Press. 2001

5. Calow, P., "Handbook of Environmental Risk Assessment and Management", Blackwell Publishing.

Supplementary Website for references:

1. E- learning NPTEL Lectures(Web :- http://nptel.ac.in/)

BCET-034	Quality Management	3L:0T:0P	3 Credit

Course Objectives

1. To understand the concept of Quality
2. To understand the Implication of Quality on Business
3. To Implement Quality Implementation Programs
4. To have exposure to challenges in Quality Improvement Programs

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

1. To realize the importance of significance of quality
2. Manage quality improvement teams
3. Identify requirements of quality improvement programs

Module 1

Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type.

Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

Manufacturing Quality Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims. **(10 Lecture hours)**

Module 2

Quality Management Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program.

Human Factor in quality: Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods. **(8 Lecture hours)**

Module 3

Charts: Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

Attributes of Control Chart: Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts. **(8 Lecture hours)**

Module 4

Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle**.**

(8 Lecture hours)

Module 5

ISO-9000 and its concept of Quality Management

ISO 9000 series, Taguchi method, JIT in some details. **(8 Lecture hours)**

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.

2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.

3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

OPEN ELECTIVE-IV

BCET-041	Metro system and Engineering	3L:0T:0P	3 Credit

COURSE OBJECTIVES

1. To teach the students about the urban mass transportation systems.
2. To familiarise with Optimum construction methodologies for intra-city Transportation systems
3. Handling of huge intra-city traffic for highly populated urban areas
4. Understand the various concepts in metro design and components
5. Analyse the construction process, maintenance and operation of metro.
6. Evaluate the cost estimation and geometric design of metro.

COURSE OUTCOMES

On completion of this course, the students will be able to

1. Demonstrate the ability to identify the components of railway track, their functions, alignment and the station yards.
2. Understand basics of construction planning & management, construction quality & safety systems.
3. Analyze vehicle dynamics and structure; tunnel ventilation systems; air -conditioning for stations and buildings and electrical system.
4. Apply electronic signaling systems and Automatic fare collection.
5. Understand overview of metro systems.

PROPOSED SYLLABUS:

Module 1: Metro Rail or Rapid Rail transit: Introduction; Historical Background, Need for Metros; Developments in India; Routing studies; Basic Planning and Financials

(8 Lecture hours)

Module 2: CIVIL ENGINEERING-Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings.
Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

(10 Lecture hours)

Module 3: ELECTRONICS AND COMMUNICATION ENGINEERING- Signalling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors. **(8 Lecture hours)**

Module 4: MECHANICAL & TV + AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators

(8 Lecture hours)

Module 5: ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

(8 Lecture hours)

Text Books

1. Metro rail in India for urban mobility by M.M Agarwal, S.Chandra, K.K. Miglani. Prabha & Co. (1 January 2021), ASIN : B08VD3RWVV
2. Metro Railways (Operation and Maintenance) Act, 2002 [Amended up to Act 34 of 2009 and as of 21-12-2020]
3. Transportation Engineering and Planning, by C. S. Papacostas, P. D. Prevedouros, PHI Publication
4. Urban Transportation Systems, by S. Grava, Mc. Graw Hill Professional

Reference Books

1. Fundamentals of Transportation Engineering, by J.D. Fricker, & R.K. Whitford, Pearson, PH
2. Transit Systems Theory, by J. E. Anderson, Lexinton Books
3. Urban Rail Transit. Publisher: Springer Verlag, Singapore ISBN: 9789811559785, 9789811559785
4. Metro Rail Projects in India: A Study in Project Planning by M. Ramachandran, Oxford University Press; Edition (21 October 2011), ISBN-10:0198073984, ISBN-13: 978-0198073987
5. Predicting Light Rail and Metro Trackworks Costs by Gunduz Murat, Publisher: VDM Verlag,ISBN:9783639164046,3639164040

Supplementary Website for references:

1. E- learning NPTEL Lectures (Web :- http://nptel.ac.in /)

BCET-042	Fundamental of Entrepreneurship	3L:0T:0P	3 Credit

Course Objective: To create awareness on entrepreneurship among engineering students and stimulating self-motivation to start up enterprise

1. Understanding basic concepts in the area of entrepreneurship
2. Understanding the role and importance of entrepreneurship for economic development,
3. Developing personal creativity and entrepreneurial initiative,
4. Adopting of the key steps in the elaboration of business idea,
5. Understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Course Outcomes:-Students able to

1. Develop idea generation, creative and innovative skills
2. Self-motivate the students by making aware of different opportunities and successful growth stories
3. To learn how to start an enterprise and design business plans those are suitable for funding by considering all dimensions of business.
4. To evaluate the effectiveness of different entrepreneurial strategies

Module 1

Introduction To Entrepreneurship: Understanding the Meaning of Entrepreneur; Characteristics and Qualities of an Entrepreneur; Entrepreneurs Vs Intrapreneurs and Managers; Classification of Entrepreneurs; Factors Influencing Entrepreneurship; Entrepreneurial Environment; Entrepreneurial Growth; Problems and Challenges of Entrepreneurs; Entrepreneurial Scenario in India. **(8 Lecture hours)**

Module 2

Micro, Small and Medium Enterprises (Msmes):

MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes, Forms of Business; Women Entrepreneurship; Rural Entrepreneurship; Family Business and First Generation Entrepreneurs. **(8 Lecture hours)**

Module 3

Idea Generation And Feasibility Analysis :-Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities. **(8 Lecture hours)**

Module 4

Business Model And Plan In Respective Industry:- Business model – Meaning, designing, analyzing and improvising; Business Plan Meaning, Scope and Need; Financial, Marketing, Human Resource and

Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails? **(8 Lecture hours)**

Module 5

Financing And How To Start Up Business :-Financial opportunity identification; Banking sources; Non banking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for funding business; Pre launch, Launch and Post launch requirements; Procedure for getting License and Registration; Challenges and Difficulties in Starting an Enterprise. **(8 Lecture hours)**

Text Books:

1. Jayshree Suresh, "*Entrepreneurial Development*", Margham Publishers, Chennai , 2011**.**

2. Poornima M Charantimath, *"Entrepreneurship development small business enterprises"*, Pearson, 2013.

References Books:

1. Raj Shankar, "*Entrepreneurship: Theory And Practice",* Vijay Nicole imprints ltd in collaboration with Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012

2. Martin, M.J., 1994, "Managing Innovation and Entrepreneurship in Technology based Firm", John Wiley.

Supplementary Website for references:

1. E- learning NPTEL Lectures (Web :- http://nptel.ac.in /)

BCET-043	Solid & hazardous waste management	3L:0T:0P	3 Credit

Course Objective: The course on Solid Waste Management gives the student an overview of municipal solid waste management including collection, transfer, transport, and disposal. Methods of processing, basic disposal facilities, disposal options, and the environmental issues of solid waste management will be covered in this course. In addition, this course provides the student with relevant information about municipal solid waste reduction and on hazardous waste management

Course Outcome: The student will be able to:

1. Explain the types, quantity, nature of solid waste generated in a town
2. Estimate the composition and characterization of solid waste
3. Devise strategic planning for the collection of solid waste, mode of transport, site selection criteria, and techniques for safe disposal of solid without harming natural attributes.
4. Explain the modern and scientific methods to dispose solid waste with due concern to environmental issues.
5. Explore the possibilities of reuse, recycling and recovery of materials from the solid waste.

Module 1

Sources and Composition of Municipal Solid Waste: Introduction, Sources of solid waste, Types of solid waste, Composition of solid waste and its determination, Types of materials recovered from MSW.

(8 Lecture hours)

Module 2

Properties of Municipal Solid Waste: Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste, Biological properties of Municipal Solid Waste, Transformation of Municipal Solid Waste. Hazardous waste- Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Characteristics Hazardous waste toxicity, reactivity, infectiousness, flammability, radioactivity, corrosiveness, irritation, bio-concentration, genetic activity, explosiveness. **(10 Lecture hours)**

Module 3

Solid Waste Generation and Collection: Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Integrated Solid Waste Management System: Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.

(8 Lecture hours)

Module 4

Handling, Separation and Storage of Solid Waste, Rules and acts: Handling and separation of solid waste at site, Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation, Waste handling and separation at Commercial and industrial facilities, Storage of solid waste at the sources. Issues of public participation in solid waste and hazardous waste management. **(8 Lecture hours)**

Module 5

Processing of Solid Waste: Processing of solid waste at residence e.g. Storage, conveying, compacting, Shredding, pulping, granulating etc., Processing of solid waste at Commercial and industrial site, Facility Development and operation, Site Remediation: Quantitative risk assessment, site and subsurface characterization, Containment, remedial alternatives. **(8 Lecture hours)**

Textbooks:

1. Vesilind, P.A., Worrell, W., and Reinhart, D., "Solid Waste Engineering", Brooks/Cole, 2002.
2. LaGrega, M, Buckingham, P. and Evants, J.C., “Hazardous Waste Management”. McGraw-Hill, New York, 2001.

Reference books:

1. Tchobanoglous, G., Theisen, H and Vigil, S., “Integrated Solid Waste Management”, McGraw-Hill, New York, 1993.
2. Pfeffer, J.T., "Solid Waste Management Engineering", Prentice Hall, 1992.
3. Wentz, C., “Hazardous Waste Management”. McGraw-Hill, New York, 1995.

Supplementary Website for references:

1. E- learning NPTEL Lectures (Web :- http://nptel.ac.in /)

BCET-044	Non-conventional energy source	3L:0T:0P	3 Credit

COURSE OBJECTIVES

1. To provide a survey of the most important renewable energy resources and the technologies for harnessing these resources within the framework of a broad range of simple to state- of -the-art energy systems. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation

COURSE OUTCOMES

After completion of the course, students will be able to:

1. Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells.

2. Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.

3. Explore the concepts involved in wind energy conversion system by studying its components, types and performance.

4. Illustrate ocean energy and explain the operational methods of their utilization.

5. Acquire the knowledge on geothermal energy.

Module 1

Introduction Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

Solar Cells: Theory of solar cells, solar cell materials, solar cell array, solar cell power plant, limitations.

(7 Lecture hours)

Module 2

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. **(8 Lecture hours)**

Module 3

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.

Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations

Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

(9 Lecture hours)

Module 4

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations.

Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

Module 5

Bio-mass: Availability of bio-mass and its conversion theory.

Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations.

Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text/References Books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.

2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.

3.M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.

4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.

5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.

6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

Supplementary Website for references:

1. E- learning NPTEL Lectures (Web :- http://nptel.ac.in /)