Dr. Babasaheb Ambedkar Technological University, Lonere

(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra
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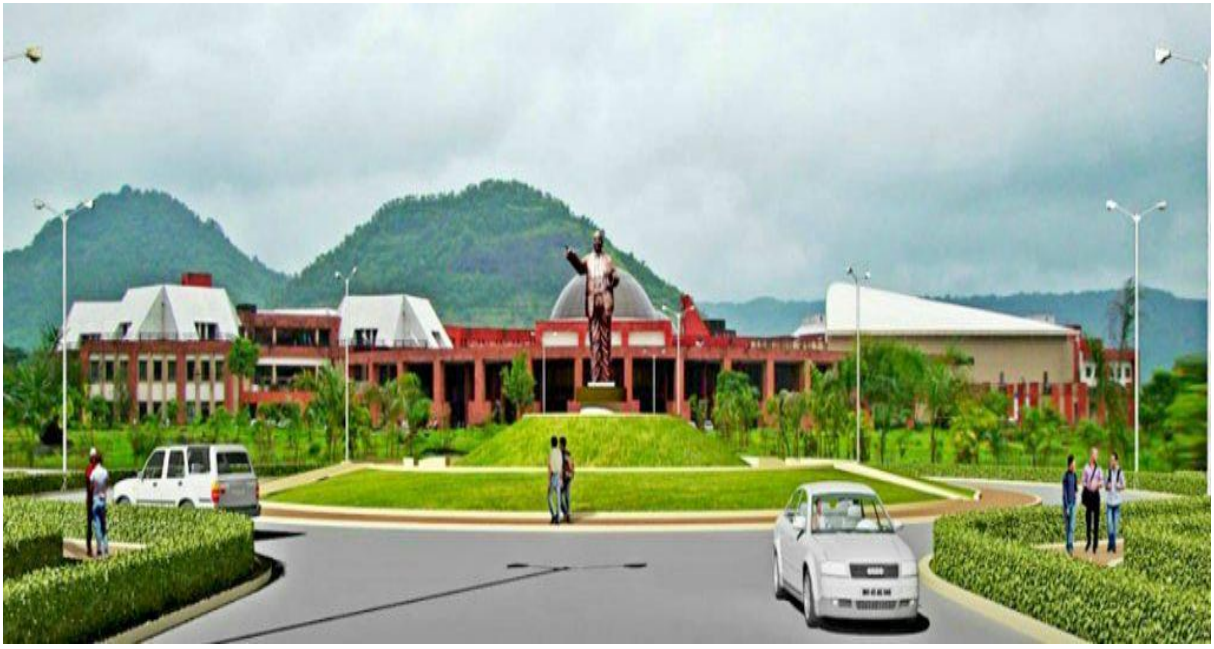
Curriculum for Undergraduate Degree Programme

S.Y. B. Tech. in Civil Engineering

With effect from AY 2021-22



Dr. Babasaheb Ambedkar Technological University
Lonere 402 103, Dist- Raigad, Maharashtra, INDIA

Teaching & Evaluation Scheme for Second Year B. Tech. Civil Engg.

Semester- III										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
BSC 5	BTBS301	Mathematics – III	3	1	-	20	20	60	100	4
ESC 8	BTCVES302	Mechanics of Solids	3	1	-	20	20	60	100	4
PCC 1	BTCVC303	Building Construction & Drawing	2	1	-	20	20	60	100	3
PCC 2	BTCVC304	Hydraulics -I	3	1	-	20	20	60	100	4
PCC 3	BTCVC305	Surveying	2	1	-	20	20	60	100	3
HSSMC2	BTHM306	Soft Skill Development	2	-	-	50	-	-	50	Audit
LC 1	BTCVL 307	Solid Mechanics Laboratory	-	-	2	20	-	30	50	1
LC 2	BTCVL 308	Hydraulics-I Laboratory	-	-	2	20	-	30	50	1
LC 3	BTCVL 309	Surveying Laboratory	-	-	2	20	-	30	50	1
Internship	BTES210P	Internship –I Evaluation (From Sem II)	-	-	-	-	-	50	50	Audit
		Total	**15**	**05**	**06**	**210**	**100**	**440**	**750**	**21**

Semester- IV										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 4	BTCVC401	Building Planning and Drawing	2	-	-	20	20	60	100	2
PCC 5	BTCVC402	Environmental Engineering	2	-	-	20	20	60	100	2
PCC 6	BTCVC403	Structural Mechanics - I	2	1	-	20	20	60	100	3
PCC 7	BTCVC404	Water Resources Engineering	3	-	-	20	20	60	100	3
PCC 8	BTCVC405	Hydraulics - II	2	1	-	20	20	60	100	3
PCC 9	BTCVC406	Engineering Geology	2	1	-	20	20	60	100	3
LC 4	BTCVL407	Building Planning and CAD Lab.	-	-	2	20	-	30	50	1
LC 5	BTCVL408	Environmental Engg. Lab.	-	-	2	20	-	30	50	1
LC 6	BTCVL409	HE-II Lab.	-	-	2	20	-	30	50	1
Internship	BTCVP410	Field Training / Internship/Industrial Training (minimum of 4 weeks training in Summer Vacation after Semester IV and appear at examination in Semester V)	-	-	-	-	-	-	-	To be evaluated in V Sem.
		Total	**13**	**03**	**06**	**180**	**120**	**450**	**750**	**19**

Detailed Syllabus

BTBS301 Mathematics – III

Teaching Scheme: (3 Lectures +1 Tutorial) hours/week

Course Contents

Module 1: Laplace Transform **(Lectures 09)**

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by tn, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

Module 2: Inverse Laplace Transform **(Lectures 09)**

Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

Module 3: Fourier Transform **(Lectures 09)**

Definitions – integral transforms; Fourier integral theorem (without proof); Fourier sine and cosine integrals; Complex form of Fourier integrals; Fourier sine and cosine transforms; Properties of Fourier transforms; Parseval's identity for Fourier Transforms.

Module 4: Partial Differential Equations and Their Applications **(Lectures 09)**

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one-dimensional heat flow equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$, and two-dimensional heat flow equation

Module5: Functions of Complex Variables **(Lectures 09)**

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping. Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

Text Books

1) Grewal B. S., "Higher Engineering Mathematics" Khanna Publishers, New Delhi.

2) Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New York.

3) Das H. K. and Er. Verma Rajnish, "Higher Engineering Mathematics", S. Chand & Co. Pvt. Ltd., New Delhi.

4) Dr. Singh B. B., "A course in Engineering Mathematics (Vol III)", Synergy Knowledgeware, Mumbai.

5) Wartikar J.N. and Wartikar P.N., "Engineering Mathematics Vol. I & II", PVG Prakashan, Pune, 1992

6) Ramana B. V., "Higher Engineering Mathematics", Tata McGraw-Hill Publications, New Delhi.

Reference Books

1) Peter O' Neil, "A Text Book of Engineering Mathematics" Thomson Asia Pte Ltd., Singapore.

2) Wylie C. R. & Barrett L. C., "Advanced Engineering Mathematics", TMH Publishing Co. Ltd., N. Delhi.

3) Dr. Singh B. B., "Integral Transforms and their Engineering Applications", Synergy Knowledgeware, Mumbai.

4) Sneddon I. N., "Integral Transforms", Tata McGraw-Hill , New York.

Course Outcomes: On completion of the course, student will be able to formulate and solve mathematical model of civilengineering phenomena in field of structures, survey, fluid mechanics and soil mechanics.

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BTCVES302 Mechanics of Solids

Teaching Scheme:(3 Lectures +1 Tutorial) hours/week

Course Contents

Module 1: Stress and Strain (Lectures 10)

Simple stress -Analysis of internal forces, simple stress, shearing stress, bearing stress, diaphragm or skin stresses in thin walled vessels, statically indeterminate members and thermal stresses

Simple strains -Stress strain diagram for different engineering materials and its importance for elastic and plastic analysis, Hooke's law: axial and shearing deformations, Poisson's ratio: biaxial and tri-axial deformations, variation of stress with inclination of element, relationship between modulus of rigidity and modulus of elasticity, variation of stress at a point: analytical derivation, introduction to strain measurement devices, Sensors: working principle

Module 2: Axial Force, Shear Force and Moment in Beam (Lectures 10)

Axial force, shear force and moment in beams – concept of unbalanced forces at a transverse section, axial forces, shear forces and moment – interaction of these, relations among load shear and moment, introduction to moving loads

Module 3: Stresses in beams (Lectures 10)

Theory of cylindrical bending, Relationship between intensity of loading, shear force and bending moment over elemental length, Derivation of flexural formula, economic sections, analysis of flexural action, derivation of formula for shearing stress, concept of shear flow, shear lag and shear center

Torsion -Assumptions, derivation of torsion formulae, torsion of circular shafts, power transmission, stresses and deformation in determinate solid/hollow homogeneous shafts

Module 4: Columns and Struts (Lectures 10)

Concept of short and long columns, formulae by Euler and Rankin, Euler's Crippling load for different end conditions, limitation of Euler's formula, equivalent length, eccentrically loaded short compression members, Kern of a section; load applied off the axes of symmetry, introduction to combined axial and flexural loads,

Module 5: Combined Stresses (Lectures 8)

State of simple shear, Analytical and graphical representation of state of combined stress at a point, absolute maximum shearing stress, application of Mohr's circle to combined loading, principal stresses and strains

Theories of Failure- maximum principal stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear stress theory, maximum shear strain theory.

Text Books:

- Singer F.L. and Pytle, 2011, "Strength of Materials", Harper Collins Publishers, Fourth Edition
- Junnarkar S.B. (2014), "Mechanics of Structures", Charotor Publishers, Anand, 31st edition,
- Khurmi R.S., 2018, "Strength of Material", S. Chand and Co., Edition revised 1968, New Delhi
- Sadhu Singh, 1978, "Strength of Materials", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-048-7
- Prasad I.B, 1988, "A text book of Strength of Materials", Khanna Publishers, N. Dehli, ISBN NO:978-81-7409-069-X
- Timoshenko S.P. and Young D.H., 2002, "Elements of Strength of Materials", East West Press, 4th edition 1962, New Delhi
- Prasad I.B, 1988, "A text book of Strength of Materials", ISBN: 978-81-7409-069-X
- Dr. Sadhu Singh, 1978, "Strength of Materials", ISBN: 978-81-7409-048-7
- Ramamrutham S., 2011, "Strength of Materials", Dhanpat rai and Sons, Delhi

Reference Books:

- Beer F P., Jhonston E. R., John. T. D E wolf, 2017, "Mechanics of Materials" TMH, 7th edition
- Popov E.P.,2015, "Introduction to Mechanics of Solids", Prentice-Hall, Second Edition 2005
- Crandall S.H., Dahl N.C., & Lardner T.J., 1955, "An Introduction to Mechanics of Solids", Tata McGraw Hill, 2nd Edi, 1978
- Nash W., 2005, "Strength of Materials Schaum's outline series", McGraw Hill, fourth edition
- Punmia B. C., 2018, "Mechanics of Materials" Laxmi Publications, revised edition, 2016
- Subramanian R., 2016, "Strength of Materials" Oxford University Press, 2nd edition, New Delhi
- Dr. Sadhu Singh, 1978, "Theory and Solved Problems in Adv. Strength of Materials", ISBN: 978-81-7409-212-7

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

CO1: Perform the stress-strain analysis.
CO2: Draw force distribution diagrams for members and determinate beams.
CO3: Visualize force deformation behavior of bodies.
CO4: Perform failure analysis

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BTCVC 303 Building Construction & Drawing

Teaching Scheme: (2 Lectures + 1 Tutorials) hours/week

Course Contents

Module 1: Masonry Construction (Lectures06)

Stone masonry: Random rubble, un-coursed rubble, coursed rubble & ashlar brickwork & brick bonds - english, flemish, principles to be observed during construction composite masonry, various partition walls, brick, aluminum & timber, solid concrete blocks, hollow concrete blocks and light weight blocks (aerated autoclaved), soil stabilized blocks, fly ash blocks, cement concrete walls

Module 2: Concrete for Construction (Lectures 06)

Introduction and properties of ingredients, importance of admixture materials such as pozzolona, fly ash, specific purpose chemical admixtures, Properties of fresh and hardened concrete

Module 3: Arches and Lintels (Lectures 06)

Arches and their stability, technical terms in arches, types of arches, methods of construction; Lintel: Necessity, materials: wood, stone, brick, steel, R.C.C. and reinforced brick lintels, beams: types according to material, layout such as primary and secondary, continuous beams, formwork for RCC elements: function, requirements

Module 4: Means of Lateral Communication (Lectures 10)

Doors and windows-Doors - classification based on parameters such as material, geometry, fixtures and fastening
Windows - classification based on parameters such as material, geometry, fixtures and fastening
Use of composite materials for doors and window frames and shutters, laying out of passages
Stairs: Terminology, requirements of a good stair, functional aspects, various types, uses and limitations
Ramps: Requirements and types, planning aspects for physically handicapped person
Elevators: Types and their Use

Module 5: Flooring Roofs and Types (Lectures 08)

Flooring: Types, factors for selections of floorings, flooring in ground and upper floors, various types of tiled flooring: natural, composite, synthetic, and special purpose flooring, concrete flooring for industrial purpose: tremix flooring
Roof coverings: Terms used, roof and their selection, pitched roofs and their types, roof coverings and their selection. Natural, composite, synthetic, and special purpose roof coverings, timber trusses (King Post and Queen Post), steel trusses types and their suitability

Precast and Pre-engineered Building Advantages and disadvantages.

List of Drawing Assignments

1) Sketch Book consisting of free hand proportional scale sketches for items to be drawn on drawing sheets as mentioned below under (2)
2) Drawing to scale on a half imperial drawing sheet covering following aspects.
   a) Lettering, Symbols, Types of lines and dimensioning as per IS 962.
   b) Foundations: - Isolated, Combined Footings, Under Reamed Piles, Rafts.
   c) Types of Stone Masonry: Elevation and Sectional Drawings.
   d) Types of Brick masonry: Elevation and Sectional Drawings.
   e) Types of Doors: Elevation and Sectional Drawings.
   f) Types of Windows: Elevation and Sectional Drawings, Standard Aluminum Sections.
   g) Types of Stairs: Plan and Sectional Drawings.
   h) Trusses: Various types, various roof covering materials, sketches for sectional profiles
   i) Typical plan for a single room and sectional views.
3) Site visit: To understand various building materials and their use.

Text Books

- Punmia B.C., Jain A. K., 2008, “Building Construction", Laxmi Pub. Pvt. Ltd., 10th Edi, N. Delhi
- Arora S. P. and Bindra S. P., 2010, “Text Book of Building Construction”, Dhanpat Rai Publications
- Kumar Sushil, 2010, “Building Construction” Standard Publishers, 20th Edition,.
- P. Purushothama Raj, 2016, “Building Construction Materials and Techniques”, Pearson Education
- Jain V.K., 2015, “Automation Systems in Smart and Green Buildings” ISBN NO: 978-81-7409-237-3

Reference Books

- NBC 2005, National Building Code of India, Parts III, IV, VII and IX, B.I.S. New Delhi
- Chudley R., 1973, "Construction Technology", Vol.1, 2, 3 and 4 ELBS Publisher
- SP 7- National Building Code Group 1 to 5, B.I.S. New Delhi
- I.S. 962 - 1989 Code for Practice for Architectural and Building Drawings, B.I.S. New Delhi
- Sikka V. B., 2015, “A Course in Civil Engineering Drawing”, S. K. Kataria and Sons

- Catalogues. Information Brochures, Trade Literature by material or product manufacturers
- Mehta, Scarborough, Armpriest, 2007, "Building Construction", Pearson Education
- Macay W.B, 2004, "Building Construction", Vol. I, II, III, IV, Pearson Education
- Jain V.K., 2015, "Handbook of Designing and Installation of Services in High Rise Building Complexes" ISBN : 978-81-7409-245-8

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

CO1: Understand types of masonry structures.
CO2: Comprehend components of building and there purposes.
CO3: Draw plan, elevation and section of various structures.
CO4: Apply the principles of planning and by laws used for building planning.
CO5: Prepare detailed working drawing for doors and windows.

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BTCVC304 Hydraulics - I

Teaching Scheme: (3 Lectures +1 Tutorial) hours/week

Course Contents

Module 1: Fluid Statics **(Lectures 10)**

Definition of fluids, fluid properties-density, specific weight, specific volume, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, types of fluids - Newtonian and non-Newtonian fluid, continuum, fluid pressure
Forces on fluid elements, fundamental equation, manometers, hydrostatic thrust on submerged surfaces, buoyancy, stability of unconstrained bodies, fluids in rigid body motion

Module 2: Fluid Dynamics **(Lectures 10)**

Types of flow, continuity equation, derivation and applications of momentum equation, flow measuring devices, Euler's equation, Bernoulli's equation, velocity potential and stream function, concept of flow net

Module 3: Laminar & Turbulent Flow **(Lectures 10)**

Fully developed laminar flow between infinite parallel plates, both plates stationary, upper plate moving with constant speed, fully developed laminar flow in pipe.
Turbulent flow: Shear stress distribution and turbulent velocity profiles in fully developed pipe flow, velocity distribution and shear stresses in turbulent flow, Prandtl mixing length theory, Nikuradse's experiment, Introduction to Boundary Layer Theory

Module4: Dimensional Analysis and Similitude **(Lectures 10)**

Nature of dimensional analysis, Rayleigh's Method, Buckingham pi theorem, dimensionless groups and their physical significance, flow similarity and model studies, Scale Effects, Distorted and Undistorted Models

Module5: Flow through Pipes **(Lectures 08)**

Loss of energy in pipes, pipe discharging from a reservoir, pipe connecting two reservoirs in series and parallel, siphon, transmission of power through nozzle, water hammer in pipes- rigid and elastic water column theory, surge tanks - function, calculation of head loss, introduction to Moody's chart, nomograms and other pipe diagrams

Text Books

- Fox. R. W. And Mc-Donald. A. T., 2011, "Introduction to Fluid Mechanics", John Wiley and Sons, Fifth Edition
- Modi and Seth, 2017, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, Tenth Edition , 1991
- Kumar K. L., 2010, "Fluid Mechanics", S. Chand publication
- Bansal R. K., 1989, "Fluid Mechanics", Laxmi publication Delhi
- Jain A.K, 1998, "Fluid Mechanics including Hydraulic Machines" ISBN: 978-81-7409-194-7

Reference Books

- Streeter V. L., Bedford K. W. and Wylie E. B., 1998, "Fluid Dynamics", New York, McGraw-Hill, Ninth Edition.
- Som S. K. & Biswas G., 2017, "Introduction to Fluid Mechanics & Fluid Machines", Tata McGraw-Hill.

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

CO1: Calibrate the various flow measuring devices.
CO2: Determine the properties of fluid and pressure and their measurement.
CO3: Understand fundamentals of pipe flow, losses in pipe and analysis of pipe network.
CO4: Visualize fluid flow phenomena observed in Civil Engineering systems.

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BTCVC305 Surveying

Teaching Scheme : (2 Lectures +1 Tutorial) hours/week

Course objectives:

1) To determine the relative position of any objects or points of the earth.
2) To determine the distance and angle between different objects.
3) To prepare a map or plan to represent an area on a horizontal plan.

Course Contents

Module 1: Chain Surveying **(Lectures 08)**

Definition, principles, classification, fields and office work, scales, conventional signs, survey instruments, their care and adjustment, ranging and chaining, reciprocal ranging, setting perpendiculars, well-conditioned triangles, traversing, plotting , enlarging and reducing figures

Module 2: Compass & Plane Table Surveying **(Lectures06)**

Prismatic compass, surveyor's compass, bearing systems and conversions, local attraction, magnetic declination, dip traversing, adjustment of errors.

Plane table instruments and accessories, merits and demerits, methods: radiation, intersection, resection, traversing

Module 3: Leveling and Applications **(Lectures08)**

Level line - Horizontal line - Levels and Staves, Sprit level – Sensitiveness, Bench marks - Temporary and permanent adjustments, Fly and Check leveling, Booking, reduction, Curvature and Refraction – reciprocal leveling - Longitudinal and cross sections - Plotting - Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs. Planimeter-Types, Theory, concept of zero circle, Study of Digital Planimeter, Computation of Areas and Volumes

Module 4: Theodolite Surveying **(Lectures 08)**

Theodolite - Vernier and micro-optic - Description and uses - temporary and permanent adjustments of vernier transit –Angles: Horizontal - Vertical - Heights and Distances - Traversing - Closing error and distribution - Gales's table - Omitted measurements

Module 5: Engineering Surveys **(Lectures 08)**

Reconnaissance, Preliminary and location surveys for engineering projects, Layout, Setting out works, Route Surveys for highways, railways and waterways, introduction to curve ranging, Mine Surveying - Instruments – Tunnels: correlation of underground and surface surveys, shafts

Text Books

- Kanetkar T.P. and Kulkarni S. V., 2014, "Surveying and Leveling", Vols. I, II and III, Vidyarthi Gruh Prakashan, Pune
- Punmia B.C., 1967, "Surveying", Vols. I, II and III, Laxmi Publications, 16th edition, 2016

Reference Books

- Clark D., 1944, "Plane and Geodetic Surveying", Vol. I & II, C.B.S. Pub. & Distri., N. Delhi, 6th edi.
- Anderson J. M. and Mikhail E. M., 1986, "Introduction to Surveying", McGraw Hill Book Company
- Bannister A. and Raymond S., 1959, "Surveying", ELBS, Sixth Edition, 1992
- Kahmen Heribert and Faig Wolfgang, 2017, "Surveying", Walter de Gruyter, 1995

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

CO1: Perform measurements in linear/angular methods.
CO2: Perform plane table surveying in general terrain.
CO3: Know the basics of leveling and Theodolite survey in elevation and angular measurements.

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BTHM306 Soft Skill Development

Teaching Scheme: (2 Lectures) hours/week

Program Educational Objectives:

1) To build the skills like team building so that they can work efficiently in groups.

2) To provide knowledge of conflict management while working in large organizations.

3) To develop management skills required in routine work environment.

4) To polish the personality of the learners in order to make them good leaders and employees.

5) To imbibe qualities like manners & etiquettes co-ordination, mutual understanding while working in a group.

Module 1: Development of Proficiency in English **(Lectures 05)**

Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups), 5 Ws& 1 H & 7 Cs for effective Communication, Imbibing Etiquettes and manners, Study of different pictorial expressions of non-verbal communication and their analysis

Module 2:Self-Management **(Lectures 05)**

Self-Evaluation, Self-discipline, Self-criticism, Recognition of one's own limits and deficiencies, dependency, etc., Self-Awareness, Self-Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride, Leadership & Team Dynamics

Module 3: Time Management Techniques **(Lectures 04)**

Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time

Module 4: Motivation/ Inspiration **(Lectures 04)**

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation

Motivation techniques: Motivation techniques based on needs and field situations

Module 5: Interpersonal & Computing Skills **(Lectures 06)**

Positive Relationship, Positive Attitudesand Empathies: comprehending others' opinions, points of views, and face them with understanding Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

Designing an effective Presentation, Contents, appearance, themes in a presentation, -Tone and Language in a presentation, Role and Importance of different tools for effective presentation

Reference Books

1) Mitra, Barun, "Personality Development and Soft Skills", Oxford University Press, 2016
2) Ramesh, Gopalswamy, "The Ace of Soft Skills: Attitude, Communication & Etiquette for Success", Pearson Education, 2013
3) Covey, Stephen R., "Seven Habits of Highly Effective People: Powerful Lessons in Personal Change"
4) Rosenberg Marshall B., "Nonviolent Communication: A Language of Life"

***Program* Educational Outcomes**

1) Learners will acquire interpersonal communication skills.
2) Learners will develop the ability to work independently.
3) Learners will develop the qualities like self-discipline, self-criticism and self-management.
4) Learners will have the qualities of time management and discipline.
5) Learners would be able to present themselves as an inspiration for others.

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BTCVL307 Solid Mechanics Laboratory

Practical: 2 hours / week

Practical Work consists of performance of at least seven experiments from the list below (excluding the eleventh study)experiment: Detailed report is expected.

List of Experiments

1. Tension test on ferrous and non-ferrous alloys (mild steel / cast iron /aluminum etc.)
2. Compression test on mild steel, aluminum, concrete, and wood.
3. Shear test on mild steel and aluminum (single and double shear tests).
4. Torsion test on mild steel and cast iron solid bars and pipes.
5. Flexure test on timber and cast iron beams.
6. Deflection test on mild steel and wooden beam specimens.
7. Graphical solution method for principal stress problems.
8. Impact test on mild steel, brass, Aluminum, and cast iron specimens.
9. Experimental on thermal stresses.
10. Strain measurement involving strain gauges / rosettes.

Assignment involving computer programming for simple problems of stress, strain computations.

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

CO1: Evaluate Young Modulus, torsional strength, hardness and tensile strength of given specimens.

CO2: Determine the strength of coarse aggregates.
CO3: Find the compressive strength of concrete cubes and bricks.

CO4: Determine physical properties of given coarse aggregates, fine aggregates and cement samples.

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BTCVL308 Hydraulics- I Laboratory

Practical: 2 hours / week

Practical Work consists of at least eight performances from list below and detailed reporting in form of journal. Practical examination shall be based on above.

1) Measurement of Viscosity of various fluids
2) Demonstration of working of different types of valves and pipe fittings
3) Measurement of pressure Piezometer, manometers, Pressure gauges
4) Measurement of discharge - Calibration of measuring tank, Use of hook or point gauge.
5) Verification of Bernoulli's Theorem
6) Determination of metacentric height.
7) Calibration of an orifice / mouthpiece / venturimeter / orifice meter
8) Study of factors affecting coefficient of friction for pipe flow (for two different materials and two differentdiameters)
9) Determination of loss of head due to Pipe Fittings

Use of computer programs such as MS Excel is desirable for post-processing of results.

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

CO1: Analyze the properties of fluids and their verification.
CO2: Predict empirical behavior of fluids.
CO3: Apply principles of hydraulics while working in field.

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BTCVL309 Surveying Laboratory

Practical: 2 hours / week

Practical Work consists of performances among the list below and detailed reporting in form of field book, journal and drawing sheets.

Perform each of the following practical work

1) Use of Dumpy Level, Auto Level and Tilting Level.
2) Sensitivity of Bubble Tube using Dumpy Level.
3) Evaluation of constant of Planimeter, and use of Digital Planimeter for measurement of areas.
4) Study of Theodolite.
5) Methods of Plane Table Survey
6) Study and use of Total Station

Among following any two shall be performed

1) Reciprocal Levelling.
2) Illustration of Permanent adjustment of Dumpy Level
3) Measurement of Horizontal Angle by Various Methods
4) Measurement of Magnetic Bearing and Vertical Angle by Theodolite
5) Two Point and Three Point Problems

Among following two shall be performed

1) Road survey, 2) Radial Contouring, 3) Block Contouring, 4) Theodolite Traversing

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

CO1: Use the theodolite along with chain/tape, compass on the field.
CO2: Apply geometric and trigonometric principles of basic surveying calculations.
CO3: Plan a survey, taking accurate measurements, field booking, and adjustment of errors.
CO4: Apply field procedures in basic types of surveys, as part of a surveying team.
CO5: Employ drawing techniques in the development of a topographic map.

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BTES210P Internship Evaluation I (from semester II)

Student shall undergo field training / industrial training / internship during summer vacation after Semester II. This training is at elementary level expecting exposure to field practices. A brief report shall be submitted. Evaluation shall be based on reportand power point presentation.

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Semester- IV										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 4	BTCVC401	Building Planning and Drawing	2	-	-	20	20	60	100	2
PCC 5	BTCVC402	Environmental Engineering	2	-	-	20	20	60	100	2
PCC 6	BTCVC403	Structural Mechanics - I	2	1	-	20	20	60	100	3
PCC 7	BTCVC404	Water Resources Engineering	3	-	-	20	20	60	100	3
PCC 8	BTCVC405	Hydraulics - II	2	1	-	20	20	60	100	3
PCC 9	BTCVC406	Engineering Geology	2	1	-	20	20	60	100	3
LC 4	BTCVL407	Building Planning and CAD Lab.	-	-	2	20	-	30	50	1
LC 5	BTCVL408	Environmental Engg. Lab.	-	-	2	20	-	30	50	1
LC 6	BTCVL409	HE-II Lab.	-	-	2	20	-	30	50	1
Internship	BTCVP410	Field Training / Internship/Industrial Training (minimum of 4 weeks training in Summer Vacation after Semester IV and appear at examination in Semester V)	-	-	-	-	-	-	-	To be evaluated in V Sem.
		Total	**13**	**03**	**06**	**180**	**120**	**450**	**750**	**19**

BTCVC 401 Building Planning and Drawing

Teaching Scheme: (2 Lectures) hours/week

Course Contents

Module 1: Principles of building planning **(6 Lectures)**

Principles of building planning, significance sun diagram, wind diagram, orientation, factors affecting, and criteria under Indian condition, concept of green building: aspect at planning level, construction stage and operational level.

Module 2: Building Services **(8 Lectures)**

Building planning byelaws & regulations as per SP-7, National Building Code of India group 1 to 5, planning of residential building: bungalows, row bungalows, apartments and twin bungalows, procedure of building permission, significance of commencement, plinth completion or occupancy certificate

Anthropometry: Study of Human dimensions, Concept of percentile in Indian standards, space required for various simple activities, Circulation spaces.

Module 3: Plumbing Systems **(8 Lectures)**

Various materials for system like stoneware, GI, AC, CI, PVC, HDPE and various types of traps, fittings, chambers, need of septic tank, concept of plumbing & drainage plan, introduction to rainwater harvesting, concept of rainwater gutters, rainwater outlet & down tank systems

Electrification: wiring types, requirements & location of various points, and concept of earthing

Fire resistance in building: Fire protection precautions, confining of fire, fire hazards, characteristics of fire resisting materials, building materials and their resistance to fire

Module4: Ventilation **(8 Lectures)**

Definition, necessity of ventilation, functional requirements, various system & selection criteria.

Air conditioning: Purpose, classification, principles, various systems

Thermal Insulation: General concept, Principles, Materials, Methods, Computation of Heat loss & heat gain in Buildings

Module 5: Introduction to Acoustics & Green Building **(6 Lectures)**

Absorption of sound, various materials, Sabine's formula, optimum reverberation time, conditions for good acoustics Sound insulation: Acceptable noise levels, noise prevention at its source, transmission of noise, Noise control-general considerations

Green Building: Concept, Principles, Materials, Characteristics, Applications

Reference Books

- Shah, Kale, Pataki, "Building Drawing", Tata McGraw- Hill
- Sane Y. S.,"Building Design and Drawing", Allied Book Stall, Pune
- Jain V.K., "Automation Systems in Smart and Green Buildings", Khanna Publishers, N. Dehli ISBN No 978-81-7409-237-3
- Jain V.K., "Handbook of Designing and Installation of Services in High Rise Building Complexes", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-245-8
- Deodhar S.V., "Building Science and Planning", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-199-8
- Jain A.K., "The Idea of Green Building"Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-256-4
- SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi
- I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings

Course Outcomes: On completion of the course, the students will be;

CO1: To plan buildings considering various principles of planning and byelaw of governing body.
CO2: Comprehend various utility requirements in buildings
CO3 : Understand various techniques for good acoustics.

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BTCVC402 Environmental Engineering

Teaching Scheme: (2 Lectures+1 Tutorial) hours/week

Course Contents

Module 1: Introduction **(6 Lectures)**

Environment and its components, importance of water, role of environmental engineer, sources of water, water demand: Design flow, design period, design population, factors affecting water consumption, variation in demand, and design capacity for water supply components, quality of water: Physical, chemical, biological characteristics, Indian standard for quality of potable water

Module 2: Treatment of Water **(10 Lectures)**

Conveyance of raw water: Canals and pipelines, hydraulics of conduits, laying and jointing of pipelines, testing of pipe lines, designing of rising main, type of valves, types of pumps, intake structure, types of intake structures, necessity of water treatment processes

Types of Treatments:

Aeration: Necessity, methods, removal of taste and odour, design of aeration fountain

Sedimentation: Suspended Solids, settling velocity, types of sedimentation tanks, surface loading, detention time, inlet and outlet arrangements

Coagulation: Necessity, coagulant dosage, choice of coagulants, optimum pH

Rapid Mixing: Necessity, gravitational, mechanical, pneumatic devices

Slow Mixing and Flocculation: Design of flocculation chamber, mean velocity gradient, design of clari-flocculator, plate settler and tube settler

Filtration: Theory of filtration, filter materials, types of filters, components, working and cleaning of filters

Disinfection: Theory of disinfection, factors affecting, efficiency of disinfection, types of disinfectants, break point chlorination, bleaching powder estimation

Water softening methods: Lime-soda, ion exchange method, demineralization

Module 3: System of Water Supply **(6 Lectures)**

Continuous and intermittent system, type of distribution systems, layouts, methods of supply: gravity, pumping and combination, hydraulic analysis of distribution system

Module 4: Treatment **(10 Lectures)**

Treatment of Waste Water

Sources of wastewater flows, components of wastewater flows, wastewater constituents, characteristic of municipal waste water, necessity of treatment of waste water, sewerage systems, concept of sewage, sullage, storm water, introduction of preliminary treatment, primary treatment, secondary treatment, introduction to tertiary or advanced treatment fundamentals of anaerobic treatment, sewage and industrial waste of common origin, types

Treatment of Solid Waste

Types, sources, characteristics, ill-effects of improper solid waste management, collection, processing techniques, methods of treatment of solid waste-composting, incineration, pyrolysis and sanitary land filling. biodegradable, non-degradable segregation of solid waste, concept of hazardous waste management, e-waste disposal

Module 5: Air Pollution **(4 Lectures)**

Definition, sources of air pollution, types air pollutants, atmospheric stability, mixing heights, plume types and meteorological parameters, effects of air pollution, control measures of air pollution

Text Books

- Rao and Rao,"Air Pollution ", Tata McGraw Hill Publications, New Delhi, 1990
- Garg S. K., "Water Supply Engineering", Khanna Publishers, New Delhi
- Birdi J. S. and Birdi G. S., "Water Supply & Sanitary Engineering", DhanpatRai Pub. Company, 8th edition, New Delhi

Reference Books

- Peavy and Rowe, "Environmental Engineering", McGraw Hill Publications
- Stern, "Environmental Engineering", Vol. I to IV, McGraw Hill Publications
- Sharma and Kaur, "Environmental Chemistry", Goyal Publisher
- Government Of India Publication, "Water Supply and Treatment Manual"
- Fair and Geyr, "Environmental Engineering", McGraw Hill Publications
- Steel and McGhee, "Environmental Engineering", McGraw Hill Publications
- Viessman& Hammer, "Water Supply & Pollution Control", Harper Collins Collage Publishers
- Publications by reouted organizations such as WHO, NEERI, MERI, MPCB, CWPRS, etc.

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

CO1: Apply the water treatment concept and methods.
CO2: Prepare basic process designs of water and wastewater treatment plants.
CO3: Apply the wastewater treatment concept and methods.
CO4: Apply the solid waste management concepts.

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BTCVC 403 Structural Mechanics– I

Teaching Scheme: (2 Lectures +1 Tutorial) hours/week

Course Contents

Module 1: Beam Deflections **(Lectures 06)**

Calculations of deflection for determinate beams by double integration, Macaulay's method, moment area method, conjugate beam method, deflection by method of superposition

Module 2: Energy Principles **(Lectures 06)**

Strain energy and strain energy density, strain energy in traction, shear, flexure and torsion - Castiglano's and Engessor's energy theorems, principle of virtual work, application of energy theorems for computing deflections in beams, Maxwell's reciprocal theorem, Williot Mohr diagrams

Module 3: Method of Consistent Deformation **(Lectures 08)**

Different structural systems, concept of analysis, basic assumptions, indeterminacy, choice of unknowns, Castiglano's theorem **Indeterminate Beams:** Analysis of indeterminate beams: Propped cantilever and fixed beams - fixed end moments and reactions for standard cases of loading – slopes and deflections in fixed beams

Module 4: Moment Distribution Method **(Lectures 08)**

Analysis of continuous beams propped cantilevers, continuous beams - theorem of three moments - analysis of continuous beams settlement effects, thermal effect, Shear Force and Bending Moment diagrams for continuous beams, portal frames with and without sway

Module 5: Slope Deflection Method **(Lectures 08)**

Analysis of continuous beams, analysis of rigid frames, frames without sway and with sway, settlement effects, introduction to difficulties in frames with sloping legs and gabled frames

Text Books

- Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill,3rd edition 2010
- Wang C.K., "Statically Indeterminate Structures", McGraw Hill
- Vazirani V.N., Ratwani M.M and Duggal S.K., "Analysis of Structures - Vol. I", ISBN NO:978-81-7409-140-8
- Khurmi R.S., "Theory of Structures", S Chand, Delhi
- Punmia B.C., "Structural Analysis", Laxmi Publications

Reference Books

- Timoshenko and Young, "Theory of structures", McGraw Hill
- Norris C. H. and Wilbur J. B., "Elementary Structural Analysis", McGraw Hill
- Kinney J. S., "Indeterminate Structural Analysis", Oxford and IBH
- Hibbler R. C., "Structural Analysis", Pearson Publications, 9th Edition
- Schodek, "Structures", Pearson Education, 7th edition
- Ramamrutham S. and Narayanan R., "Theory of Structures" Dhanpat Rai Publishers, Delhi

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

CO1: Describe the concept of structural analysis, degree of indeterminacy.
CO2: Calculate slopes and deflection at various locations for different types of beams.
CO3: Identify determinate and indeterminate trusses and calculate forces in the members of trusses
Perform the distribution of the moments the in continuous beam and frame

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BTCVC404 Water Resources Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction **(6 Lectures)**

Introduction, definition, scope, necessity, ill-effects of irrigation, advantages, types of irrigation systems, methods of distribution of water, development of irrigation in India

Water Requirement of Crops

Water requirement of crops, base, delta and duty, methods of improving duty, types of soil, types of soil water, soil moisture, consumptive use, irrigation frequency, irrigation methods, crops season, crop pattern

Module 2: Reservoirs **(6 Lecturers)**

Planning of Reservoirs: Classification of Reservoir, Selection of site for Reservoir, Investigation works for Reservoir, Yield and Capacity of Reservoir, Mass Curve and Demand Curve, Storage Calculations, Control Levels, Useful Life of Reservoir, Silting of Reservoirs, Losses in Reservoirs

Module 3 Dams and Hydraulic structures **(8 Lectures)**

Difference between weir, barrage and dam, Gravity Dams – Estimation of Loading, Design Criteria, Causes of Failure of Gravity Dam, Precaution against Failure, Theoretical and Practical Profile, Stability Calculations, Galleries, Joints, and Earth Dams: Components and their Functions, Design Criterion, Inverted Filters, Downstream Drainage, Causes of Failure of Earthen Dam. Arch Dams – Types, Forces on Arch Dam, Introduction and types of Spillway.

Module 3: Weirs and Canals **(8 Lectures)**

Weirs on Permeable Foundations: Theories of Seepage, Bligh's Creep Theory, Limitations of Bligh's Creep Theory, Khosla's Theory, Piping and Undercutting Canals: Types, Alignment, Kennedy's and Lacey's Silt Theories, Canal Losses, Typical Canal Sections, Canal Lining: Necessity and Types, Canal Structures: Cross Drainage Works and Canal Regulatory Works

Module 4: Hydrology **(6 Lectures)**

Introduction to hydrology: hydrologic cycle, rain, surface and ground water
measurement of rainfall, peak flow, base flow, precipitation and its measurement, average depth of precipitation, water losses, flood frequency, catchment area formulae, flood hydrograph, rainfall analysis, infiltration, run off, estimation of runoff, unit hydrograph and its determination, s- hydrograph

Module 5:

Lift Irrigation **(8 Lectures)**

Lift irrigation, wells and tube wells, introduction, classification of well, specific yield, deep and shallow wells, comparative advantage of well and canal irrigation, duty of well water, types of tube wells, types of strainers, boring methods. Darcy's law, permeability, safe yield of basin. Lift irrigation schemes: Various components and their design principles (Only concepts).

Water logging and drainage

Causes of water logging, preventive and curative measures, drainage of irrigation of lands, reclamation of water logged, alkaline and saline lands, Preventive and Curative Measures Water Conservation: Rain water Harvesting, Ground Water Recharge, small scale techniques of surface water detention such as: Soil embankments, field ponds, concrete bandhara.

Text Books

1. Varshney R. S., Gupta & Gupta, 1987, “Theory and Design of Irrigation Structures”, Vol. I & II
2. Punamia B. C. Pandey B. B. and Lal, 1992, “Irrigation and Water Power Engineering”, Standard Publishers, New Delhi
3. Garg S. K., 1976, “Irrigation Engineering & Hydraulic Structures”,Khanna Publishers, N. Delhi,
4. Priyani, 1982, “Irrigation and Water Power”, Charotar Publishing House, Anand
5. Bharat Singh,1979, “Irrigation”, Nemchand Brothers, Roorkee
6. Subramanya K., 1984, “Engineering Hydrology”, Tata Mc-Graw Hill Company Limited, N. Delhi

References Books

1. USBR, “Design of Small Dam", OXFORD & IBH, Publishing Company
2. Justinn, 1961, “Engineering for Dam” Vol. I, II, III, Creager and Hinds
3. Leliavsky, “Design of Hydraulic Structures” Vol. I & II,
4. C B I & P “River Behaviour, Management and Training”
5. Circular of Government of Maharashtra, 18 February 1995, “Design of Canals”

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

CO1: Understand need of Irrigation in India and water requirement as per farming practice in India.
CO2: Understand various irrigation structures and schemes. CO3: Develop basis for design of irrigation schemes.

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BTCVC405 Hydraulics-II

Teaching Scheme: (2 Lectures +1 Tutorial) hours/week

Course Contents

Module 1: Uniform Flow in Open Channel **(Lectures 06)**

Introduction, difference between pipe flow and open channel flow, types of open channels, types of flows in open channel, geometric elements, velocity distribution, measurement of velocity-(pitot lube, current meter) weir & spillway: sharp, broad & round crested weirs, calibration of weir, time of emptying tank with weir, profile of ogee spillway, flow below gates

Module 2: Steady & Uniform Flow **(Lecture 06)**

Chezy's& Manning's formula, Roughosity coefficient, uniform flow computations, hydraulically efficient section- considerations for rectangular, triangular, trapezoidal, circular sections

Specific energy: definition & diagram, concept of critical, sub-critical, super-critical flow, specific force, specific discharge derivation of relationships and numerical computations

Module 3: Varied Flow & Impact of Jet **(Lectures 10)**

Gradually (G.V.F.): Definition, classification of channel Slopes, dynamic equation of G.V.F. (Assumption and derivation), classification of G.V.F. profiles-examples, direct step method of computation of G.V.F. profiles

Rapidly varied flow (R.V.F.): Definition, examples, hydraulic jump- phenomenon, relation of conjugate depths, parameters, uses, types of hydraulic jump

Impact of Jet: Impulse momentum principle, impact of jet on Vanes-flat, curved (stationary and moving), inlet & outlet velocity triangles under various conditions, Series of flat, curved vanes mounted on wheel

Module 4: Turbines **(Lectures 08)**

Turbines: Importance of hydro-power, classification of turbines, description, typical dimensions and working principle of Pelton, Francis & Kaplan turbine (detailed design need not to be dealt with), Module quantities, specific speed, performance characteristics, selection of type of turbine, description & function of draft tube, Thomas's cavitation number

Module 5: Pumps **(Lectures 06)**

Pumps: Classification, component parts, working of centrifugal pump, performance characteristics, pump selection, common troubles & remedies, introduction to different types of pumps: reciprocating, multi-stage, jet, air lift, submersible pump

Text Books

- Modi, Seth, “Fluid Mechanics – Hydraulic & Hydraulic Mechanics” Standard Book House
- Bansal R.K., “Fluid Mechanics”, Laxmi Publications, 9th edition 2017
- Garde R. J., “Fluid Mechanics through Problems”, New Age Publications, 3rd edition 2011
- Jain A. K., “Fluid Mechanics”, Khanna Publications, 8th edition, 2003, Delhi
- Kumar K. L., “Fluid Mechanics”, Eurasia Publication House, 11th edition, Delhi
- Rangaraju, “Open Channel flow”, Tata McGraw-Hill Pub. Co., Delhi
- Subramanian K., “Fluid Mechanics through Problems” Tata McGraw-Hill Pub. Co., Delhi
- Subramanian K., “Flow in Open Channel”, Edition V, Tata McGraw-Hill Pub. Co., Delhi

Reference Books

- Streeter, "Fluid Mechanics" McGraw-Hill International Book Co., 3rd edition, Auckland
- Shames, "Mechanics of Fluids", McGraw Hill, 4th edition
- Chaw V. T., "Flow in Open Channel", McGraw-Hill International Book Co., Auckland
- Hughes & Brighton, "Fluid Mechanics", Tata McGraw Hill

Course Outcomes: On completion of the course, the students will

CO1: Design open channel sections in a most economical way.
CO2: Know about the non-uniform flows in open channel and the characteristics of hydraulic jump.
CO3: Understand application of momentum principle of impact of jets on plane

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BTCVC406 Engineering Geology

Teaching Scheme: 3 hours/week

Course Contents

Module 1: Introduction and Physical Geology **(Lectures 06)**

Definition, Scope and subdivisions, applications of Geology in Civil Engineering, Major features of the Earth's structure, internal structure of earth, and Geological work of river: features of erosion, deposition and transportation, Civil Engineering Significance, Geological work of wind: Processes and features of erosion, deposition and transportation, Civil Engineering Significance. Volcano: Central and Fissure types, Products of volcano, Mountain: Origin and formation, types, examples.

Module 2: Mineralogy and Petrology **(Lectures 06)**

Mineralogy: Physical properties of mineral, Classification of minerals, Petrology: Definition, rock cycle, Igneous rocks: origin, textures and structures, classification, concordant and dis-concordant intrusions, civil engineering significance, Secondary rocks: formation, classification, residual deposits: soil, laterite and bauxite and their importance, Sedimentary deposits: formation, textures, classification and structures, civil engineering significance, chemical and organic deposits, Metamorphic rocks: agents and types of metamorphism, stress and anti-stress minerals, structures, products of metamorphism.

Module 3: Structural Geology, Building Stones and Ground Water **(Lectures 08)**

Outcrop, Strike and Dip, Unconformity-Types, Outliers and Inliers, Overlap Fold and Fault: Parameters, Classification, Causes, Civil Engineering significance Joint: Types, Civil engineering considerations.
Building Stones - Properties of rocks, Requirement of good building stone, various building stones in India.
Groundwater: Sources of groundwater, water table, zones of groundwater, porosity and permeability.

Module 4: Preliminary Geological Investigations **(Lectures 08)**

Preliminary geological survey, steps in geological investigations, consideration of structural features. Exploratory drilling: observations, preservation of cores, core logging, core recovery, graphical representation of core log, limitation of exploratory drilling method.

Module 5: Geology of Dams, Reservoirs, Tunnels and Bridges **(Lectures 08)**

Dam, types of dams, Influence of geological conditions on location, alignment, design and types of a dam, geological considerations in site selection for dams, Site improvement techniques, dams on carbonate rocks, sedimentary rocks, folded strata and Deccan traps, favorable and unfavorable geological conditions for a reservoir site**.** Tunneling:- Types of tunnels, influence of geological conditions on tunneling, difficulties during tunneling, tunnel lining, tunneling in folded strata, sedimentary rocks and Deccan traps. Bridges:- Types of bridges, dependence of types of bridges on geological conditions.

Text Books

- Singh Prabin, 2009, "Engineering and General Geology", S. K. Katariya and sons, Delhi
- Mukerjee P. K., 2013, "A Text Book of Geology", World Press Pvt. Ltd., Calcutta
- Gokhale K.V.G.K. and Rao D. M., 1982, "Experiments in Engineering Geology", TMN, New-Delhi
- Gupte R. B., "A Text Book of Engineering Geology", Pune Vidyarthi Griha Prakashan, Pune
- Subinoy Gangopadhyay, 2013, "Engineering Geology ",oxford university

Reference Books

- G. W. Tyrrell, 1926, "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi
- A. Holmes, 1944, "Principles of Physical Geology", ELBS Chapman & Hall, London
- Billings M. P., 1942, "Structural Geology", Prentice Hall of India Private Ltd., New Delhi
- Legget R. F., 1983"Geology Hand book in Civil Engineering", McGraw-Hill, New York
- Krynine D. P. & Judd W. R., 2005, "Principles of Engineering Geology & Geo-technics", CBS Publishers &Distri., New Delhi
- Reddy Dr. D. V., 2017, "Engineering Geology for Civil Engineering", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
- Read H. H., 1962, "Rultey's Elements of Mineralogy", CBS Publishers & Distributors, Delhi

List of Assignments

It consists of study of relevant rock and mineral samples. Detailed report is expected.

- Megascopic study of Rock forming minerals
- Megascopic study of Ore forming minerals
- Megascopic study of Igneous rocks
- Megascopic study of Secondary rocks

- Megascopic study of Metamorphic rocks
- Cross-section Preparation and interpretation of geological maps
- Study of Structural Geological models
- Preparation of bore log /lithologs
- Interpretation of bore- hole data

Study Visit to the places of Engineering Geological importance.

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

CO1: Recognize the different land forms which are formed by various geological agents.
CO2: Identify the origin, texture and structure of various rocks and physical properties of mineral.
CO3: Emphasize distinct geological structures which have influence on the civil engineering structure.
CO4: Understand how the various geological conditions affect the design parameters of structures.

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BTCVL407 Building Planning and CAD Lab

Practical: 2 hours / week

Term work shall consist of detailed report of in form of set of drawings mentioned below. In practice sessions, free-hand sketching in drawing book shall be insisted.

1) Imperial size sheets based on actual measurement of existing residential building consisting of plan, elevation, section passing through staircase, Site plan. Area statement & brief specifications.
2) Planning & design of a building (Minimum G+1): Full set of drawings for:
    1) Municipal Submission drawing as per local statutory body bye-laws such as Town Planning, Municipal Council or Corporation Authorities.
    2) Foundation / Center Line Drawing.
    3) Furniture layout plan.
    4) Electrification plan.
    5) Water supply & drainage plan.
    6) Project report giving details of Drainage System, Water Supply System, Water Tank, Septic Tank Design of terrace Drainage System.
    7) Rain water harvesting systems
3) Setting out of planned building actually on ground using conventional or modern surveying instruments

It is desirable to use drawings produced in this submission for carrying out structural design under BTCVL708 and / orBTCVL806 in next semesters. If this is implemented, student shall get extra 10% weightage limited to maximum limit.

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

Draw plan, elevation and section of load bearing and framed structures.
Draw plan, elevation and section of public structures.

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BTCVL 408 Environmental Engineering Laboratory

Practical: 2 hours / Week

Practical Work consists of performance of at least six experiments from the List (A) below:

(A) Determination of:

1) pH and Alkalinity
2) Hardness
3) Chlorides
4) Chlorine demand and residual chlorine
5) Turbidity and optimum dose of alum
6) MPN
7) Sulphates
8) Fluorides and Iron
9) Total Solids, Dissolved Solids & Suspended Solids
10) Sludge Volume Index (SVI)
11) Dissolved Oxygen
12) BOD and COD

B) Site Visit to Water Treatment Plant:

A report based on the visit to water treatment plant shall be submitted.

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

CO1: Quantify the pollutant concentration in water, wastewater and ambient air.
CO2: Recommend the degree of treatment required for the water and wastewater.
CO3: Analyze the survival conditions for the microorganism and its growth rate.

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BTCVL 409 Hydraulic Engineering Laboratory - II

Practical: 2 hours / week

Practical Work consists of at least three performances from groups listed below and detailed reporting in form of journal. Practical examination shall be based on above.

Group (A)

1) Calibration of V notch / Rectangular notch.
2) Calibration of Ogee Weir.
3) Study of hydraulic jump
    a) Verification of sequent depths,
    b) Determination of loss in jump.
    c) Study of parameters with respect to Fraud Number: i) Y2/Y1; ii) Length; iii) Energy loss
4) Study of flow below gates – Discharge v/s head relation, Equation of flow, Determination of contraction in fluid in downstream of gate.
5) Velocity distribution in open channel in transverse direction of flow.

Group (B)

1) Impact of jet.
2) Study of Turbines (Demonstration).
3) Tests on Centrifugal Pump.
4) Study of Charts for Selection of Pumps

Use of computer programs such as MS Excel is desirable for post-processing of results.

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

CO1: Understand various properties of fluids and measurement techniques.
CO2: Carry out calibrations of various flow measuring devices.
CO3: Understand mechanism of hydraulic jump, various jets and pumps.

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BTCVP410 Field Training/Internship/Industrial Training

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester IV and appear at examination in Semester V.

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Dr. Babasaheb Ambedkar Technological University, Lonere

(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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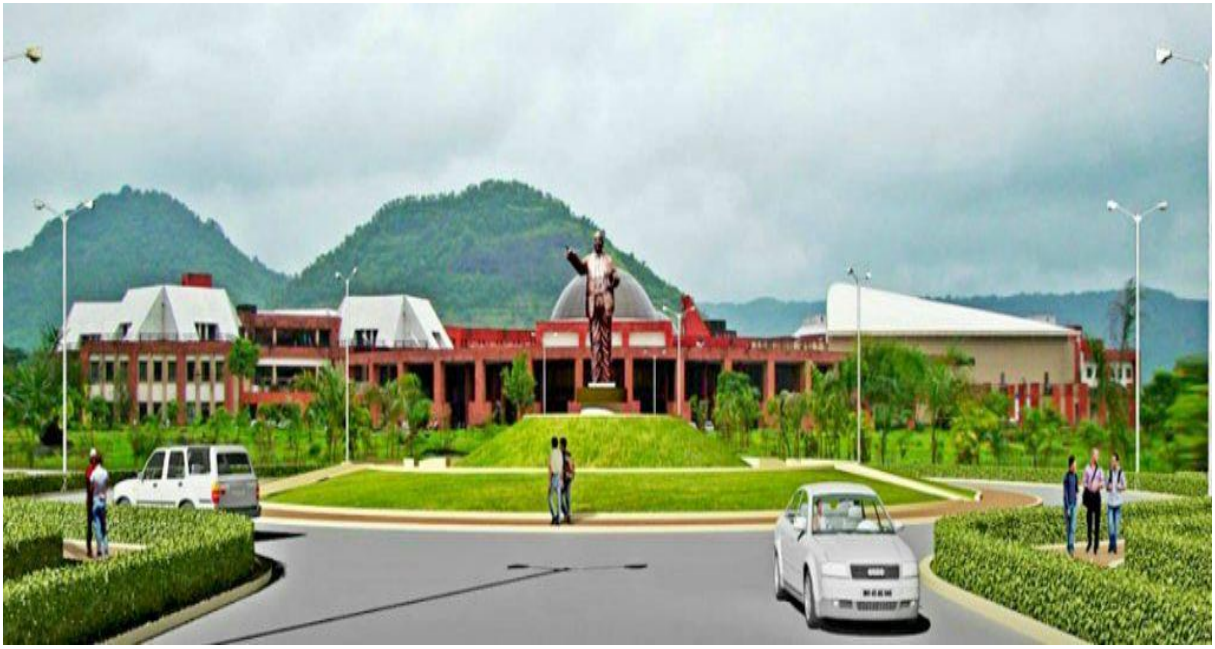
Draft Copy of Curriculum for Undergraduate Degree Programme

B. Tech. in Civil Engineering

Third Year

With effect from AY 2022-2023



Teaching & Evaluation Scheme for Third Year B Tech Civil Engg.

Semester- V										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 10	BTCVC501	Design of Steel Structures	2	1	-	20	20	60	100	3
PCC 11	BTCVC502	Geotechnical Engineering	3	1	-	20	20	60	100	4
PCC 12	BTCVC503	Structural Mechanics –II	2	1	-	20	20	60	100	3
PCC 13	BTCVC504	Concrete Technology	2	-	-	20	20	60	100	2
HSSMC3	BTHM505	Project Management	3	-	-	20	20	60	100	3
PEC 1	BTCVPE506	A. Advanced Environmental Engg. B. Applied Geology C. Hydraulic Engineering Design D. Advanced Water Resources E. Geomatics F. Town and Urban Planning G. Material, Testing and Evaluation H. Construction Economics & Finance	3	-	-	20	20	60	100	3
ESC10	BTCVES507	Software applications in Civil Engineering	2	-	-	50	-	-	50	Audit
LC 7	BTCVL508	SDD of Steel Structures Lab.	-	-	2	20	-	30	50	1
LC 8	BTCVL509	Geotechnical Engineering Lab.	-	-	2	20	-	30	50	1
LC 9	BTCVL510	Concrete Technology Lab.	-	-	2	20	-	30	50	1
Internship	BTCVP410	Internship – 2 Evaluation	-	-	-	-	-	-	-	Audit
		Total	**17**	**3**	**6**	**230**	**120**	**450**	**800**	**21**

Semester- VI										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 14	BTCVC601	Design of RC Structures	3	1	-	20	20	60	100	4
PCC 15	BTCVC602	Foundation Engineering	3	1	-	20	20	60	100	4
PCC 16	BTCVC603	Transportation Engineering	3	-	-	20	20	60	100	3
PEC 2	BTCVPE604	A. Industrial Waste Treatment B. Managerial Techniques C. Open Channel Flow D. Water Power Engineering E. Ground Improvement Techniques F. Structural Audit G. Intelligent Transportation Systems H. Plastic Analysis of Structures I. Numerical Methods in Civil Engg. J. Engineering Management	3	-	-	20	20	60	100	3
OEC 1	BTCVOE605	A. Environmental Impact Assessment B. Basic Human Rights C. Business Communication and Presentation Skills D. Composite Materials E. Experimental Stress Analysis F. Python Programming G. Operation Research H. Applications of Remote Sensing and Geographic Information Systems I. Civionics: Instrumentation & Sensor Technologies for Civil Engineering J. Planning for Sustainable Development K. Development Engineering	3	-	-	20	20	60	100	3
HSSMC4	BTHM606	Indian Constitution	2	-	-	50	-	-	50	Audit
LC 10	BTCVL607	SDD of RC Structures Lab.	-	-	2	20	-	30	50	1
LC 11	BTCVL608	Transportation Engineering Lab	-	-	2	20	-	30	50	1
Project	BTCVM609	Mini Project	-	-	2	20	-	30	50	1
Internship		**Mandatory (BTCVP610)** Field Training/ Internship/Industrial Training (minimum of 4 weeks training in Summer Vacation after Semester VI and appear at examination in Semester VII.)	-	-	-	-	-	-	-	Credits to be evaluated in VII Sem
Total			**17**	**2**	**6**	**210**	**100**	**390**	**700**	**20**

Detailed Syllabus

Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Third Year B Tech Civil Engg.

Semester- V										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 10	BTCVC 501	Design of Steel Structures	2	1	-	20	20	60	100	3
PCC 11	BTCVC 502	Geotechnical Engineering	3	1	-	20	20	60	100	4
PCC 12	BTCVC 503	Structural Mechanics –II	2	1	-	20	20	60	100	3
PCC 13	BTCVC 504	Concrete Technology	2	-	-	20	20	60	100	2
HSSMC3	BTHM505	Project Management	3	-	-	20	20	60	100	3
PEC 1	BTCVPE506	A. Advanced Environmental Engg. B. Applied Geology C. Hydraulic Engineering Design D. Advanced Water Resources E. Geomatics F. Town and Urban Planning G. Material, Testing and Evaluation H. Construction Economics & Finance	3	-	-	20	20	60	100	3
ESC9	BTCVES507	Software applications in Civil Engineering	2	-	-	50	-	-	50	Audit
LC 7	BTCVL508	SDD of Steel Structures Lab.	-	-	2	20	-	30	50	1
LC 8	BTCVL509	Geotechnical Engineering Lab.	-	-	2	20	-	30	50	1
LC 9	BTCVL510	Concrete Technology Lab.	-	-	2	20	-	30	50	1
Internship	BTCVP410	Internship – 2 Evaluation	-	-	-	-	-	-	-	Audit
		Total	**17**	**3**	**6**	**230**	**120**	**450**	**800**	**21**

BTCVC 501 Design of Steel Structures

Teaching Scheme: (2 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: Introduction and Connections **(6 Lectures)**

Introduction, advantages & disadvantages of steel structures, permissible stresses, factor of safety, methods of design, types of connections, various types of standard rolled sections, types of loads and load combinations
Types: Riveted, Bolted, Welded; Analysis of axially & eccentrically loaded connections (subjected to bending & torsion), Permissible Stresses, Design of connections, failure of joints

Module 2: Axially Loaded Members, and Flexure Members **(8 Lectures)**

Tension members: Common sections, net effective area, load capacity, connection using weld / bolts, design of tension splice Compression members: Common sections used, effective length and slenderness ratio, permissible stresses, load carrying capacity, connection using weld / bolt

Beams: Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections.

Module 3: Industrial Roofing **(8 Lectures)**

Gantry girder: Forces acting on a gantry girder, commonly used sections, introduction to design of gantry girder as laterally unsupported beam, connection details
Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, design of hinge & roller supports

Module 4: Columns and Column Bases **(6 Lectures)**

Simple and built up section, lacing, battening, column subjected to axial force and bending moment, column splices.

Column bases: Analysis and design of: Slab base, gusseted base and moment resisting bases, grillage foundation, design of anchor bolt

Module 5: Introduction to Plastic Analysis and Limit State method **(8 Lectures)**

Introduction to: Plastic Analysis, Hinge Formation, Collapse Mechanism, Recent approaches in Steel Structure design based on Plastic Analysis Method and Limit State Approach, Introduction to Provisions in IS 800-2007

Note: Contents in Module 1 to part of 4 shall be taught with help of relevant text or reference books based on elastic design concept and IS 800: 1984. Module 5 shall be taught with reference to IS 800 2007
Use of IS 800: 1984 and 2007, IS 875 (All Parts), IS: Handbook No.1 for Steel Section and Steel Table is permitted for theory examination.

Text Books

- Duggal S. K., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Gambhir, "Fundamentals of Structural Steel Design", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Negi L. S., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Chandra Ram, "Design of Steel Structures", Vol. I & Vol. II, Standard Book House, New Delhi
- Dayaratnam P., "Design of Steel Structures", Wheeler Publishing, New Delhi
- Subramanian N., "Steel Structures: Design and Practice" Oxford Univ. Press, Delhi
- Vazirani V.N. and Ratwani M.M., "Design and Analysis of Steel Structures", ISBN NO: 978-81-7409-295-3
- Sai Ram K. S., "Design of Steel Structures", Pearson Education, 2nd Edition

Reference Books

- Arya A. S. and Ajamani J.L., "Design of Steel Structures", Nemchand and Brothers, Roorkee
- Vazirani&Ratwani, "Design of Steel Structures", Standard Book House, New Delhi
- Duggal S. K., "Limit State Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Publications of Bureau of Indian Standards, New Delhi, IS 800:1984, 2007, IS 875 (Part I to V)
- Gaylord E.H. and Gaylord C.N., "Design of Steel Structures" McGraw Hill, New York
- Lothers J.E., "Design in Structural Steel" Vol.-I, Prentice Hall New Jersy
- Salmon and Johnson, "Steel Structures: Design and Behaviour", Harper and Row, New York
- Steel Designers Manual.

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

CO1: Identify and compute the design loads and the stresses developed in the steel member.

CO2: Analyze and design the various connections and identify the potential failure modes.

CO3: Analyze and design various tension, compression and flexural members.
CO4: Understand provisions in relevant BIS Codes.

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BTCVC502 Geotechnical Engineering

Teaching Scheme: (3 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: Introduction **(8 Lectures)**

Definition of soil and soil engineering, Application areas of soil mechanics, Three Phase system, Soil moisture, Soil minerals Soil structure, Terzaghi's effective stress concept, Effective and neutral pressure

Module 2: Soil Consistency **(10 Lectures)**

Index properties of soil: Different unit weights of soil, and their determination, unit weight of solids, unit weights of soil mass, method for determination of field density viz. sand replacement and core cutter, Specific Gravity determination methods void ratio and porosity, degree of saturation, Inter relation between weight volume state, density indexes, Atterberg's limits and their significance,Soil Classification: Soil classification based on particle size and consistency, I.S. classification system

Module 3: Flow of Water Through Soil: Permeability **(10 Lectures)**

Head, gradient and potential, Darcy's law, Factors affecting permeability, Field and Laboratory methods of determining permeability, Seepage pressure, quick sand condition, Derivation of Laplace equation, Flow net: characteristics& application, construction of flow net, piping phenomenon, Permeability through stratified soil, Discharge and seepage velocity.

Module 4: Shear Strength **(10 Lectures)**

Concept of shear, Coulomb's theory and failure envelope, Principle stress, stress analysis (Total stress approach and effective stress approach), representation of stresses on Mohr's circle for different types of soil such as cohesive and cohesionless, saturated and partly saturated soil etc, Application of shear stress parameters in the field, Different types of shear tests: Unconsolidated undrained, Consolidated undrained and consolidated drained choice of the type of test, box shear test, triaxial compression test with pore pressure and volume change measurement, Unconfined compression test, vane shear test

Module 5: Compressibility of Soils **(10 Lectures)**

CompactionTheory of compaction, factors influencing compaction, compacted density, Laboratory Standard and modified compaction test, Method and measurement of field compaction, Field compaction control Consolidation Compressibility: Definition, compressibility of laterally confined soil, compression of sand and clay, e-p and e-log p curve, compression index. Consolidation: Terzaghi's theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation, degree of consolidation, relevance of one dimensional consolidation to field condition, time factor

Earth Pressure Theories: Earth pressure at rest, active and passive conditions, Elementary idea about Rankin's and Coulomb's earth pressure. Graphical methods for active earth pressure.

Text Books:

- Kasamalkar B. J., "Geotechnical Engineering", Pune Vidyarthi Griha Prakashan Pune
- Murthy V.N.S., "Soil Mechanics & Foundation Engineering", U.B.S. Publishers and Distributors N. Delhi
- Punmia B.S., "Soil Mechanics & Foundation Engineering", Laxmi Publications
- Arora K. R., "Soil Mechanics" Standard Publishers, N. Delhi
- Gopal R Rao "Basic Soil Mechanics "

Reference Books:

- Alam Singh, "Text book of soil mechanics in theory and practice", Asian Pub. House, Mumbai
- Taylor D.W., "Fundamentals of Soil mechanics"
- Terzaghi and Peak "Soil mechanics" John Willey and Sons, New-York
- Scott R. F., "Principal of soil mechanics"
- Lambe T.W, "Soil Testing" by Willey Eastern Ltd., New Delhi

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

CO1: Understand different soil properties and behavior

CO2: Understand stresses in soil and permeability and seepage aspects.

CO3: Develop ability to take up soil design of various foundations

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BTCVC503 Structural Mechanics -II

Teaching Scheme: (2 Lectures + 1 Tutorial) hours/week

Course Contents

Application of all methods shall be restricted to beams, Frames and /or pin jointed frames or trusses of Degree of Indeterminacy up to three.

Module 1: Analysis of trusses **(6 Lectures)**

Analysis of determinate and indeterminate pin jointed trusses by energy method, effects of settlement and pre-strains

.

Moving Loads and Influence Lines

Introduction to moving loads, concept of equivalent UDL, absolute maximum bending moment and shear force, concept of influence lines, influence lines for reaction, shear force, bending and deflection of determinate beams, influence line diagram (ILD) for forces in determinate frames and trusses, analysis for different types of moving loads, single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than span, application of Muller Breslau principle for determinate structures to construct ILD.

Module 2: Cables, Suspension Bridges and Arches **(8 Lectures)**

Analysis of forces in cables, suspension bridges with three hinged and two hinged stiffening girders, theory of arches, Eddy's theorem, circular , parabolic and geometric arches, concept of radial shear force and axial thrust, analysis of three hinged and two hinged arches, effect of yielding of supports, rib shortening and temperature changes. ILD for 3 hinged arches and suspension bridges

Module 3: Analysis of Indeterminate Structures by direct Flexibility Method **(8 Lectures)**

Fundamental concepts of flexibility method of analysis, flexibility coefficients and their use in formulation of compatibility equations, application of above methods to propped cantilevers, fixed beams, continuous beams,simple pin jointed frames including effect of lack of members, rigid jointed frames.

Module 4: Analysis of Indeterminate Structures by direct Stiffness Method **(8 Lectures)**

Fundamental concepts of stiffness method of analysis, stiffness coefficients for prismatic members and their use for formulation of equilibrium equation, applications of the above methods to indeterminate beams and simple rigid jointed frames, rigid jointed frames with inclined member but having only one translational DoF in addition to rotational DoF's, including the effect of settlement of supports, pin jointed frames.

Module 5: Finite Element Method (Contents to conceptual level) **(6 Lectures)**
Introduction to analysis by discretization such as finite difference method, Finite element method: types of elements-1D, 2D, 3D, Plane Strain and Plane Stress Problem, isoperimetric and axisymmetric, convergence criteria, Pascal's triangle, direct stiffness method, principle of minimum potential energy. Shape functions, concept of local and global stiffness matrix

Text Books

- Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill
- Pandit G. S. and Gupta S. P., "Structural Analysis - a Matrix Approach", Tata McGraw Hill, N.Delhi, 1986
- Chandrupatla T. R., Belegundu A. D., "Introduction to Finite Elements in Engineering, PrenticeHall, N. Delhi, 1996
- Thadani B. N. and Desai J. P., "Structural Analysis"
- Punmia B.C., "Structural Analysis", Laxmi Publications
- Vazirani V.N., Ratwani M.M and Duggal S.K., "Analysis of Structures - Vol. II" Khanna Publishers, N. Dehli, Sadhu Singh, "Theory and Solved Problems in Adv. Strength of Materials", Khanna Publishers, N. Dehli,
- Ramamrutham S. and Narayanan R., "Theory of Structures" DhanpatRai Publishers, Delhi

Reference Books

- Norris C. H. and Wilbur J. B., "Elementary Structural Analysis", McGraw Hill
- Beaufait, F. W., "Basic Concepts of Structural Analysis", Prentice Hall, N.J. Kinney J. S., "Indeterminate Structural Analysis", Oxford and IBH
- Krishnamurthy, C.S., "Finite Element Analysis – Theory and Programing", Tata McGraw Hill, N. Delhi 1994
- Hibbler R. C., "Structural Analysis", Pearson Publications
- Kanchi M. B., "Matrix Methods of Structural Analysis", Wiley Eastern Ltd., N. Delhi
- Wang C. K., "Matrix Methods of Structural Analysis", International Text-book, Scranton, Pennsylvania, 1970
- Gere J.M., Weaver W., "Analysis of Framed Structures", D. Van Nostrand Company, Inc., Princeton, N. Jersey

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

CO1: Have a basic understanding of matrix method of analysis and will be able to analyze the determinant structure.

CO2: Have a basic understanding of the principles and concepts related to finite difference and finite element methods

CO3: Have a basic understanding of concept of influence line

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BTCVC504 Concrete Technology

Teaching Scheme: (2 Lectures) hours/week

Course Contents

Module 1 **(4 Lectures)**

Materials for Concrete: Cement, Manufacturing Process, Physical Properties, Hydration of Cement, hydration products, Chemical Compounds in Cement, Types of Cement, Aggregates: Classification of aggregates, Physical Properties, Bulking of Sand, Mechanical Properties, Water: Specifications of Water to be used For Concrete

Module 2 **(4 Lectures)**

Properties of Fresh Concrete -Types of Batching, Mixing, Transportation, Placing Including Pumping and Compaction Techniques for Good Quality Concrete, Workability, Factors affecting workability, Methods of Measuring Workability, Segregation and Bleeding, setting time, Curing of Concrete, Types of curing, Temperature Effects on Fresh Concrete

Module 3 **(4 Lectures)**

Admixtures In Concrete: Types, Plasticizers and Super-plasticizers and their Effects On Workability, Air Entraining Agents, Accelerators, Retarders, Pozzolanic Admixtures, Green concrete, Bonding Admixtures, Damp-Proofing Admixtures, Construction Chemicals

Module 4 **(8 Lectures)**

Desired Properties of Concrete, Strength, Durability &Im-permeability, Characteristic Strength, Compressive, Tensile and Flexure of Concrete, Bond Strength, Tests on Concrete, Modulus of Elasticity, Effect of W/C Ratio and admixtures on Strength, Types of concrete, High Strength and High Performance Concrete Creep and Shrinkage of Concrete, Significance, Types of Shrinkage and Their Control,
Factors Affecting Creep. Durability of Concrete: Minimum & Maximum Cement Content, Strength & Durability Relationship, Exposure to Different Conditions, Factors Contributing to Cracks in Concrete, Sulphate Attack, Alkali Aggregate Reaction (AAR), factors affecting on AAR, Deteriorating effects of AAR, Chloride Attack, Corrosion of Steel (Chloride Induced)

Module 5 **(4 Lectures)**

Concrete Mix Design, Nominal Mix Concrete, Factors Governing Mix Design, Methods of Expressing Proportions, Trial Mixes, Acceptance Criteria, Factors Causing Variations, Field Control, Statistical Quality Control, Quality Measurement in
Concrete Construction, Non-destructive Testing of Concrete

Text Books

- Gambhir M. L. “Concrete Technology”, Tata Mc-Graw Hill 2015 15th edition
- Shetty M. S. “Concrete Technology”, S. Chand 2005.
- Krishnaswamy, “Concrete Technology”, DhanapatRai and Sons

Reference Books

- Orchard, “Concrete Technology”, Applied Science Publishers
- Neville A. M., “Concrete Technology”, Pearson Education
- Neville A. M., “Properties of Concrete”, Pearson Education
- Relevant Publications by Bureau of Indian Standards, New Delhi
- IS:10262(2009), IS:456 (2009), IS 4926 (2003)

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

CO1: Understand the various types and properties of ingredients of concrete.
CO2: Understand effect of admixtures on the behavior of the fresh and hardened concrete.
CO3: Formulate concrete design mix for various grades of concrete.

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BTHM505 Project Management

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 Lectures)**

Introduction, Steps in Project Management, fundamentals of material, machinery and manpower management in Project, Bar Chart, Mile stone chart, Development of network, Fulkerson's Rule, Introduction to CPM, Time estimates, floats, critical path

Module 2: **(6 Lectures)**

Network Compression, Least Cost and Optimum Duration, Resource Allocation, Updating Calculations for Updated Network

Module 3: **(8 Lectures)**

Introduction to PERT, concept of probability, normal and beta distribution, central limit theorem, time estimates, critical path, slack, probability of project completion

Module 4: **(8 Lectures)**

Introduction to engineering economics, importance, demand and supply, types of costs, types of interests, value of money – time and equivalence, tangible and intangible factors, introduction to inflation, cash – flow diagram, economic comparisons – discontinuing methods, non-discontinuing criteria

Module 5: **(6 Lectures)**

Linear break even analysis – problems, quality control – concept, statistical methods – control charts
Total quality management– philosophy of Juran, Deming, importance, Quality Circle implementation, introduction to ISO 9000 series and 14000 series, Introduction to Computer Aided Project Management

Text Books

- Roy Pilcher, "Project Cost Control in Construction",Sheridon House Inc.(Feb1988)
- Gupta R.C. "Statistical Quality Control", khanna publishers 9th edition
- Layland Blank and Torquin, "Engineering Economics",Mc-Graw-Hill Edition
- Naik B. M. "Project Management",Stosius Inc./Advent Book division
- Khanna O.P., "Work Study",Dhanpatrai publication
- Srinath L. S. "CPM PERT", Affiliated East-West Press (Pvt) ltd

Reference Books

- Antill and Woodhead, "C.P.M. in Construction Practice", Wiley-Interscience 4th edition 1990
- Taylor. G.A., "Management and Engineering Economics", Mc-Graw Hill 4th edition
- Roy Pilcher, "Principles of Construction Management" Mc-Graw Hill Higher Education 2rd revision

Course Outcomes: On completion of the course, the students will be able to: Understand various steps in project Management, different types of charts.Construct network by using CPM and PERT method.
Determine the optimum duration of project with the help of various time estimates.
Know the concept of engineering economics, economic comparisons, and linear break even analysis problems.
Understand the concept of total quality Management including Juran and Deming's philosophy.

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BTCVPE506 A. Advanced Environmental Engineering

Teaching Scheme :(3 Lectures) hours/week

Course Contents

Module 1: Low cost wastewater treatment methods **(8 Lectures)**

Principles of waste stabilization pond, Design and operation of oxidation pond, aerobic & anaerobic Lagoons, Aerated Lagoon, Oxidation ditch, Septic tank. Concept of recycling of sewage Disposal of waste water-stream pollution, Self Purification, DO sag curve, Streeter Phelp's Equation, Stream classification, disposal on land, effluents standards for stream and land disposals

Module 2: Industrial Waste Water Treatment Management **(8 Lectures)**

Sources of Pollution: Physical, Chemical, Organic and Biological properties of Industrial Wastes – Differences between industrial and municipal waste waters –Effects of industrial effluents on sewers and treatment plants, Prevention vs Control of Industrial Pollution
Pre and Primary Treatment: Equalization, Proportioning, Neutralization, Oil Separation by Floatation, Prevention v/s Control of Industrial Pollution

Module 3: Waste Water Treatment Methods **(8 Lectures)**

Nitrification and De-nitrification – Phosphorous removal – Heavy metal removal – Membrane Separation Process–Reverse osmosis– Chemical Oxidation–Ion Exchange – Air Stripping and Absorption Processes – Special Treatment Methods – Disposal of Treated Waste
Common Effluent Treatment Plants (CETPs): Need, Planning, Design, Operation & Maintenance Problems

Module 4: Environmental Sanitation **(6 Lectures)**

Communicable diseases, Methods of communication, Diseases communicated by discharges of intestines, nose and throat, other communicable diseases and their control

Module 4: Insects and Rodent Control **(6 Lectures)**

Mosquitoes, life cycles, factors of diseases control methods - natural &chemical, Fly control methods and fly breeding prevention, Rodents and public health, plague control methods, engineering and bio-control methods in Rural areas, Population habits and environmental conditions, problems of water supply and sanitation aspects, low cost excreta disposal systems, Rural sanitation improvement schemes.

Text Books

- Masters G.M. (2008) "Introduction to Environmental Engineering and Science"Prentice-Hall of India Pvt. Ltd., N. Delhi
- Metcalf & Eddy (1982) "Waste Water Engineering Treatment & Disposal", Tata McGraw Hill, New Delhi
- Garg S. K. (1979) "Sewage Disposal and Air Pollution Engineering", Khanna Publishers,New Delhi
- Rao M.N.& Datta A. K. (2018)"Waste water treatment", Oxford & Ibh Publishing Co Pvt Ltd, New Delhi

Reference Books

- Peavey H. S., Rowe D.R. (2017) "Environmental Engineering", McGraw-Hill Book Co., New Delhi
- Viessman W. and Hammer M. J. (2008) "Water Supply and Pollution Control",Pearson Publications, N. Delhi
- Hammer M. J. (2012) "Water and Waste water Technology", Prentice-Hall of India Private Limited,New Delhi
- Canter L. W. (1995) "Environmental Impact Assessment", Tata McGraw Hill Publication,New Delhi

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

1. Determine the sewage characteristics and design various sewage treatment plants.
2. Understand municipal water and wastewater treatment system design and operation.
3. Apply environmental treatment technologies and design processes for treatment of industrial waste water.
4. Understand the rural sanitation schemes.

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BTCVPE 506B Applied Geology

Teaching Scheme: (3Lectures) hours/week

Course Contents

Module 1: Stratigraphy and Indian geology **(6 Lectures)**

geological time scale, physiographic divisions of India and their geological, geomorphologic and tectonic characteristics, study of important geological formations of India namely: Vindhyan, Gondwana, and Deccan traps with respect to: distribution, lithology, tectonics, economic importance etc. significance of these studies in civil engineering

Module 2: Sub-surface exploration **(8 Lectures)**

Steps in geological studies of project site, engineering consideration of structural features, exploratory drilling, preservation of cores, core logging, graphical representation of core log, limitations of exploratory drilling method, numerical problems on core drilling, introduction to geological map

Sub-surface water: Runoff, fly off and percolation of surface water, juvenile, connate and meteoric water, water table, zones of subsurface water, perched water table, aquifer theory

Module 3: Engineering geology of Deccan traps **(8 Lectures)**

Types of basalts and associated volcanic rocks, engineering characteristics, infillings of gas cavities, compact and amygdaloidal basalt as construction material, effect of jointing, hydrothermal alteration and weathering on engineering behaviour, tail channel erosion problem in Deccan trap region, suitability for tunnelling, problems due to columnar basalt, dykes, red bole, tachylitic basalt, volcanic breccias and fractures, laterites: origin, occurrence and engineering aspects, ground water bearing capacity of rocks of Deccan trap region, percolation tanks

Module 4: Geology of soil formations **(6 Lectures)**

Soil genesis, geological classification of soils, residual and transported soils, soil components, characteristics of soils derived from different types of rocks, nature of alluvium and sand from rivers of Deccan trap region, scarcity of sand

Geophysics:

Various methods: magnetic, gravitational and electrical resistivity methods, applications of electrical resistivity method using Wenner configuration in civil engineering problems such as: finding thickness of over burden and depth of hard rock, locating the spot for ground water well, seepage of water finding,

Module 5: Rock mechanics: **(8 Lectures)**

General principles, engineering properties of rocks and their dependence upon geological characters, in- built stresses in rocks, measurements of these stresses

Plate tectonics, seismic zones of world, seismic activity of Deccan trap region, various theories on the origin of the seismic activity of Deccan trap region, prediction of earthquake, earthquake resistant constructions, numerical problems based on seismic data, cause and prediction and preventive measurement of landslide in Deccan trap region.

Text Books

- Gupte R. B., "A Text Book of Engineering Geology", Pune Vidyarthi Griha Prakashan, Pune.
- Gokhale K.V.G.K. and Rao D. M., "Experiments in Engineering Geology", TMN, New-Delhi.
- Mukerjee P. K., "A Text Book of Geology", The World Press Pvt. Ltd., Calcutta.
- Prabin Singh, "Engineering and General Geology", S. K. Katariya and sons, Delhi.

Reference Books

- Tyrrell G. W., "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi.
- Holmes A., "Principles of Physical Geology", ELBS Chapman &Hall,London.
- Billings M. P., "Structural Geology", Prentice Hall of India Private Ltd., New Delhi.
- Farmer L. W., "Engineering Properties of Rocks", Champman& Hall, London.
- SathyaNarayanSwamiB. S., "Engineering Geology", DhanpatRai& Co.(P) Ltd, Delhi

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

CO1 :Understand geological time scale and physiographic division of India and their geological and characteristics different geological formation in India.
CO2: Perform sub surface exploration and interpret core log.
CO3:Solve numerical problem based on core drilling and seismic data.
CO4 :Familiar with origin of earthquake, seismic wave and landslide in Deccan trap.

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BTCVPE 506C Hydraulic Engineering Design

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(6 Lectures)**

Design of Spillways and Energy Dissipation for Flood Control Storage and Conveyance Systems, major features of dams (e.g., type, design basis, spillway type), Analysis of Spillway flow, Design of stilling basis

Module 2: Hydraulic Processes: Pressurized Pipe Flow **(8 Lectures)**

Continuity and energy equations to pipe network, problems, Calculation of friction losses, DarcyWeisbach, Colebrook-White, Jain, Hazen-Williams, Manning's, loss coefficient tables to estimate local energy losses, analysis of pipe networks by interpreting energy and hydraulic grade lines

Module 3: Boundary Layer Theory **(8 Lectures)**

Concept, Boundary layer along thin plate- Characteristics, Laminar, Turbulent Boundary Layer, laminar sub layer, Various Thicknesses-Nominal, displacement, Momentum, Energy. Hydraulically smooth and Rough boundaries, Separation of Boundary layer, control of Separation, Introduction to Drag and Lift on submerged bodies (Flat plates, Sphere, Cylinder, aerofoil), Stokes law, Concept of Drag and Lift coefficients.

Module 4: **(8 Lectures)**

Impulse momentum principle, impact of jet on Vanes-flat, curved (stationary and moving), inlet & outlet velocity triangles under various conditions, Series of flat, curved vanes mounted on wheel.

Module 5: **(6 Lectures)**

Pump Performance, Analysis of pump performance with regards to pump location, multi-pump system performance in a specified hydraulic system

Text Books:

- Rajnikant M. Khatsuria "Hydraulics of Spillways and Energy Dissipators by"
- R.S.Varshney, S.C. Gupta, R.L. Gupta Theory and Design of Hydraulic Structures Vol. 1 and 2
- Bansal R.K., "Fluid Mechanics", Laxmi Publications, 9th edition 2017
- Garde R. J., "Fluid Mechanics through Problems", New Age Publications, 3rd edition 2011
- Jain A. K., "Fluid Mechanics", Khanna Publications, 8th edition, 2003, Delhi
- Subramanian K., "Fluid Mechanics through Problems" Tata McGraw-Hill Pub. Co., Delhi

Reference Books

- Streeter, "Fluid Mechanics" McGraw-Hill International Book Co., 3rd edition, Auckland
- Hughes & Brighton, "Fluid Mechanics", Tata McGraw Hill
-

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

CO1: Analyse spillway flow

CO2: Compute drag and lift coefficients using the theory of boundary layer flows.

CO3: Analyse Pump performance

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BTCVPE 506D Advanced Water Resources

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Hydrogeology **(8 Lectures)**

Porosity and Permeability of Rocks, Groundwater in Igneous, Metamorphic, Sedimentary Rocks and Non Industrated Sediments, Hydro-geological Regions of India, Surface and Subsurface Geophysical methods for Groundwater Explorations..

Module 2: Well Hydraulics **(8 Lectures)**

Aquifers and Aquifer Parameters, Darcy's law, Hydraulic Conductivity and its Characteristics, Dupuit Equation, Groundwater Flow Direction Steady Groundwater Flow, Groundwater Flow Equation, Estimation of Aquifer Parameters from Pumping Test Data, Graphical Techniques and their Limitations, Groundwater Well Losses, Interference among Wells, Potential Flow, Image well theory and its Application in Groundwater Flow.

Module 3: Water Well Design and Well Drilling **(8 Lectures)**

Water Well Design and Well Drilling: Well Screen, Development and Completion of Well, Rotary Drilling and Rotary Percussion Drilling, maintenance of Wells.

Module 4: Groundwater Management **(6 Lectures)**

Groundwater Management: Conjunctive Use, Alternative Basin Yields, Artificial Recharge of Groundwater, Groundwater Quality.
Groundwater Modelling: Groundwater Flow, mathematical, Analog and Digital modeling, Regional Groundwater Modelling.

Module 5: Ground Water Development **(6 Lectures)**

Introduction, Development of artificial recharging, Methods of artificial recharging, Suitability of artificial recharging methods.

Text Books:

- Walton, W.C.(1970) "Groundwater Resources Evaluation", McGraw Hill Inc, n York .
- Todd, D.K. (1995), "Groundwater Hydrology", John Wiley & Sons, Singapore
- Johnson, E.E. (1966),"Groundwater", E. Johnson Inc. Washington.
- Raghunath, H.M. (1992) "Groundwater", Wiley Eastern Ltd, N Delhi
- Sharma, H.D. and Chawla, A.S. (1977), "Manual on Groundwater and Tube Wells", Technical Report No. 18, CBIP, New Delhi,
- Davis, S.N. and De Weist, R.J.M. (1966), "Hydrogeology", John Wiley & Sons, N York.
- Garg, S.P. (1993) "Groundwater and Tube Wells", Oxford and IBH Publishing C. N Delhi.

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

CO1: Apply methods to recharge ground water

CO2: Ability to know about various surface and subsurface geophysical methods for groundwater explorations.

CO3: Ability to know about well hydraulics

CO4: Ability to know about design principles of well

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BTCVPE 506E Geomatics

Teaching Scheme: (3 Lectures) hours/week

Contents

Module 1: Tachometry **(8 Lectures)**

Significance and systems, principle, constants, basic formulae and field work stadia method, auto reduction tachometer, tangential system

Electronic Distance Measurement: Importance, principles of electronic distance measuring (EDM) instruments, classification of EDM's based on carrier waves used, study and use of total station

Module 2: Triangulation **(8 Lectures)**

Principle & classification, system, selection of station, base line measurement, correction and use of subtense bar, signals, satellite station, reduction to center, spherical excess, angular observations, tri-iteration

Triangulation Adjustments: Theory of errors, laws of weights, concept of most probable value

Module 3: Field Astronomy **(8 Lectures)**

Terms, co-ordinate systems, determination of latitude and true bearing by observation on the sun and pole star

Curves: Horizontal and vertical curves, simple curves, setting with chain and tapes, tangential angles by theodolite, double theodolite, compound and reverse curves, transition curves, functions and requirements, setting out by offsets and angles, vertical curves, sight distance requirements

Module 4: Photogrammetry **(6 Lectures)**

Terms, types, vertical photographs, scale, ground coordinates, relief displacement, flight planning photomaps and mosaics, stereoscopy and photo interpretation

Module 5: Introduction to Remote Sensing **(6 Lectures)**

Introduction, classification and principles, electromagnetic energy and its interaction with matter, idealized systems, sensors, platforms, and application in civil engineering, G.P.S & G.I.S. as surveying techniques – Overview, uses and applications

Text Books

- Bannister A., Raymond S., Wartikar J.N., Wartikar P.N.,1992 "Surveying", ELBS, 6th Editon,
- Heribert Kahmen and Wolfgang Faig,1995 "Surveying ", Walter de Gruyter,
- Kanetkar T.P., "Surveying and Leveling", Vols. I, II and III, Vidyarthi Gruh Prakashan, Pune
- Punmia B.C., "Surveying", Vols. I , II and III, Laxmi Publications

Reference Books

- James M. Anderson and Edward M. Mikhail, "Introduction to Surveying", McGraw Hill Book Company
- Clark D., "Plane and Geodetic Surveying", Vol. I and II, C.B.S. Publishers and Distributors, New Delhi, Sixth Edition
- Agor, "Advanced Surveying", Khanna Publications, Delhi
- Arora K. L., "Surveying", Vol.1 & 2
- Basak, "Surveying and Levelling"
- Duggal S. K., "Surveying", Vol 1 & 2, Tata Mcgraw Hill Publications, New Delhi
- Gopi S., Satikumar R. and Madhu N., "Advanced Surveying", Pearson Education
- Chandra A. M., "Higher Surveying", New Age International Publication

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

CO1: Understand basics different types of curves on roads and their preliminary survey.

CO2: Perform setting of curves, buildings, culverts and tunnels.

CO3: Comprehend different geodetic methods of survey such as triangulation, trigonometric leveling.

CO4: Comprehend modern advanced surveying techniques.

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BTCVPE 506 F Town and Urban Planning

Teaching Scheme: Lectures: 3 Hours / Week

Course Contents

Module 1: **(8 Lectures)**

Necessity and scope of Town Planning, Brief history, Greek and Roman Towns, Planning in ancient India - Indus Valley Civilization, Vedic Period, Buddhist Period, Medieval Period, Mogul Period, British Period, Post-Independence Period, Theories in urban and regional planning

Module 2: **(8 Lectures)**

Town Planners in Modern Era such as Sir Patrick Geddes, Sir Ebenezer Howard, Clarence stein, Sir Patrick Abercrombie, Le Corbusier, Present Status of Town Planning in India, Efficiency Measures, Planners skills, Integrated Area Planning in India. Distribution and sizes of Settlements

Module 3: **(8 Lectures)**

Layout of Residential Units, Neighborhood Unit Planning, Radburn Plan, Grid Iron Pattern, Shoe String Development, Growth Pattern of Towns, Concentric Satellite, Ribbon Development, Scattered growth

Module 4: **(6 Lectures)**

Elements of Town, Various Zones, Development Control Rules and Building Bye Laws, Urban Roads: Objective, Classification, Road Networks, Data Collection Surveys, Analysis of data,

Town aesthetics, Landscape Architecture, Suitability of Trees, Treatment of Traffic Islands, Open Spaces Walkways Public Sit-outs, Continuous Park System, Green ways

Town Planning works with reference to M.R.T.P. Act, Land Acquisition Act, Necessity and procedure of acquisition

Module 5: **(6 Lectures)**

Village Planning, Multilevel Planning, Decentralization Concepts, Rural Developments, Planning Methodology, GrowthCentre Approach, Area Development Approach, Integrated Rural Development Approach

Text Books:

1. Hiraskar G.K. (2018) “Town and country Planning”DhanpatRai Publication, N. Delhi
2. Rangawala S.C. (2015) “Town Planning”, Charotar Publications, Anand
3. Sundaram K.V. (1978) “Urban and Regional Planning in India”, Vikash Publishing House P.L
4. MRTP Act 1966 & 2002
5. Land Acquisition Act - 1894
6. Misra S. N. (1984) “Rural Development Planning-Design and Method”, Satvahan Publications, N. Delhi

Reference Books

1. Eisner S. and Gallion A. (1993) “The Urban Pattern”, John Wiley & Sons, N. Delhi

Outcomes: Upon completion of the course the students will be able to:

1. Understand town and Urban planning and their essential attributes
2. Identify elements of planning and regulations of the same
3. Implement guidelines provided by standard authorities

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BTCVPE506 G. Materials, Testing &Evaluation

Teaching Scheme: (3 Lectures) hours / Week

Course Contents

Module1: **(8 Lectures)**

Basic Properties of Materials: importance of materials in civil engineering construction, types of materials such as ceramics, concrete, composites, optical /electronics materials, glass, metals, nano-materials ,polymers and plastics, wood and other materials. some basic properties of materials such as temperature, energy, specific heat, thermal conductivity, coefficient of thermal expansion ,mechanical properties of metals ,stress, strain modulus of elasticity, ,stress-strain behavior, elastic and plastic deformations, elastic properties of materials, tensile properties, ductility, resilience and toughness ,compressive, shear and torsional deformation, hardness. Variability of material properties.

Module2: **(8 Lectures)**

Civil Engineering Materials: introduction to cement and concrete, uses of cement, strength of cement and concrete ,sand, coarse aggregates, mortar and grouts, masonry mortars, rendering, cementitious grouts, RCC, clay bricks ,calcium silicate bricks, concrete blocks., rubbles, steel , steel grades, mechanical properties of steel, different applications, floor and roofing tiles, slates, timber, strength of timber ,Engineered wood products, metals, glass for glazing, glass fibres, glass wool, bituminous materials, binder properties, binder mixtures, asphalt mixture.

Module3: **(6 Lectures)**

Composite Materials: RCC, FRC, steel/concrete composite bridge decks, fibre reinforced plastics structural insulated panels.
Comparison of Different Materials, Introduction, comparison of strengths of various materials, comparison for environmental impact, health and safety.

Module 4: **(6 Lectures)**

New Techniques in Constructions—Introduction,3D printing, photo catalytic admixture, self-healing concrete, zero cement concrete ,hemp lime, wood-glass epoxy composites, bamboo.

Module 5: **(8 Lectures)**

Material Testing ,Machines And Equipment Requirements---Necessity of material testing, various testing methods, destructive tests, classification of destructive tests---static, impact and cyclic testing,
non-destructive testing—its classification ,visual inspection, penetration test, magnetic detection, ultrasonic test, radiography test and spark test. Types of testing machines, UTM and CTM, force and displacement controlled machines, loading frames. Hardness testing machines, fracture tests.

Recommended Books:

- Deodhar S.V. (1990) Civil Engineering Materials' Allied Publishers, N. Delhi.
- RangwalaS.C. (1983)Civil Engineering Materials', DhanpatRai and Sons, N. Delhi.

References:

- B.I.S., 1980, "National Building Code of India', ISI, New Delhi.

Course Outcomes: The required course for emphasis in development engineering will help students

CO1: To develop skill to construct strong and durable structures by applying knowledge of material science.
CO2: To make the students aware of quality assurance and control in their real life as a professional.
CO3: To propose suitable material in adverse conditions

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BTCVPE506 H. Construction Economics & Finance

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 **(8 Lectures)**

Engineering Economics, Time Value of Money, Cash Flow diagram, Nominal and effective interest – continuous interest, Single Payment Compound Amount Factor, Uniform series of Payments, comparing alternatives, Present worth Analysis, Annual worth Analysis, Future worth Analysis, Rate of Return Analysis, Break Even Analysis, Benefit/Cost Analysis

Module 2 **(8 Lectures)**

Economics of Project Parameters, Equipment Economics, Operating Costs, Buy, Rent and Lease Options, |Replacement Analysis, Cost Estimates, Type of Estimates, Parametric Estimate, Management Accounting, Financial accounting principles, basic concepts, Financial statements, accounting ratios

Module 3 **(6 Lectures)**

Investment Evaluation and Financing Projects, Taxation, Depreciation, switching between different depreciation methods, Inflation, Sources of finance, equity, debit, securities, borrowings, debentures, Working capital requirement, financial institutes

Module 4 **(8 Lectures)**

Financial Management, Introduction, Charts of Accounts, Balance Sheet, Financial Ratios, Working Capital Management, Budgeting and budgetary control, Performance budgeting. Profit & Loss, statement, Ratio analysis, Appraisal through financial statements, International finance forward

Module 5 **(6 Lectures)**

PPP in Projects Public Private Participation in Projects- PPP Models, BOOT, BOT, Joint Ventures, BOOT, BOT, Annuity, DBFO, External Commercial Borrowings, International Finance, FIDIC.

Text Books

- Blank, L.T., and Tarquin, A. J., (1988). *Engineering Economy*, Mc-Graw Hill Book Co.
- Collier C. and Gla Gola C. (1998). *Engineering Economics & Cost Analysis*, Addison Wesley Education Publishers,
- Patel, B. M., (2000). *Project management- strategic Financial Planning, Evaluation and Control*, Vikas Publishing House Pvt. Ltd. New Delhi,
- Shrivastava, U. K., (2000). *Construction Planning and Management*, Galgotia Publications Pvt. Ltd. New Delhi.

References

- Van Horne, J.C. (1990). Financial Management and Policy, Prentice-Hall of India Ltd.
- Taylor, G.A. (1968). Managerial and Engineering Economy. East-West Edition.
- Thuesen, H.G. (1959). Engineering Economy, Prentice-Hall, Inc.
- Brigham, E.F. (1978). Fundamentals of Financial Management, the Dryden Press, Hinsdale, Illinios,
- Kolb, R.W. and Rodriguez, R.J. (1992). Financial Management, D.C. Heath & Co.
- Walker, E.W. (1974). Essentials of Financial Management, Prentice Hall of India Private Limited, New Delhi.

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

CO1: Adopt as per principles of economics and financing
CO2: Analyze available alternatives and propose best suitable among them
CO3: Apply various models of financial management and accounting

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BTCVES507 Software Applications in Civil Engineering

Teaching Scheme: (2 Lectures) hours/week

Course Contents

Module 1: **(5 Lectures)**

Importance and need of software for modeling, analysis and design in Civil Engineering field, Advantages and limitations of software, causes for errors, validation of software results. Failures due to errors in modeling, data entry and interpretation of software results.

Module 2: **(5 Lectures)**

Determination of Bending Moment Diagram, Deflections for different loading conditions for a Simply Supported Beam and Cantilever Beam. Determination of fixed end moments for different loading conditions of a fixed beam. Calculation of Influence line diagrams at any section of a Simply Supported Beam.

Module 3: **(5 Lectures)**

Application of problems in Hydraulics such as Hardy cross method in the Analysis of pipe network, Computation of water surface profiles in open channel flows. Estimation of Settlement of foundations in Cohesive Soil, Stability Analysis of Slopes. Estimation Earth Pressures in Cohesive and Cohesionless soils.

Module 4: **(5 Lectures)**

Application of problems in Environmental engg., Transportation Engg. Design of Slabs using I.S. Code method. Analysis and Design of Beams by using Limit state method. Design of columns subjected to axial load and Uni-axial Moment. Design of Isolated Footing. Design of rolled steel columns, built up columns, Beams and built-up Beams.

Module 5: **(4 Lectures)**

Software application in various disciplines of Civil Engineering: Learning and practice of any one software: from at least any 4 domain from 14 domain

1. Drafting and drawing: AutoCAD,
2. building information modelling:
3. Numerical Analysis and Mathematical operations:
4. Structural Analysis and Design:
5. Finite Element Analysis:
6. Project Management: MS Project
7. Geotechnical Engineering:
8. Quantity Surveying:
9. Environmental Engineering:
10. Remote Sensing and Geographical Information System: QGIS,
11. Transportation Engineering:
12. Hydraulics and Water Resources Engineering:
13. Different Open-source software used for specific problems
14. MS Excel: Conduct concrete mix design for M40 grade concrete. or any exercise of Civil Engineering domain.

(Any open source softwares such as Auto CAD, MS Project, QGIS may be used for above purpose and along with that other appropriate softwares can be used for the same.)

Text Books

- Computer aided design, software and analytical tools by C.S. Krishnamoorthy & S. Rajesh.
- Computer applications in Civil Engineering by S.K. Parikh.
- Computer aided design in Reinforced concrete by V.L. Shah.

Reference Books

- http://www.stepinau.com/offline/Civil/4-1/COMPUTER%20APPLICATIONS%20IN%20CIVIL%20%20ENGINEERING/COMPUTER%20APPLICATIONS%20IN%20CIVIL%20%20ENGINEERING.html#.YrANZXZBxQI
- https://www.inspirenignite.com/mh/ce-c507-software-applications-in-civil-engineering-syllabus-for-ce-6th-sem-2018-pattern-mumbai-university/

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

CO1: Understand & Analyse civil engineering softwares

CO2: Use applications of various softwares in specialized works of civil engineering

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BTCVL508 SDD of Steel Structures Lab

Practical: 2 Hours / Week

Term work shall consist of detailed analytical report for structural design and drawing of any one of the following steel structures from Group A and B. Student may use IS 800 1984 or 2007.

Group A

1) Industrial Shed: Roof Truss with Necessary Bracing System, Purlins, Column and Column Bases
2) Industrial Shed: With Portal or Gable Frames of Solid or Open Web Sections with Necessary Bracing System, Purlins, Column and Column Bases
3) Industrial Shed: Gantry Girder, Columns with Necessary Bracing System, Purlins, Column and Column Bases
4) G + 3 Building Structure

Group B

1) Foot Bridge: Analysis using Influence lines for Main Truss, Cross Beams, Raker, and Joint Details
2) Plate Girder: Analysis and Design of Rivetted or Welded Plate Girder.
3) Elevated Water Tank: Analysis and Design of Staging and Tank Body.
4) Steel Chimneys

Course Outcomes: on completion of the course, student will be able to

CO1: simulate a practical design requirement in to a theoretical statement to solve mathematically to arrive at a safe economical and realistic feasible solution that can be executed.

BTCVL509 Geotechnical Engineering Lab

Practical: 2 hours / week

Term work shall consist of performance of at least seven experiments from the following mentioned list of experiments.

1) Specific gravity determination of coarse and fine grained soil
2) Particle size distribution-Mechanical sieve analysis, wet sieve analysis
3) Determination of Atterberg's consistency limit
4) Permeability- Determination of coefficient of permeability
5) Field density determination
6) Direct shear box test
7) Procter compaction test
8) Tri-axial test
9) Unconfined compression test
10) One dimensional consolidation test

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

CO1: Determine different engineering properties of soil.

CO2: Identify and classify soils based on standard geotechnical engineering practices.

CO3: Perform Laboratory oratory compaction and in-place density tests.

CO4: Perform and interpret direct shear tests and estimate shear strength parameters.

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BTCVL 510 Concrete Technology Laboratory

Practical: 2 Hours / Week

Term work shall consist of performing minimum five experimental sets from the list below.

1) Testing of Cement: Consistency, Fineness, Setting Time, Specific Gravity,
2) Soundness and Strength Test for Cement
3) Testing of Aggregates: Specific Gravity, Sieve Analysis, Bulking of Fine Aggregate, Flakiness Index, Elongation Index and Percentage Elongation
4) Placement Tests on Concrete: Workability Tests: Slump, Compaction,
5) Strength Tests on Concrete: Compression, Flexure, Split & Tensile Test,
5) Effects of Admixture: Accelerator, Retarder, Super Plasticizer,
6) Exercise and verification of Concrete Mix Design,
7) Non-destructive Testing for Concrete.

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Evaluation of (BTCVP410) Field Training/Internship/Industrial Training

Evaluation of industrial training undergone by students in Summer Vacation after Semester IV. A neat detailed report on activities carried out during training has to be submitted, along with a presentation to evaluate the training work.

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Detailed Syllabus

Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Third Year B Tech Civil Engg.

Semester- VI										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 14	BTCVC601	Design of RC Structures	3	1	-	20	20	60	100	4
PCC 15	BTCVC602	Foundation Engineering	3	1	-	20	20	60	100	4
PCC 16	BTCVC603	Transportation Engineering	3	-	-	20	20	60	100	3
PEC 2	BTCVPE604	K. Industrial Waste Treatment L. Managerial Techniques M. Open Channel Flow N. Water Power Engineering O. Ground Improvement Techniques P. Structural Audit Q. Intelligent Transportation Systems R. Plastic Analysis of Structures S. Numerical Methods in Civil Engg. T. Engineering Management	3	-	-	20	20	60	100	3
OEC 1	BTCVOE605	L. Environmental Impact Assessment M. Basic Human Rights N. Business Communication and Presentation Skills O. Composite Materials P. Experimental Stress Analysis Q. Python Programming R. Operation Research S. Applications of Remote Sensing and Geographic Information Systems T. Civionics: Instrumentation & Sensor Technologies for Civil Engineering U. Planning for Sustainable Development V. Development Engineering	3	-	-	20	20	60	100	3
HSSMC4	BTHM606	Indian Constitution	2	-	-	50	-	-	50	Audit
LC 10	BTCVL607	SDD of RC Structures Lab.	-	-	2	20	-	30	50	1
LC 11	BTCVL608	Transportation Engineering Lab	-	-	2	20	-	30	50	1
Project	BTCVM609	Mini Project	-	-	2	20	-	30	50	1
Internship		**Mandatory (BTCVP610)** Field Training/ Internship/Industrial Training (minimum of 4 weeks training in Summer Vacation after Semester VI and appear at examination in Semester VII.)	-	-	-	-	-	-	-	Credits to be evaluated in VII Sem
Total			**17**	**2**	**6**	**210**	**100**	**390**	**700**	**20**

BTCVC 601 Design of RC Structures

Teaching Scheme: (3 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: Introduction **(4 Lectures)**

Basic Aspects of Structural Design, Introduction to Design Philosophies, Stress Strain behavior of Materials Working stress method, Ultimate load method and Limit state method, Comparison of Different Philosophies, Factor of Safety, Estimation of Loads.

Working Stress Method

Module 2: **(8 Lectures)**

Stress block parameters, permissible stresses, balanced, under reinforced and over reinforced section, analysis and design for flexure, shear, analysis and design of singly and doubly reinforced beams. Design of axial and uniaxial eccentric loaded columns, Isolated Column Footings, WSM design requirements as per Annexure B of IS 456:2000

Limit State Method

Module 3: Introduction to LSM **(10 Lectures)**

Introduction to limit state approach, types and classification of limit states, characteristics strength and characteristics load, load factor, partial safety factors, strain variation diagram, stress variation diagram, serviceability criteria

Limit State of Collapse in Shear and Bond

Design for shear: shear failure, types of shear reinforcement, minimum shear reinforcement, design of shear reinforcement

Design for bond: types, factors affecting, resistance, check for development length, detailing of reinforcement

Module 4: Limit State of Collapse in Flexure **(16 Lectures)**

Design of beams: Analysis and Design: Singly and Doubly Reinforced Beams, Flanged (L and T) sections.

Design of Slabs: One-Way and Two-Way Slab: Behavior of slabs, types, support conditions, analysis and design with various conditions Staircases, effective span and load distribution, design of dog- legged and open well stair case.

Module 5: Limit State of Collapse in Compression **(10 Lectures)**

Design of columns, and footings

Analysis and design of axially and eccentrically loaded short columns (Circular and Rectangular), construction of Interaction diagrams for uni-axial bending and its application in design, concept of design charts, concept of bi-axial bending, concept of interaction surface, Design of isolated column footing for axial load, and uni-axial bending.

Text Books

- IS: 456-2000, IS: 456-1978, Bureau of Indian Standards, New Delhi
- Karve and Shah, “Limit State Theory & Design”, Structures Publications, Pune
- Jain A.K., “Reinforced Concrete Design (Limit State)”, Nemchand Brothers, Roorkee
- Sinha and Roy, “Fundamentals of Reinforced Concrete”
- Sinha S.N., “Reinforced Concrete Design, Vol. I, II”, Tata Mc-Graw Hill
- Varghese P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi
- Mehra H. and V.N. Vazirani, “Limit State Design of Reinforced Concrete Structures”, Khanna Publishers, N. Delhi, ISBN No: 978-81-7409-162-9
- Vazirani V.N. and Ratwani M.M., “Design of Reinforced Concrete Structures”, Khanna Publishers, N. Delhi, ISBN No: 978-81-7409-232-8
- Pillai S Unnikrishna, and Menon Devdas., “Reinforced Concrete Design” Tata Mc-Graw Hill

Reference Books

- Punmia B.C., “Reinforced Concrete Design, Vol. I, II”, Laxmi Publications
- Relevant Publications by Bureau of Indian Standards, New Delhi

Course Outcomes: On completion of the course, the students will be able to comprehend the various design philosophies used in design of reinforced concrete. Analyze and design the reinforced concrete sections using working stress and limit state method.

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BTCVC 602 Foundation Engineering

Teaching Scheme: (3 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: **(8 Lectures)**

Introduction, General requirements to be satisfied for satisfactory performance of foundations, Soil exploration: Necessity, Planning, Exploration Methods, Soil Sampling Disturbed and undisturbed, Rock Drilling and Sampling, Core Barrels, Core Boxes, Core Recovery, Field Tests for Bearing Capacity evaluation, Test Procedure & Limitations

Module 2: **(10 Lectures)**

Bearing Capacity Analysis - Failure Modes, Terzaghi's Analysis, Specialization of Terzaghi's Equations, Skempton Values for Nc, Meyerhof's Analysis, I.S. Code Method of Bearing Capacity Evaluation, Effect of Water Table, Eccentricity of load, Safe Bearing Capacity and Allowable Bearing Pressure, Settlement Analysis: Immediate Settlement - Consolidation Settlement, Differential Settlement, Tolerable Settlement, Angular distortion

Module 3: **(10 Lectures)**

Foundations for Difficult Soils - Guidelines for Weak and Compressible Soils, Expansive soil, Parameters of Expansive Soils, Collapsible Soils and Corrosive Soils, Causes of Moisture changes in Soils, Effects of Swelling on Buildings, Preventative measures for Expansive Soils, Design of Foundation on Swelling Soils, Ground Improvement Methods: for general considerations, for Cohesive Soils, for Cohesionless Soils,

Shallow Foundations: Assumptions & Limitations of Rigid Design Analysis, Safe Bearing Pressure, Settlement of Footings, Design of isolated, Combined, Strap Footing (Rigid analysis), Raft Foundation (Elastic Analysis), I. S. Code of Practice for Design of Raft Foundation

Module 4: **(10 Lectures)**

Deep foundations: Pile Foundation: Classification, Pile Driving, Load Carrying Capacity of Piles, Single Pile Capacity, Dynamic Formulae, Static Formulae, Pile Load Tests, Penetration Tests, Negative skin Friction, Under Reamed Piles, Group Action of Piles,
Caissons Foundations: Box, Pneumatic, Open Caissons, Forces, Grip Length, Well Sinking, Practical Difficulties And Remedial Measures
Sheet Piles: Classification, Design of Cantilever Sheet Pile in Cohesionless and Cohesive soils. Design of Anchored Sheet Pile by Free Earth Support Method, Cellular Cofferdams: Types, Cell Fill Stability Considerations

Module 5: **(10 Lectures)**

Slope Stability: Different Definitions of Factors of Safety, Types of Slope Failures, Stability of an Infinite Slope of Cohesionless Soils, Stability Analysis of an Infinite Slope of Cohesive Soils, Stability of Finite Slopes- Slip Circle Method, Semi Graphical and Graphical Methods, Friction Circle Method, Stability Number: Concept and its use

Text Books

- Kasamalkar, B.J., "Foundation Engineering", Pittsburgh vintage Grand Prix
- Murthy V.N.S., "Soil Mechanics and Foundation Engineering", CRC Press 2002
- Arora K.R., "Soil Mechanics and Foundation Engineering", Standard publication 2009
- Punmia B. C., "Soil Mechanics And Foundation Engineering", Laxmi publication 16th 2017
- Nayak N.V., "Foundation Design Manual", DhanpatRai And Sons
- Brahma S.P., "Foundation Engineering", Tata McGraw-Hill 5th Edition
- Braja Das, "Principles of Geotechnical Engineering", Engage Learning 9th edition
- Bowles J.E., "Foundation analysis & Design", McGraw-Hill Higher Education 5th edition

References Books

- Teng W.C., "Foundation Design", Prentice-Hall Inc
- Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall; 7th edition
- Lee, "Sheet Piles" Concrete Publication,1961
- Relevant Publications by Bureau of Indian Standards, New Delhi
- IS 6403:1981, IS 1904:1986, IS 4091:1979

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

To predict soil behavior under the application of loads and come up with appropriate solutions to foundation design queries. Analyze the stability of slope by theoretical and graphical methods.
Analyze the results of in-situ tests and transform measurements and associated uncertainties into relevant design parameters. Synthesize the concepts of allowable stress design, appropriate factors of safety, margin of safety, and reliability.

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BTCVC603 Transportation Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction **(6 Lectures)**
Importance of various modes of transportation, Highway Engineering, Road Classification, Developments in RoadConstruction, Highway Planning, Alignment and Surveys

Module 2: **(6 Lectures)**
Geometric Design- Cross section elements, Sight distances, Horizontal alignment, Vertical alignment, Intersections, Construction of Pavements, Construction and Maintenance of Drainage, Road Arboriculture

Module 3: **(8 Lectures)**
Highway Materials: Soil – relevant properties, Various tests, Aggregates – strength, hardness, toughness, soundness, durability, shape, specific gravity, water absorption, Bituminous materials – Bitumen, Tar, and Asphalt – various properties, Design of Bituminous paving mixes-Marshall stability test

Module 4: Traffic Engineering **(8 Lectures)**
Traffic Characteristics, Speed, Journey Time and Delays, Vehicle Volume Counts, Origin and Destination Studies, Analysis and Interpretation of Survey Data, Traffic Operations, Design of Signals and Rotary intersections, Parking Space Design,Highway Lighting, Planning and Administration, Road Markings, Signs
Road Accidents and Safety: Classification, Causes, Mitigation and Control Measures, Aspects of Safety in Usage of Roads, Type and Design of anti-crash barriers, Introduction to Intelligent Transport Systems (ITS).

Module 5: Pavement Design **(8 Lectures)**
Basic Principles, Methods for different Types of Pavements, Design of flexible pavement using IRC: 37- 2012, Design of rigid pavement using IRC: 58-2011
Other modes of Transport
Introduction to Railways, Airways, Waterways, Pipeline Transportation, Classification, Requirements, Comparative Studies

Text Books

- Khanna and Justo, “Highway Engineering”, Nemchand& Bros., Roorkee
- Khanna S.K., “Highway Engineering”,
- Arora N. L., “Transportation Engineering”
- Bindra and Arora, “Highway Engineering”, Standard Publishers
- Vazirani V.N. and Chandola S.P., “Transportation Engineering”, VolIKhanna Publishers, N. Delhi
- Vazirani V.N. and Chandola S.P., “Transportation Engineering”, Vol II Khanna Publishers, N. Delhi ISBN NO: N/A
- Shahani P.B, “Road Techniques” Khanna Publishers, N. Delhi ISBN NO: 978-81-7409-197-1 PRICE 149/-
- Kadiyali L.R, “Traffic Engineering and Transport Planning”, Khanna Publishers, N. Delhi, ISBN NO:978-81-7409-220-X

Reference Books

- Garber, N.J. and Hoel, L.A., “Traffic and Highway Engineering”, West Publishing Company, New York
- Jones, J.H., “Geometric Design of Modern Highways’, E & FN SPON Ltd., London.
- Khistry, C.J., “Transportation Engineering – An Introduction’, Prentice Hall of India Ltd.
- Agor R., “Surface Transportation (Railways and Highways)”,Khanna Publishers, N. Delhi ISBN NO: 978-81-7409-273-1

CO: On completion of the course, the students will be able to:

Comprehend various types of transportation systems and their history of the development Comprehend to various types of pavements
Design the pavements by considering various aspects associated with traffic safety measures.

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BTCVPE 604A Industrial Waste Treatment

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction **(8 Lectures)**

Water use in industry, Industrial water quality requirements, Deterioration of water quality, Classification and characterization of Industrial wastewater, Standards of Disposal, Monitoring of wastewater flow, Quality and quantity variations in waste discharge. Liquid wastes from industries – their volumes and characteristics, Effect of disposal into natural water courses, Municipal sewers and on land, River standards and effluent standards. Designated Water Quality Standards, Type of samples-Grab and Composite.

Module 2: Treatment objectives and strategies **(6 Lectures)**

Waste Volume reduction, Strength reduction techniques, Segregation, proportioning, Waste Neutralization methods for acidic and alkaline waste, Equalization tank- online and offline, design problem. Recycle, reuse and byproduct recovery, Concept of Zero liquid Discharge (ZLD)

Treatment objectives and strategies, Treatment techniques for removal of specific pollutants in industrial wastewaters, e.g., oil and grease, cyanide, fluoride, calcium, magnesium, toxic organics, heavy metals, radioactivity.

Module 3: Manufacturing processes for industries **(6 Lectures)**

Manufacturing process flow sheets along with sources and characteristics of wastewater for various industries sugar, Distillery, Textile, Tannery, Paper and pulp mill, dairy, Fertilizer, steel mill, power plant etc.

Development of Treatment flowsheets based on characteristics of industrial wastewater. Industrial wastewater Treatment alternatives (Treatment Flowsheets) for above listed industries

Dewatering and disposal of sludge – floatation, vacuum filtration, centrifugation, filter press and membrane filters.

Module 4: Effluent Treatment Plants **(8 Lectures)**

Water pollution control act and Environmental Protection act - organizational set up of central and state boards for water pollution control, other important provisions. Classification of river on water use, minimal national standards, socio-economic aspects of water pollution control. Modern Trends in Environmental Engineering, Cleaner Production Technologies, Environmental Bio-Technology, Bioremediation.

Common Effluent Treatment Plants (CETPs): Concept, Need, Objectives, Methodology, grouping of industries, Location, Design, Operation and Maintenance Problems and Economical aspects.

Module 5: Treatability and environmental aspects **(8 Lectures)**

Treatability index, Population equivalent, Treatability aspects of raw industrial wastewater with domestic sewage, partially treated industrial wastewater with domestic sewage, Completely treated industrial wastewater with domestic sewage. Stream and effluent standards, Introduction to Water Quality Index (WQI) - simple problems.

Introduction to environmental impact assessment and environmental audit.

ISO 14000- introduction, how it is helpful to industries. Importance of Environmental management plan and environmental monitoring plan, Consent to operate and consent to establish

Text Books

- Metcalf and Eddy,1995,Wastewater Engineering - Collection, Treatment, Disposal and Reuse, McGraw Hill Pub. Co.,.
- Nelson Leonard Nemerow,2007 Industrial Waste Treatment, Butterworth-Heinemann,
- Nelson Nemerow. Theories and Practices of Industrial waste treatment
- M. N. Rao & Datta. Waste water treatment:
- IS Standard guide for treatment and disposal of various industries.
- Industrial Waste Treatment: Contemporary Practice and Vision for the Future

- Woodard, F., Industrial Waste Treatment Handbook, Butterworth-Heinemann, Woodard & Curran
- J.D. Edwards, Industrial Wastewater Treatment CRC Press
- Government of India Publication, "Water Supply and Treatment Manual"
- Publications by renowned organizations such as WHO, NEERI, MERI, MPCB, CWPRS, etc.
- Hammer M.J., "Water and Waste Water Technology", PHI Private Limited
- Peavy and Rowe, Environmental Engineering , TMH.
- Numersorn, N.L., Liquid Waste from Industry – Theories, Practice and Treatment, Addison-Wesley,

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

CO1: Identify and analyze the characteristics of industrial wastewater

CO2: Describe pollution effects of disposal of industrial effluent.

CO3: Identify and design treatment options for industrial handling industrial liquid waste

CO4: Formulate environmental management plan

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BTCVPE 604 B. Managerial Techniques

Teaching Scheme:(3 Lectures) hours/week

Course Contents

Module 1: Introduction to Managerial Techniques **(Lectures 06)**

Introduction, Evolution of Managerial techniques, Managerial aspects, management characteristics, Essentials of Managerial Techniques

Module 2: Process Control Techniques in Management **(Lectures 08)**

Quality- Improvement Programs, Starting a Quality Improvement Program, Experimental Designs for Quality improvement, Quality Control - Statistical process control: concepts of stable industrial processes, Systematic variation, random variation, Control Charts for Measurements, Control Charts for Attributes, Tolerance Limits, Acceptance Sampling

Module 3: Method Study and Work Study and Motion Study **(Lectures 08)**

Method Study: Analysis of Operations, job work, systems involving man and machines. Schematic methods, charts and other aids for analysis
Work Study: Method of work measurement, stopwatch study; PMTS; work sampling, setting of time standards.
Motion Study: Principles of motion economy and work center design

Module 4: Technology based Managerial Techniques **(Lectures 08)**

Introduction, Need of Technological advancements in management, MIS, Resources Management using softwares, Planning softwares, BIM, MSP, Primavera, Advantages, Applications

Module 5: Introduction to Six Sigma Technique **(Lectures 06)**

Introduction, Concept, Tools, DMAIC, DMADV, Justifying six sigma, Readiness of six sigma, Advantages, Applications

Text Books:

- Jain P. L. (2001) "Quality Control and Total Quality Management", Mc-Graw Hill Book Co.,New Delhi
- Breu G.(2002) "Six Sigma for Managers", Mc-Graw Hill Book Co., New Delhi
- Arora P. N., Arora S., Arora S. Arora A.(2007) "Comprehensive Statistical methods", S Chand Publishing, New Delhi
- Jhamb L. C. (2000) "Work Study & Ergonomics" Everest Publishing House, Pune

References:

- IS: 15883 (Part I): 2008 "Construction Project Management" BIS, New Delhi 2008
- Munro R. A. and Ramu G. (2012) "The certified six sigma green belt Handbook" American Society of Quality,

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

CO1: Inculcate various managerial techniques in practices
CO2: Analyze process control tools and techniques to improve the outcome
CO3: Adopt modern technological advancements to suit the project characteristics, at large.

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BTCVPE604C Open Channel Flow

Teaching Scheme: 3 Hours /week

Course Contents

Module 1: Open Channel Flow **(08 Lectures)**
Introduction, difference between pipe flow and open channel flow, types of open channels, types of flows in open channel, geometric elements, velocity distribution, measurement of velocity-(pitot lube, current meter), Discharge through open channel.

Module 2: Steady and Uniform flow **(08 Lectures)**
Chezy's & Manning's formula, Roughosity coefficient, uniform flow computations, hydraulically efficient section considerations for rectangular, triangular, trapezoidal, circular sections

Module 3: Specific energy **(06 Lectures)**
Specific energy: definition & diagram, concept of critical, sub-critical, super-critical flow, specific force, specific discharge derivation of relationships and numerical computations

Module 4: **(08 Lectures)**
Gradually varied flow
Definition, classification of channel Slopes, Back water curve and its length, Afflux, dynamic equation of G.V.F. (Assumption and derivation), classification of G.V.F. profiles-examples, direct step method of computation of G.V.F. profiles
Rapidly varied flow
Definition, examples, hydraulic jump- phenomenon, relation of conjugate depths, loss of energy, parameters, uses, types of hydraulic jump

Module 5: weir & spillway **(06 Lectures)**
Introduction, Classification, Discharge over various notches and weirs (Rectangular, Triangular, Stepped, Broad-Crested, Narrow crested), Velocity of Approach, Cipolletti Weir, calibration of weir, time of emptying tank with weir, profile of ogee spillway, flow below gates, Most economical sections in channels: Rectangular, Trapezoidal, Circular.

Text Books:

- Modi P. N. and Seth S. M.(2017) "Fluid Mechanics – Hydraulic & Hyd. Mechanics" Standard Book HouseN. Delhi
- Bansal R.K. (2017) "Fluid Mechanics", Laxmi Publications, N. Delhi
- Garde R. J.(2011) "Fluid Mechanics through Problems", New Age Publications, Hyderabad
- Jain A. K. (2003) "Fluid Mechanics", Khanna Publications, 2003, Delhi
- Rangaraju K. G. (2001) "Open Channel flow", Tata McGraw-Hill Pub. Co., Delhi
- Subramanian K. (2015) "Fluid Mechanics through Problems" Tata McGraw-Hill Pub. Co., Delhi

Reference Books

- Streeter V. (2017) "Fluid Mechanics" McGraw-Hill International Book Co., 3rd edition, Auckland
- Chaw V. T. (2009) "Flow in Open Channel", McGraw-Hill International Book Co., Auckland

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

1. Understand phenomena of hydraulic jump.
2. Compute Discharge through various open channel sections.
3. Discuss different applications of gradually varied flow profiles.

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BTCVPE 604D Water Power Engineering

Teaching Schemes: (Lectures: 3) Hours/Week

Course Contents

Module 1 **(8 Lectures)**

Introduction, Sources of Energy, Types of Power Plants, Choice of Type of Generation, Components of Water Project, Types of Hydro Power Schemes, General Layouts, Estimation of Hydro Power, Nature of Demand: Load Curve, Load Duration Curves, Load Factor, Firm Power Secondary Power

Module 2 **(8 Lectures)**

Intake, Types, Hydraulics of Intake, Trash Rack Transition, Conduits: Types, Economic Section, Power Canals, Pen-stock Types, Hydraulic Design, Anchor Blocks

Tunnels: Classification, Location, Hydraulic Design, Tunnel Linings

Surge Tank: Functions, Behavior, Location, Types of Surge Tanks, Basic Design Criteria of Simple Surge Tank, Forebay

Module 3 **(6 Lectures)**

General Arrangements of Power Station, Power House, Sub-structure and super structure Under Ground Power Station: Necessity, Types, Development and Economics

Module 4 **(6 Lectures)**

Turbines: Classification, Characteristics of Different Types, Choice of Specific Type, Turbine Setting and Cavitation, Tail Race: Functions, Types, Channel and Tunnel Draft Tubes

Module 5 **(6 Lectures)**

Pumped Storage Plants, Purpose, General Layout, Types, Typical Arrangements of the Upper Reservoirs, Economics of Pumped Storage Plants**,** Tidal Power Stations: Necessity, Advantages, Classification, Limitations

Text Books

- Dandekar and Sharma, “Water Power Engineering”, Vikas Pub. House Pvt. Ltd.
- Bhattacharya P. K., “Water Power Engineering”, Khanna Publications, New Delhi
- Deshmukh M. M. “Water Power Engineering”, Dhanapatrai and Sons N. Delhi

References

- Creager and Justin, “Hydro – Electric Hand Book”
- Brown G., “Hydro-electric Engineering Practice”, Vol. I to III
- Mosonvi, “Water Power Development”

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

CO1: Identify potential energy sources and adapt as per the requirement

CO2: inculcate basics of electricity generation and power plants

CO3: propose suitable energy source for running a project optimistically.

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BTCVPE604E Ground Improvement Techniques

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 Lectures)**

Dewatering: Introduction – Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum and electroosmotic methods. Stabilization by thermal and freezing techniques - Applications.

Module 2: **(8 Lectures)**

Compaction and Sand Drains: Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation – Preloading with sand drains, fabric drains, wick drains etc. – Theories of sand drain – design and relative merits of various methods – Case studies.

Module 3: **(6 Lectures)**

Stone Column, Lime Piles and Soil Nailing: Stone column, lime piles – Functions – Methods of installation– design, estimation of load carrying capacity and settlement. Root piles and soil nailing – methods of installation – Design and Applications - Soil liquefaction mitigation methods - case studies.

Module 4 **(6 Lectures)**

Earth Reinforcement: Earth reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber-based Geotextiles and their applications. Filtration, drainage, separation, erosion control – case studies.

Module 5 **(8 Lectures)**

Grouting: Grouting – Types of grout – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – injection methods – jet grouting – grout monitoring – Electro – Chemical stabilization – Stabilization with cement, lime - Stabilization of expansive clays – case studies.

Text Books

- Pappala, A.J., Huang,J., Han, J., and Hoyos, L.R., "Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010
- Cox, B.R., and Grifiths S.C., "Practical Recommendation for Evaluation and mitigation of Soil Liquefaction" in Arkansas, (Project Report), 2010.
- Day, R.W., "Foundation Engineering Handbook, McGraw – Hill Companies, Inc. 2006.
- Rowe, R.K., "Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
- Das, B.M., "Principles of Foundation Engineering, Fourth Edition, PWS Publishing, 1999.

References Books

- Moseley, M.P., "Ground Treatment, Blackie Academic and Professionals, 1998.
- Koerner, R.M., "Designing with Geosynthetics, Third Edition, Prentice Hall 1997.
- Hehn, R.W., "Practical Guide to Grouting of Underground Structures, ASCE, 1996.
- Jewell, R.A., "Soil Reinforcement with Geotextiles, CIRIA, London, 1996.
- Koerner, R.M. and Welsh, J.P., "Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.

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

CO1: To identify and evaluate the deficiencies if any in the deposits of the given project area.

CO2: Capable of providing alternative methods to improve its quality so that the structures built on it will be stable and serve the intended purpose.

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BTCVPE 604F Structural Audit

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(08 Lectures)**

Introduction to Structural Audit, Objectives, Bye-laws, Importance, Various Stages involved, Visual inspection: scope, coverage, limitations, Factors to be keenly observed. Aspects of audit of Masonry buildings, RC frame buildings, Steel Structures.

Module 2: **(06 Lectures)**

Causes and types of deterioration in Structures: Permeability of concrete, capillary porosity, air voids, Micro cracks and macro cracks, corrosion of reinforcing bars, sulphate attack, alkali silica reaction.

Causes of deterioration in Steel Structures: corrosion, Uniform deterioration, pitting, crevice, galvanic, laminar, Erosion, cavitations, fretting, Exfoliation, Stress, causes of defects in connection

Module 3: **(08 Lectures)**

Elementary aspects of Non-Destructive Testing, Concrete Strength Assessment: Rebound hammer, Ultrasonic Pulse velocity, Penetration resistance, Pull out test, Chemical test: Carbonation test, Chloride test, Corrosion potential assessment, Fire damage assessment: Differential thermal analysis, X ray diffraction, Structural Integrity and soundness assessment: Radiography, Impact echo test, dynamic testing of structure, Interpretation and evaluation of test results.

Module 4 **(08 Lectures)**

Strength Evaluation of Existing Structures, Reserve strength, identification of critical sections, structural system and its validation, evaluation of damage in RC structures

Module 5: **(06 Lectures)**

Approach to conduct Structural Audits Guidelines of Statutory Bodies, Legal aspects, Responsibility of calling Structural Audit, Scope of Investigation.

Structural Audit Report, Study of sample Structural audit report for up-gradation of existing building, Audit for continuation of usage of old Buildings, Audit for Buildings damaged due to Earthquakes, Fire,

References

- Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.

Outcomes: Upon completion of the course the students will be able to:

- Gain the knowledge of Bye laws, procedure of Structural audit and study the typical problems in structures.
- Aware of causes and types of deterioration in structures.
- Develop skills for use of various Nondestructive tests required during auditing of structures.
- Strength evaluation of existing structures.
- Acquire knowledge of legal procedure to conduct structural audits.
- Prepare a Structural audit report.

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BTCVPE 604G Intelligent Transport Systems

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction **(06 Lectures)**

Definition of intelligent transport system (ITS), History of ITS, Objectives, Benefits, data collection techniques: Detectors, automatic vehicle location, automatic vehicle identification, geographic information system.

Module 2: Telecommunication in ITS **(08 Lectures)**

Importance of telecommunication, information Management, Traffic management centers, vehicle roadside communication, vehicle positioning system.

Module 3: Functional areas **(08 Lectures)**

Traffic management systems, traveler information system, commercial vehicle operations, vehicle control system, public transportation system, rural transportation system.

Module 4: User needs and services **(06 Lectures)**

Travel and traffic management, Public transportation management, electronic payment, commercial vehicle operations, emergency management, advanced vehicle safety systems, information management.

Module 5: Automated highway systems **(06 Lectures)**

Vehicles in plantoons, integration of automated highway systems, implementations in developed countries and developing countries.

Text Books

Sarkar, P. K. and Jain, A.K., Intelligent Transportation systems. PHI learning pvt.ltd.
Chen P. K., & Miles, J., Recommendations for world road Association (PIARC). Its Hand book

References

1. M A Chowdhary and A Sadek. Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003.
2. Bob Williams. Intelligent transportation systems standards. Artech House, London, 2008

Outcomes: Upon completion of the course the students will be able to:

- Gain the knowledge Intelligent transport components
- Understand functional areas of ITS
- Management of ITS and correlated systems

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BTCVPE604H Plastic Analysis of Structures

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 Lectures)**

Plasticity in ductile materials, stress-strain for mild steel, elasto-plastic behavior of beam in flexure, shape factor for different cross sections, yield zones, concept of plastic hinge

Module 2: **(8 Lectures)**

Collapse loads of determinate and indeterminate structures such as beams and rectangular portal frames, statical and kinematical methods, mechanisms. Bending moment diagram at collapse

Module 3: **(6 Lectures)**

Philosophy of Limit State design, requirement of steel for design, Limit State of Strength and Serviceability, partial safety factors, design of laterally supported beams, shear resistance

Module 4: **(8 Lectures)**

Secondary design considerations, design of beams with high shear, interaction of bending and shear, interaction of bending and axial force

Module 5: **(6 Lectures)**

Design of portal frames, design of corner connection with and without haunches, Consideration of deformations, calculation of deflections for plastically deformed structures

Text Books:

- Bureau of Indian Standards, "Handbook for Structural Engineers: Application of Plastic Theory in Design of Steel Structures SP: 6 (6)".
- Bureau of Indian Standards, "IS: 800 Code of Practice for General Construction in Steel"
- Arya A.S. and Ajmani J.L., "Design of Steel Structures", Nemchand& Bros., Roorkee
- Ramchandra, "Design of Steel Structures Vol – II", Standard Book House, Delhi
- Neal B.G., "Plastic Method of Structural Analysis", Chapman & Hall
- Beedle L.S., "Plastic Design of Steel Frames", John Wiley & Sons

References:

- Bureau of Indian Standards, "Handbook for Structural Engineers SP 6"
- INSDAG Kolkata, "Teaching Resource for Structural Steel Design"
- "Steel Designers Manual" ELBS

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

CO1: Understand modes of structural collapse

CO2: Perform the plastic analysis and design of various determinant and in-determinant structures.

CO3: Adapt plastic theory of design for various structures

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BTCVPE604I Numerical Methods in Civil Engineering

Teaching Scheme :(3 Lectures) hours/week

Course Contents

Module 1 **(Lectures 8)**

Basis of Computations, Matrix Operations on Computer, Multiplication and Inversion, Solution of Simultaneous Equations, Gauss Elimination Method, Cholesky Decomposition method, Gauss Jordan and Gauss Sceidal Methods

Module 2 **(Lectures 8)**

Roots of Equation, Trial and Error, Bisection, Secant Iteration, Newton Rapson Method, Solution of Ordinary Differential Equation, Euler's Method, Modified Euler's Method and Runga Kutta Methods.

Module 3 **(Lectures 08)**

Interpolation with Newton's Divided Differences, Lagrange's Polynomial, Finite Difference Method, Central, Forward and Backward Differences, Least Square Polynomial Approximations Application in Deflection of Determinate Beams, Buckling Load of Long Columns

Module 4 **(Lectures 04)**

Numerical Integration: Trapezoidal Rule, Simpon's Rules, Gauss Quadrature Rules

Module 5 **(Lectures 08)**

Statistical Analysis of Experimental Data, Mean, Median, Mode, Deviation, Measures of Dispersion, Least Square Method, Regression Analysis: Linear, Parabolic, Curve Fitting

Text Books

- Balaguruswami E., "Numerical Methods", Tata Mc-Graw Hill
- Scheid F, "Numerical Analysis (Schaum's series)", Tata Mc-Graw Hill
- Chapra. S. C. and Canale R. P., "Numerical Methods for Engineers", by, Tata Mc-Graw Hill
- Shantha Kumar M , "Computer Based Numerical Analysis", Khanna Publication
- Grewal B.S. and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publication, N. Delhi
- Sastry, S.S., "Introductory Methods of Numerical Analysis", Printice Hall of India, New Delhi

Reference Books

- Jain, Aryengon, "Numerical Methods for Scientific and Engineering Applications", Wiley Eastern Publication
- Numerical Recipe , Oxford Publishing
- Manuals for the Commercial Computer Programmes

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BTCVPE604J Engineering Management

Teaching Scheme: 3 hours/week

Course Contents

Module 1: Evolution of Management Thought **(Lectures 06)**

Scientific, human behavior, system approach, introduction to elements of systems – input, output, process restriction, feedback, contingency approach, contributions by Taylor, Frank and Lillion, Gilbreth, Henry Fayol, Elton Mayo, McGregor (theory X and theory Y), H. L. Gantt, Maslo

Module 2: Functions of Management **(Lectures 06)**

Planning – nature and purpose of planning, strategies and policies, management by objectives, formal and informal organization, centralization, decentralization, line, line and staff, functional organization, principles of site layout, leading and directing, controlling and coordination (introduction only), communication process, motivation

Module 3: Decision Making **(Lectures 06)**

Importance of decision making, steps in decision making, analysis of decision, decision under certainty, uncertainty and decision under risk, criterion of optimism and regret, sensitivity of criteria and decision under conflict, expected monitory value, decision tree, theory of games (dominance pure and mixed strategy

Module 4: Operations Research & Simulation Studies **(Lectures 12)**

Linear programming, simple l-p model, simplex method - duality, sensitivity analysis, application of linear programming in transportation and assignment models

Simulation Studies

Monte-Carlo simulation, queuing or waiting line theory (simple problems), dynamic programming.

Module 5: Material management **(Lectures 06)**

Introduction to emerging optimization techniques Material management – purchasing principles, stores, coding system function, responsibilities, record and accounting. Inventory control – an introduction, inventory cost, EOQ analysis, ABC analysis, safety stocks

Text Books:

- Deshpande S. H., 1976, "Operation Research", S Chand Delhi.
- Deshpande A. S., "A Text book of Management"
- Gopal Krishnan, 2015, "Material Management", Sudeshan.
- Taha, 1971, "Operation Research", Pearson.
- Banga and Sharma, 2017, "Engineering Management", Khanna publishing.

References:

- Stoner, 2018, "Engineering Management", Pearson education.
- Davar, 1980, "Principles of Management", Progressive corporation Pvt. Limited.
- Koontz, Dounell and Weigrick, 2015, "Essentials of Management", McGraw Hill publishers.
- Kast and Rosinweig, 1973, "Management and Organization", Tata McGraw Hill Publication.
- Wagner, "Operation Research", Wikey Easter Ltd., New Delhi
- Zhamb L.C.,1999, "Quantitative Techniques in Management", Vol. I,
- Miller and Stars, 1960, "Executive Decisions & Operation Research", Prentice Hall of India

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

CO1: Demonstrate the nuances of management functions.
CO2: Analyze the framework of a business organization.
CO3: Adopt an empirical approach toward business situations.
CO4: Apply various Management techniques.

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BTCVOE 605A Environmental Impact Assessment

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction **(8 Lectures)**

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

Module 2: Identifying the Key Issues **(6 Lectures)**

Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection - Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues

Module 3: EIA Methodologies **(6 Lectures)**

Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods,

Reviewing the EIA Report:

Scope, Baseline Conditions, Site and Process alternatives, Public hearing, Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System

Module 4: Review of EMP and Monitoring **(8 Lectures)**

Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, What should be monitored? Monitoring Methods, Who should monitor? Pre-Appraisal and Appraisal.

Module 5: Case Studies **(6 Lectures)**

Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.

Text Books

- Wathern. P Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.
- Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.
- Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
- Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
- Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

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

CO1: Identify the environmental attributes to be considered for the EIA study

CO2: Formulate objectives of the EIA studies

CO3: Identify the methodology to prepare rapid EIA

CO4: Prepare EIA reports and environmental management plans

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BTCVOE605B Basic Human Rights

Teaching Scheme:(3 Lectures) hours/week

Course Contents

Module 1: Basic Concepts **(Lectures 06)**

Individual, group, civil society, state, equality, justice. Human Values, Human rights & Human Duties: Origin, Contribution of American bill of rights, French revolution. Declaration of independence, Rights of citizen, Rightsof working & exploited people

Module 2: Fundamental Rights and Economic Program **(Lectures 06)**

Society, religion, culture, and their inter-relationship. Impact of social structure on human behavior, Social Structure and Social Problems: Social and communal conflicts and social harmony, rural poverty, unemployment, bonded labour.

Module 3: Workers and Human Rights **(Lectures 08)**

Migrant workers and human rights violations, human rights of mentally and physically challenged. State, Individual liberty, Freedom and democracy.

NGOs and Human Rights in India

Land, Water, Forest issues.

Module 4: Human Rights in Indian Constitution and Law **(Lectures 08)**

i) The Constitution of India: Preamble; ii) Fundamental rights; iii) Directive principles of state policy; iv) Fundamental duties; v)Some other provisions

Module 5: UDHR and Indian Constitution **(Lectures 08)**

Universal declaration of human rights and provisions of India; Constitution and law; National human rights commission and state human rights commission.

References

1) Shastry, T. S. N., "India and Human Rights: Reflections", Concept Publishing Company India (P Ltd.), 2005.

2) C. J. Nirmal, "Human Rights in India: Historical, Social and Political Perspectives (Law in India)", Oxford India.

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BTCVOE605C Business Communication & Presentation Skills

Teaching Scheme: (3 Lectures) hours / Week

Course Contents

Module 1: Language for Technical Purpose and Presentation Tools **(06 Lectures)**

Technical vocabulary, Sentence structures, Computer Aids, Graphical presentations
Drafting Letters, e-Mails, Memos, Notices, Circulars, Schedules.

Module 2: Project Proposals and Project Reports **(08 Lectures)**

Abstract, Aims, Background & significance, Design & methods, writing a sample proposal,
Project Report: Types of reports, planning a report, Collection & organization of information, Structure & style, Proof reading etc.

Module 3: Leadership Skill and Team Building, Working **(08 Lectures)**

Leadership Skills**:** Leadership quality and styles, Emotional intelligence, Diplomacy and Tact and effective communication, Case studies. Need of team, Effective teams, Group development

Module 4: Business Meetings **(08 Lectures)**

Understanding role of meetings, planning meetings, developing meeting agendas, scheduling meetings, Taking notes and publishing minutes

Module 5: Presentation Skills **(06 Lectures)**

Use of presentation tools, Presentation, nonverbal techniques, handling questions

References:

- Hariharan S. (2010)"Soft Skills" MJP Publishers, Chennai
- Seely S. (2009)"Oxford Guide to Effective Writing and Speaking" Oxford University Press, UK
- Huckin T. N. and Olsen L. A."Technical Writing and Professional Communication for Nonnative Speakers of English"Tata McGraw Hills, UK
- Masters A. & Harold R. W. (2011) Personal Development for Life & Work, Learning India Private Limited.

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

- CO1: Inculcate basics of business communication skills & relevant tools.
- CO2: Understand business SOPs and essentials of the same.

- CO3: Adapt modern skills regarding communication, presentation & team working

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BTCVOE605D Composite Materials

Teaching Scheme :(3 Lectures) hours/week

Course Contents

Module1 Introduction: **(8Lectures)**
Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.

Module2 Types of Reinforcements/Fibers **(6Lectures)**
Role and Selection or reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres. Material properties that can be improved by forming a composite material and its engineering potential

Module3 Various types of composites **(8 Lectures)**
Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC),

Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites

Module 4 Fabrication methods **(6Lectures)**
Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin-transplant method, pltrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films

Module 5 Testing of Composites **(8Lectures)**
Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc

Text Books

- ASM hand book, Materials characterization, Vol. 10,
- G. Dieter, Mechanical Metallurgy, Mc-Graw Hill
- R.F. Speyer Thermal Analysis of Materials, Marcel Decker
- A.K Bhargava Engineering Materials: Polymers, Ceramics and Composites Prentice Hall India

Reference Books:

- Jones, R.M., (2015) “Mechanics of Composite Materials” McGraw Hill Co., New Delhi
- Whitney, Daniel I. M. and Pipes R. B. (1984)“Experimental Mechanics of Fibre Reinforced Composite Materials” Prentice Hall, New Jersey
- Hyer, M.W. (1998)“Stress Analysis of Fibre Reinforced Composite Materials” Mc Graw Hill Co., New Delhi
- Herakovich C. T. (1998)“Mechanics of Fibrous Composites” John Wiley Sons Inc., N. Delhi

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

CO1: Understand fundamental knowledge in mechanical analysis
CO2: Understand design of structures made of composite materials.
CO3: Propose suitable materials in relation with the project

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BTCVOE605E Experimental Stress Analysis

Teaching Scheme: 3 Hours /week

Course Contents

Module 1: **(6 Lectures)**

Introduction to Theory of Elasticity, Assumptions made in strength of materials and theory of Elasticity, Necessary and sufficient conditions for analyzing a structure,

Module 2: **(8 Lectures)**

State of stress at a point, Specification of stress at a point-Determination of Normal thrust and Shear stress, Problems on specification of stress at a point.
Concept of Orthogonal Transformation of axes and Problems, Determination of Stress invariants, Determination of Principal Stresses and Planes, Determination of Maximum shear Stresses and their corresponding plane systems, Tresca's criteria.

Module 3: **(6 Lectures)**

Derivation of Equilibrium conditions in three dimensions, Concept of Strain at a point, Determination of Normal and Shear Strain, Generalized Hooke's Law and problems on interrelationship between stress and Strain in three dimensions.

Module 4: **(8Lectures)**

Formulation of a stress analysis problem using the necessary and sufficient conditions in three dimensions and modifying the same to identify the unknowns in plane cases, Derivation of Airy's Stress function using the boundary conditions, equilibrium equations, compatibility conditions.

Module 5: **(8 Lectures)**

Solution to stress analysis problems, Torsion of circular shafts, Strain Measurement- Types of Strain gauges, Characteristics of ideal strain gauges, gauge factor, Strain gauge Rosettes, Introduction to two dimensional photo elasticity, Stress-Optic law.

References:

- Timoshenko S. P. and Goodier J. N. (2010) Theory of Elasticity, 3rd Ed., McGraw Hill**.,** N. Delhi
- NPTEL Course on Experimental Stress Analysis, https://nptel.ac.in/courses/112/106/112106068/
- Swayam Course on Experimental Stress Analysis by Prof. K. Ramesh, IIT Madras, https://swayam.gov.in/nd1_noc20_me02/preview

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

1. Apply principles of elasticity theory to determine stresses and strains.
2. Apply theory of elasticity and formulate plane stress and plane strain problems.
3. Formulate the stress analysis problems using elasticity theory.
4. Apply experimental techniques to solve field problems.

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BTCVOE605F Python Programming

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Basics of C **(8 Lectures)**

Editing, Compiling, Error Checking, executing, testing and debugging of programs. IDE commands. Eclipse for C Program development, Flowcharts, Algorithms, Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

Module 2: Algorithmic Problem Solving **(7 Lectures)**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

Module 3: Data, Expressions, Statements **(7 Lectures)**

Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precede operators comments ;modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Module 4: Control Flow, Functions **(8 Lectures)**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope,.

Functions: Function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Module 5: Lists, Tuples, Dictionaries **(6 Lectures)**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

Files, Modules, Packages

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

Text Books

- Martin C. Brown, Python: The Complete Reference.
- R. Nageswara Rao Core Python Programming.
- Kenneth A. Lambert, Introduction to Python.
- Vittorio Lora, Python for Civil and Structural Engineers.
- https://www.pythonforengineers.com/.
- W. Chun, Core Python Programming, Pearson.

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

CO1: Experience with an interpreted Language.

CO2: To build software for real needs

CO3: Prior Introduction to testing software

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BTCVOE605G Operation Research

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction to Operation Research **(06 Lectures)**

Introduction, History of operation research, Stages of development operation research, OR tools and techniques, Applications of Operation research, Modelling approach, Defining the problem and gathering data, Formulating a mathematical model, Deriving solutions from the model, Testing the model, Preparing to apply the model, Implementation, Limitations of operation research.

Module 2: Linear Programming and graphical analysis **(06 Lectures)**

Introduction to linear programming, Assumptions, Linear programming model, Formulation with different types of constraints, Graphical analysis of linear programming, Graphical linear programming solution.

Module 3: Simplex method and Duality method **(08 Lectures)**

Simplex Method: Introduction, Basics of simplex method, Simplex method computation, Algebra of the simplex method, Simplex method in tabular form, Simplex method in matrix form, Tie breaking in the simplex method, Adapting to other model forms, Post optimality analysis.
Duality: Introduction, Economic interpretation of duality, Primal–Dual relationships, Duality problems, Duality results, Dual problem and the simplex table, Role of duality theory in sensitivity analysis, Sensitivity analysis.

Module 4: Assignment Problems **(08 Lectures)**

Introduction, Assignment problems, Unbalanced assignment problem, Balanced assignment problem, Infeasible assignment problem, Minimization & Maximization, special algorithm for the assignment problem.

Module 5: Transportation Problems **(08 Lectures)**

Introduction, Methods for initial basic feasible solution, balanced transportation problem, Minimization & Maximization, Vogel's approximation method, Optimization, Modified distribution method, Streamlined simplex method for the transportation problem, Dual of the transportation problem.

Text Books

- Gupta P. K., Hira D. S. "Operation Research" S Chand Publishers, 2006
- Taha H. A. "Operation Research", Pearson, 2014
- G.Srinivasan "Operations Research:Principles and Applications", PHI Learning Pvt. Ltd.
- Ishizika A., Nemery P., "Multi-criteria Decision Analysis", John Wiley & Sons, 2013

References:

- Vohra, N. D. "Operations Research", Tata McGraw Hill Co., New Delhi.
- Wagner, "Operation Research", Wiley Eastern Ltd., New Delhi
- Zhamb L.C., "Quantitative Techniques in Management", Vol. I,
- Miller and Stars, "Executive Decisions & Operation Research", Prentice Hall of India
- Hillier and Liberman "Operations Research: Concepts and Cases" McGraw-Hill

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

CO1: Adopt Operation Research tools and techniques while working in industry

CO2: Analyze the problem statement with computational approach

CO3: Apply various models to propose suitable outcomes.

CO4: Apply various decision-making tools to propose best suitable alternatives, at large.

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BTCVOE605H Applications of Remote Sensing and GIS

Teaching scheme: (3 Lectures) hour/week

Course contents

Module 1: Remote Sensing **(Lectures 8)**

Basic concepts in remote sensing, information and data collection, Remote Sensing process advantages & limitations, necessity, importance and use; basic laws of electromagnetic radiation, Atmospheric effects on radiation, Interaction of EM energy with matter

Module 2: Applications of remote sensing **(Lectures 8)**

Resolution in remote sensing, Satellite remote sensing, Problems confronting in remote sensing system. Ideal and real remote sensing systems. Applications of remote sensing in civil engineering.

Module 3: Visual Interpretation of Satellite Images **(Lectures 8)**

Elements of interpretation, Interpretation keys characteristics of digital satellite image, image enhancement, filtering, classification, integration of GIS and remote sensing, urban applications- integration of GIS and remote sensing water resources, urban analysis and watershed management.

Module 4: Geographical Information System & **Geo-referencing** **(Lectures 8)**

Introduction to Geographic Information System. Applications of GIS such as visibility analysis, slope analysis, watershed analysis & preparation of thematic maps. Limitations of GIS.

Geo-referencing; GIS data, spatial (raster & vector) & a spatial data. Introduction to vector and raster data analysis such as network analysis, overlay analysis etc. for vector, DEM, Management of a spatial data.

Module 5: Coordinate Systems and Projections **(Lectures 4)**

Geographic coordinate system: approximation of the earth, datum; map projections: types of map projections, map projection parameters, commonly used map projections, projected coordinate systems.

Text Book:

- Chandra A. M. and Ghosh S. K., 2015, "Remote sensing and Geographical Information System", Narosa Publishing House.
- Gopi S., Sathikumar R. and Madhu N., 2017, "Advanced Surveying -Total Station, GIS and Remote Sensing", Pearson publication.
- Lilles and Kiefer," Remote sensing & image interpretation", John Wiley Pub.
- Jensen J. R., "Remote sensing of the environment – An earth resources perspective" 2nd edition Pearson Education.
- Reddy M. A., 2001, "Textbook of Remote sensing and Geographical information system", B.S. Publications, Hyderabad.

References:

- Burragh P.A. and Mc Donnnell R. A., 2016, "Principals of Geo physical Information system", Oxford Publications, 2004.
- Kumar A., 2016, "Basics of remote sensing & GIS", Laxmi publications.

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

CO1: Acquire knowledge demonstrating of earth resources management using remote sensing.
CO2: Gain skills in storing, managing digital data for planning and development.
CO3: Acquire skills in advance software's deals with remote sensing data for utilization.

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BTCVOE605I Civionics: Instrumentation & Sensor Technologies for Civil Engg.

Teaching scheme: (3 Lectures) hour/week

Course contents

Module 1: Instrumentation **(Lectures 8)**

Piezometer: measure pore water pressure open standpipe vibrating wire (push in). Pneumatic Inclinometers: measure tilts Strain gauges, Full Bridge, Half bridge and Quarter Bridge. Linear Variable Differential Transformer, LVDT (Linear Variable Displacement Transducer), Load Cells.

Module 2: Calibration of Instruments **(Lectures 8)**

Mechanical, electrical, electronic system and their calibration, various types of sensors for displacement, velocity, acceleration, pressure, loads, strains, full-field measurements.

Module 3: Sensor Technologies for Civil Infrastructures **(Lectures 8)**

Similitude and structural models: dimensional analysis, Buckingham's Pi theorem, scale factors and dynamic similitude; Uses and applications of models: types of model investigation, indirect and direct models, elastic and inelastic model (steel, concrete and masonry), size effects.

Module 4: Analysis of Experimental Data **(Lectures 6)**

Error and uncertainty in experiment, measurement systems, accuracy in models and reliability of results; Test planning, design and implementation: testing sequence and experimental plan, loading systems, devices, actuators and their control.

Module 5: Data Acquisition System and Data Processing **(Lectures 6)**

Analog systems, digital systems using personal computers, dynamic measurement

Data Processing: numerical and graphical data processing and archiving. Experiments to illustrate buckling of structural members; load-deformation behavior of beams, columns, joints, and frames under various loads.

Text Books:

- Wang M., Lynch L.J.P. and Sohn H., "Sensor Technologies for Civil Infrastructures, Applications in
- Structural Health Monitoring (Woodhead Publishing Series in Civil and Structural Engineering)"
- Chen H. P., 2018, "Structural Health Monitoring of Large Civil Engineering Structures", Wiley-Blackwell.
- Blake L. S., 1994, "Civil Engineer's Reference Book Butterworth-Heinemann".
- Brunelle A. and Don J., 2017, "Calibration Handbook of Measuring Instruments", the International Society of Automation (ISA).

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

CO1: Understand workings of sensors and transducers.
CO2: Determine the in-situ characterization and various properties.
CO3: Carry out subsurface measurements and techniques of data collection.
CO4: Understand ongoing studies on use of sensors in civil engineering practice &research.

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BTCVOE605J Planning for Sustainable Development

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(Lectures 06)**
Sustainable Development-explains and critically evaluates the concept of sustainable development

Module 2: **(Lectures06)**
Environmental degradation and poverty Sustainable development: its main principles, the evolution of ideas about sustainability

Module 3: **(Lectures 06)**
Strategies for promoting sustainable development, resistances to the concept, and some alternative approaches. Examine some important current issues and areas of debate in relation to sustainable development.

Module 4: **(Lectures 06)**
Innovation for sustainable development- Environmental management and innovation strategies.

Module 5: **(Lectures 12)**
Societal transformations. Institutional theory, Governance for sustainable development. Policy responses to environmental degradation. Capacity development for innovation. Research methods.

Text/Reference Books:

- Harris, J.M., 2004, " Basic Principles for Sustainable Development, Global Development and Environment"
- Robinson, J., 2004, “Squaring the circle? Some thoughts on idea of sustainable Development” Ecological Economics
- Hjorth, P. & A. Bagheri, 2006, “Navigating towards Sustainable Development: A System Dynamics Approach”, Futures
- Mog, J.M., 2004, "Struggling with Sustainability – A Comparative Framework for Evaluating Sustainable Development Programs‟, World Development 32(12): 2139–2160. IISD Commentary on the OECD's Draft Principles for International Investor Participation in Infrastructure
- Arundel, A., R. Kemp, and S. Parto, 2004,"Indicators for Environmental Innovation: What and How to Measure, forthcoming in International Handbook on Environment and Technology Management (ETM), edited by D. Annandale, J. Phillimore and D. Marinova, Cheltenham, Edward Elgar.

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BTCVOE605K Development Engineering

Teaching Scheme: (3 Lectures) hours / Week

Course Contents

Module1 **(6 Lectures)**

Introduction to Development Engineering: need of development engineering, core disciplines and concept, major issues in development; urban development; rural development; socioeconomic development; scientific social research, formulation of research problem, field work and data collection, report drafting

Module 2 **(6 Lectures)**

Design of Sustainable Communities: Concept and development of sustainable communities; Sustainable design, principles, building regulations, codes and standards - ANSI, ASTM, ASHRAE, approval process; green buildings- green building techniques- energy solutions, site solutions, site solutions, exterior and interior solutions, Certification -BREEAM, GRIHA, NAHB, LEED, IGBC;

Module 3 **(8 Lectures)**

Town / City Planning: Town Planning- history of town planning 111 India, characteristics of city/town, town planning at national, regional and local levels, planning standards, master plan, site layout and development, zoning and density control, green belt, slum redevelopment; Smart city planning- introduction to city planning, infrastructure elements of smart city planning, dimensions of smart cities - global standards and performance benchmark; smart solutions- e governance, waste management, water management, energy management, urban mobility, citizen services, other services such as tele-medication and education, trade facilitation, skill development; GIS for planning

Module 4 **(8 Lectures)**

Planning and Development of Rural Areas: District administration, District Planning, introduction to various sectors of rural areas such as drinking water, waste water treatment, electricity, public transport, irrigation, sanitation and cooking energy; issues and challenges associated with these sectors; People's participation and role in development of rural areas; various schemes and policies floated by state and central government - phases in the schemes; life cycle costing of these schemes.

Module 5 **(8 Lectures)**

Geoinformatics for Planning and Development: Introduction to Geoinformatics; Advantages, benefits and limitations; Interdisciplinary applications; Data extraction; use of Geoinformatics for planning, mapping and preparation of layouts.

Development aspects: Urban and Rural: Planning and designing of a model town / city and using AutoCad and/ or GIS. Visit to a village or small town - The project will be carried out in groups. Problem faced by the villagers pertaining to various sectors or existing schemes; define the need, method, tools and techniques for development; deliver technology based solution.

Recommended Books:

- Chand, M. and Puri, U.K.(1983),'Regional Planning in India', Allied Publishers, N. Delhi.
- Kaiser, E. J ., et.al. (1995), 'Urban Land use Planning', (ed) Urbana, University of Illinois Press.
- Sundaram, K.V. 1985 'Geography & Planning', Concept Publishing Co., New Delhi.
- Ayyar, C.P.V. (1987), 'Town Planning in Early South India', Mittal Publications, Delhi.
- Reeder, L. Hoboken, NJ, 'Guide to green building rating systems', John Wiley &Sons, Inc., 2010.
- Longley, P.A., Michael F. Goodchild, Maguire, D.J., Rhind, D. W. (2005), 'Geographic Information Systems and Science', Second Edition 2005: John Wiley &, Sons, New York.
- Desai, V. (2005), 'Rural Development of India', Himalaya publishing house, Mumbai.
- Rau, S.K. (200 I), 'Global Search for Rural Development', NIRD, Hyderabad

References:

- Institute of Town Planners, India, Ministry of Urban Affairs & Employment, Government of India, New Delhi, UDPFI Guidelines, 1996.
- Miles R. Simon, 1970, 'Metropolitan Problems' Methuen Publications, Canada.
- B.I.S., 1980, "National Building Code of India', ISI, New Delhi.
- ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low -Rise Residential Buildings
- ASHRAE Standard 90. 1, Energy Standard for Buildings Except Low-Rise Residential Buildings

Course Outcomes: The required course for emphasis in development engineering will help students

CO 1 : To develop multi scaled perspective about decisions in the built environment,

CO 2 : To expose the students to the analysis and evaluation of real world problems aiming to bring desired change in the society.

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BTHM606 Indian Constitution

Teaching Scheme: 2 Lecture / week

The constitution of India:

1. Preamble
2. Fundamental Rights
3. Directive principles of state policy
4. Fundamental Duties
5. Some other provisions

Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

Module.1 Introduction **(5 Lectures)**
Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive, Principles of State Policy

Module.2 Union Government and its Administration **(5 Lectures)**
Structure of the Indian Union: Federalism, Centre- State, relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

Module.3 State Government and its Administration **(4 Lectures)**
Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Module.4 Local Administration **(5 Lectures)**
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Module.5 Election Commission **(5 Lectures)**
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

TEXT/REFERENCE BOOKS:

- Sastry, T. S. N., (2005). India and Human rights: Reflections, Concept Publishing Company India (P Ltd.),
- Nirmal, C.J., (1999). Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

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BTCVL607 SDD of RC Structures Lab

Term work shall consist of detailed analytical report for structural design and drawing of the following RC structures:

A) G + 2 Building

B) Any one of the following

(The introduction, analysis and design of these topics shall be studied in self-study mode. If required the subject teacher should address the student's queries during tutorials).

1) Retaining wall
2) Elevated water tank: analysis and design of staging and tank body.
3) Staircase of special form such as helicoidal stair
4) Shell roofs
5) Special foundation type such as combined footing, raft, pile foundation

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BTCVL608 Transportation Engineering Lab

Practical: 2 Hours / Week

Practical Work consists of all experiments from (a) and at least six performances among the list (b) below and detailed reporting in form of journal and Project Reports. Practical examination shall be based on above

a) Tests on Aggregates

1) Shape Test
2) Specific Gravity and Water Absorption Test
3) Stripping Value Test
4) Soundness Test
5) CBR Test on Soil and Aggregates

b) Test on Bituminous Materials

1.

1. Penetration Test
2. Softening Point Test
3. Flash and Fire Point Test
4. Ductility Test
5. Viscosity Test
6. Specific Gravity Test
7. Demonstration of Marshall Test
8. Pavement design exercise based on flexible pavement consisting of bituminous concrete.
9. Visit to Road construction site for studying different construction equipment's.

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

Perform tests on various road construction materials.

PerformCBRtestsonlocalsoilstodeterminesubgradepropertiesneededforroadways

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BTCVM609 Mini Project

Student shall choose a topic of his interest in consultation with faculty in the department. The topic for mini projectmay be related to Civil Engineering area and/or interdisciplinary area. Student shall attempt to collect necessary informationand present a summary indicating comprehension of the topic and acquired depth of knowledge. It is desirable to obtainindustry or community sponsorship. Simplified tools or devices may be presented in form of working model and a brief reportstating development.A power point presentation shall also be submitted.

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BTCVP 610 Field Training /Internship /Industrial Training

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. A neat detailed report on activities carried out during training is expected. Students should undergo training for minimum 4 weeks which can be completed partially in V Semester and VI Semester or in at one time after VI Semester. Evaluation will be done in VII Semester.

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Dr. Babasaheb Ambedkar Technological University, Lonere

(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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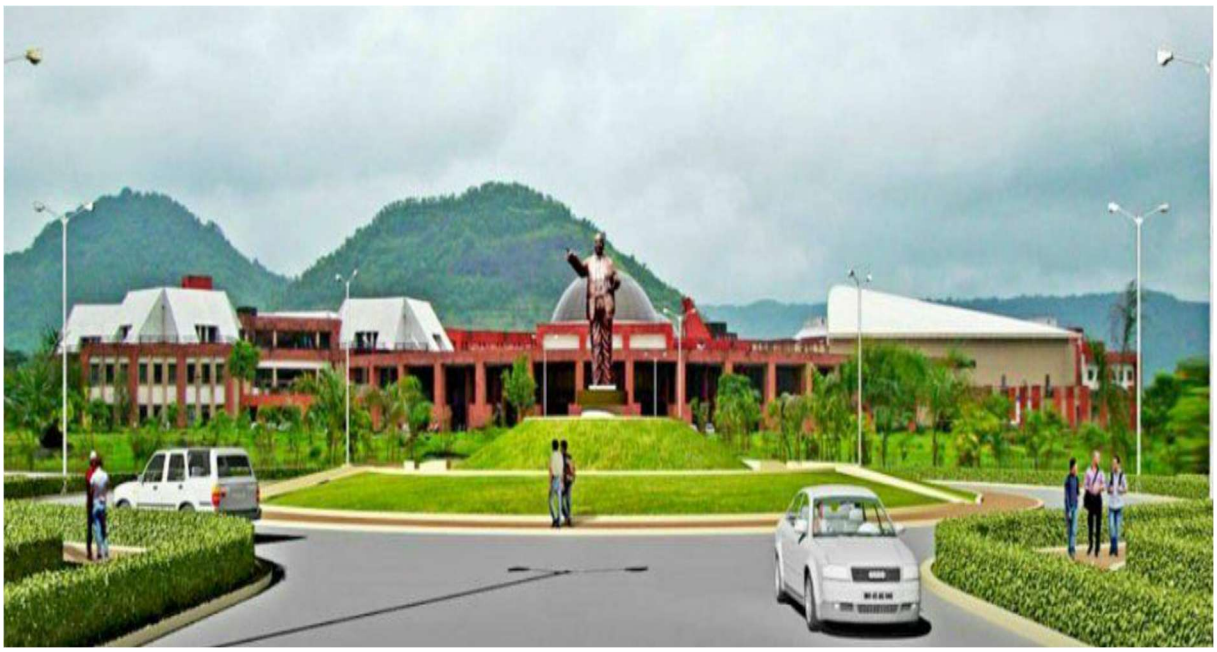
Draft Copy of Curriculum for Undergraduate Degree Programme

B. Tech. in Civil Engineering

With effect from (Fourth Year) AY 2023-24



Dr. Babasaheb Ambedkar Technological University

B.Tech. Civil Engineering

Course Structure for Semester VII (Fourth Year) w.e.f. 2023-2024

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTCVC701	**Core**	Design of Reinforced & Prestressed Concrete Structures	3	1	--	20	20	60	100	4
BTCVC702	**Core**	Infrastructure Engineering	3	--	--	20	20	60	100	3
BTCVC703	**Core**	Construction Techniques	3	--	--	20	20	60	100	3
BTCVC704	**Core**	Professional Practices	3	1	--	20	20	60	100	4
BTCVE705A	**Elective IV**	Engineering Economics	3	--	--	20	20	60	100	3
BTCVE705B		Finite Element Method								
BTCVE705C		Limit State Design of Steel Structures								
BTCVE705D		Rock Mechanics								
BTCVE705E		Applications of Drone Technology								
BTCVE705F		Advanced RC Design								
BTCVE705G		Applied Hydrology & Flood Control								
BTCVE705H		Legal Aspects in Civil Engineering Contracts								
BTCVE705I		Bridge Engineering								
BTCVOE706A	**Open Elective V**	Advanced Structural Analysis	3	--	--	-	--	--	--	Audit
BTCVOE706B		Air Pollution Control								
BTCVOE706C		Applications of AI and ML in Civil Engineering								
BTCVOE706D		Introduction to Earthquake Engineering								
BTCVOE706E		Internet of Things								
BTCVOE706F		Tunneling and Underground Excavations								
BTCVOE706G		Bamboo Construction Technology								
BTHM707A		Essence of Indian Traditional Knowledge	2	--	--	--	--	--	--	Audit
BTHM707B		Foreign language##								
BTCVL708		Design & Drawing of Prestressed Concrete	--	--	2	30	--	20	50	1

	Lab.	Structures								
BTCVL709		Professional Practices	--	--	2	30	--	20	50	1
BTCVP610	Training	Field Training / Internship/Industrial **Evaluation**	--	--	--	--	--	50	50	1
BTCVS710	BTS	Seminar	--	--	2	--	--	50	50	1
BTCVP711	BTP	Project Stage-I**	--	--	4	--	50	50	100	3
		Total	**20**	**2**	**10**	**160**	**150**	**490**	**800**	**24**

B.Tech. Civil Engineering

Course Structure for Semester VIII [Fourth Year] w.e.f. 2023-2024

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme$				Credits
			L	T	P	CA	MSE	ESE	Total	
BTCVSS801A	(Self-Study Course) #	Characterization of Construction Materials	02**	--	--	20	20	60	100	3
BTCVSS801B		Geo synthetics and Reinforced Soil Structures								
BTCVSS801C		Higher Surveying								
BTCVSS801D		Maintenance and Repair Of Concrete Structures								
BTCVSS801E		Structural Dynamics								
BTCVSS801F		Engineering Systems & Development								
BTCVSS801G		Sustainable River Basin Management								
BTCVSS801H		Modern Construction Materials								
BTCVSS801J		Advanced Town & Urban Planning								
BTCVSS802A	(Self-Study Course) #	Energy Efficiency Acoustics and Day lighting in Building	02**	--	--	20	20	60	100	3
BTCVSS802B		Environmental Remediation of Contaminated Sites								
BTCVSS802C		Remote Sensing Essentials								
BTCVSS802D		Mechanical Characterization of Bituminous Materials								
BTCVSS802E		Soil Structure Interaction								
BTCVSS802F		Design of Water Supply Systems								
BTCVP803	Project Stage-II	Project Stage II or Internship	--	--	24	100	--	100	200	12
		Total	04	--	24	140	40	220	400	18

[##] ***Student may take foreign language course from online platform NPTEL/SWAYAM/any other approved foreign language course run by university***

[#] ***The subjects are to be studied on self-study mode using SWAYAM/NPTEL/any other online source approved by the University.***

[**] ***If required Coordinator may be appointed for each Self-study course and an administrative load of 02 hours per week may be considered for monitoring and assisting the students, and to conduct examination (if required), evaluation and preparation of result.***

[$] ***If the examination schedule for the online Self study course chosen by student do not match with the University's Academic Schedule, University/Institute have to conduct exam for such courses.***

**** Internship of One Semester as per BTCEP803: One Faculty guide from the Institute side and one Mentor from the Industry should be identified to monitor the progress of work. During the period of Internship, a review of work should be taken followed by a final presentation at the end.***

Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Final Year B Tech Civil Engg.

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTCVC701	**Core**	Design of Reinforced & Prestressed Concrete Structures	3	1	--	20	20	60	100	4
BTCVC702	**Core**	Infrastructure Engineering	3	--	--	20	20	60	100	3
BTCVC703	**Core**	Construction Techniques	3	--	--	20	20	60	100	3
BTCVC704	**Core**	Professional Practices	3	1	--	20	20	60	100	4
BTCVE705A	**Elective IV**	Engineering Economics	3	--	--	20	20	60	100	3
BTCVE705B		Finite Element Method								
BTCVE705C		Limit State Design of Steel Structures								
BTCVE705D		Rock Mechanics								
BTCVE705E		Applications of Drone Technology								
BTCVE705F		Advanced RC Design								
BTCVE705G		Applied Hydrology & Flood Control								
BTCVE705H		Legal Aspects in Civil Engineering Contracts								
BTCVE705I		Bridge Engineering								
BTCVOE706A	**Open Elective V**	Advanced Structural Analysis	3	--	--	-	--	--	--	Audit
BTCVOE706B		Air Pollution Control								
BTCVOE706C		Applications of AI and ML in Civil Engineering								
BTCVOE706D		Introduction to Earthquake Engineering								
BTCVOE706E		Internet of Things								
BTCVOE706F		Tunneling and Underground Excavations								
BTCVOE706G		Bamboo Construction Technology								
BTHM707A		Essence of Indian Traditional Knowledge	2	--	--	--	--	--	--	Audit
BTHM707B		Foreign language[##]								
BTCVL708	Lab.	Design & Drawing of Prestressed Concrete Structures	--	--	2	30	--	20	50	1

BTCVL709		Professional Practices	--	--	2	30	--	20	50	1
BTCVP610	Training	Field Training / Internship/Industrial **Evaluation**	--	--	--	--	--	50	50	1
BTCVS710	BTS	Seminar	--	--	2	--	--	50	50	1
BTCVP711	BTP	Project Stage-I**	--	--	4	--	50	50	100	3
		Total	**20**	**2**	**10**	**160**	**150**	**490**	**800**	**24**

Detailed Syllabus (VII Semester)

BTCVC701 Design of RC and PSC Structures

Teaching Scheme: (3 Lectures + 1 Tutorial) hours/week

Course Contents
Limit State Method for RC Structures

Module 1: **(6 Lectures)**
Limit State of Collapse (Torsion) - Types of torsion, behavior of R.C. rectangular sections subjected to torsion, Design of sections subjected to combined bending and Torsion

Module 2: **(6 Lectures)**
Analysis and design of axially and eccentrically loaded short columns (Circular and Rectangular), detailing of reinforcement, and construction of Interaction diagrams for uni-axial bending, concept of bi-axial bending Prestressed Concrete

Pre-stressed Concrete Structure

Module 3: **(8 Lectures)**
Introduction to prestressed concrete, concepts, types, systems and methods of pre stressing,

Module 4: **(10 Lectures)**
Stress analysis for rectangular and symmetrical I sections, Pressure Line, Cable Profiles
Losses in Prestressing for Pre-tensioned & Post tensioned members

Module 5: **(6 Lectures)**
Design of Rectangular and Symmetrical I sections, Design of End Block
Structural audit of various structures such as load bearing wall type, RCC, Steel Framed, Prestressed Concrete, etc.: conceptual introduction to elaborate necessity, implementation of audit, format of reporting, consequences

Text Books

1. IS: 456, IS 1343, SP16, SP24, SP34 of Recent Editions, Bureau of Indian Standards, New Delhi
2. Karve& Shah, “Limit State Theory & Design”, Structures Publications, Pune
3. Lin T.Y., “Prestressed Concrete”, John Willey & Sons New York
4. Jain A.K., “Reinforced Concrete Design (Limit State)”, Nemchand Brothers, Roorkee
5. Sinha S.N., “Reinforced Concrete Design”, Vol. I, II, Tata Mc-Graw Hill
6. Sinha& Roy, “Fundamentals of Reinforced Concrete”, S. Chand & Co. New Delhi
7. Sinha& Roy, “Prestressed Concrete”, S. Chand & Co. New Delhi
8. Krishnaraju N., “Prestressed Concrete”, Tata Mc-Graw Hill

Reference Books

1. Punmia B.C., “Reinforced Concrete Design”, Vol. I, II, Laxmi Publications
2. Varghese P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi
3. Relevant Publications by Bureau of Indian Standards, New Delhi
4. Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.

Course Outcomes: On completion of the course, the students will be;

CO:1 Able to identify the behavior, analyze and design of the beam sections subjected to torsion.

CO:2 Able to analyze and design of axially and eccentrically loaded column and construct the interaction diagram for them.

CO:3 Understand various concepts, systems and losses in pre-stressing.

CO:4 Able to analyze and design the rectangular and symmetrical I-section pre-stressed beam/girders.

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BTCVC702 Infrastructure Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 **(8 Lectures)**

Railway Engineering: Permanent Way, gauges, rails, sleepers, ballast, sub grade formation, fixtures and fastenings, Geometric Design of tracks- Horizontal Alignment, Vertical Alignment

Module 2 **(8 Lectures)**

Points and Crossings: Standard types, Design of simple turnout, various types of Junctions, Stations and Yards: Purpose, Location, Site selection, general layouts of Terminus and Junction, Signaling and Interlocking, Construction and Maintenance of Track, Modern trends in Railways

Metro Rail: Introduction to mass rapid transit system in India, Options of Mass Rapid Transit Systems(MRTS), Choice of Metro Rail as a Mode of Mass Transit, Advantages and disadvantages, Planning and Implementation of Metro Rail Projects, Private participation and public private partnership (PPP), Financing options of metro rail project in India, Alignment and track structure requirement, Track components- Rail, Rail to sleeper Fastenings, Base slab

Module 3: **(6 Lectures)**

Dock and Harbor Engineering: Inland Water Transport in India, Tides, Winds and Waves Erosion, Transport of Sediments, Beach Drift, Littoral Drift, Sand Bars, Coast Protection, Classification of Ports and Harbors, Site Selection, Features of Break Waters, Jetties, Wharves, Piers, Facilities required, Dry Docks, Wet Docks, Lift Docks, Floating Docks, Spillways, Navigational Aids, Lighthouses, Terminal Buildings, and Dredging- Special Equipment.

Module 4: **(6 Lectures)**

Airport Engineering: Planning, Airport Surveys, Site Selection, Zoning Laws, Runways, Geometric Design, Airport Capacity, Terminal Buildings, Parking Systems, Taxiways, Hangers, Airport Drainage, Air Traffic Control, Airport Lighting

Module 5: **(8 Lectures)**

Tunnel Engineering: Shape and Size of Tunnel Shafts, Pilot Tunnels, Tunneling in Hard Rock, Tunneling in Soft Materials, Drilling-Patterns, Blasting, Timbering, Mucking, Tunnel Lining, Advances In Tunneling Methods, Safety Measures, Ventilation, Lighting and Drainage of Tunnels

Text Books

1. Saxena S. C. and Arora S. (2003) “A Course in Railway Engineering,” Dhanpat Rai & Sons, Delhi
2. Arora N. L. (1995) “Transportation Engineering”, IPH New Delhi
3. Bindra S. P. “Bridge Tunnel and Railway Engineering”, Dhanpatrai and Sons, New Delhi
4. Hariharan K. V. (2002) “Multimodal Transport & Infrastructure Development in India”, Shroff Publishers, Mumbai
5. Quinn A. D. “Planning and Construction of Docks and Harbours”, Tata McGraw Hill, New Delhi
6. Oza H. P. and Oza G. H. (2012) “Dock and Harbour Engineering”, Chartor Publishing House, Anand
7. Shrinivasan R. (2016) “Dock, Harbour and Tunnel Engineering”, Chartor Publishing House, Anand
8. Khanna S. K. and Arora N. L. (1999), “Airport Engineering” Nemchand& Bros., Roorkee
9. Rangawala S. C. (2012) “Airport Engineering”, Charotar Publishing House Pvt. Limited, Anand

References

1. Publications of Bureau of Indian Standards, New Delhi, Relevant To the Syl Laboratories
2. Cormick H. F. (1975) “Dock and Harbour Engineering” Giffin Publishers
3. Horonjeff R. (2012) “Planning and Design of Airports”, Tata McGraw Hill, New Delhi

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

CO:1 Know about the basics and design of various components of railway engineering

CO:2 Understand the types and functions of tracks, junctions and railway stations.

CO:3 Able to understand Airport engineering.

CO:4 Able to understand Docks and Harbours.

CO:5 Know about the aircraft characteristics, planning and components of airport

CO:6 Understand the types and components of docks and harbors

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BTCVC703 Construction Techniques

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 Lectures)**

Introduction, planning of a new project, site access and services, mechanical and manual construction, excavation in earth: Understanding basics and functions of equipment, earthmoving equipment - Tractors, Bulldozers, Scrappers, Power shovel, Hoes, simple numerical problems based on cycle time and production rates, drag line, Clamshell, Trenchers, Compactors- types and performance, operating efficiencies, lifting capacities

Module 2: **(6 Lectures)**

Excavation in hard rock, Rippers, jack hammers, drills, compressors and pneumatic equipment, blasting explosives, detonators, fuses, drainage in excavation – necessity and methods of dewatering

Module 3: **(6Lectures)**

RMC Plant, layout and production capacity, type of concrete mixers, machinery for vertical and horizontal transportation of concrete, grouting, Shotcreting, under water concreting, Type of formwork, Slip formwork, equipment for placing of concrete in normal and difficult situations

Module 4: **(6 Lectures)**

Prefabricated construction: Relative economy, steel construction: planning and field operations, erection equipment, cranes of various types such as tower, crawler, luffing jib tower crane, floating and dredging equipment

Module 5: **(8 Lectures)**

Road construction aspects, asphalt mixing and batching plant (Hot Mix Plant), sensor paver for rigid roads, crushing plants belt conveyers, cableway, construction of a new railway track, aspects of bridge construction

Diaphragm walls: purpose and construction methods, safety measures in construction, prevention of accidents and introduction to disaster management

Text Books

1. Peurifoy R.L. (2010). Construction, Planning, Equipment & Methods, McGraw hill Book Co. N. Delhi
2. Verma Mahesh, (1975). Construction Equipment, Metropolitan book Co., New York
3. Singh J., (2006). Heavy Construction - Planning, Equipment & Methods, Oxford & IBH Pub., N. Delhi

Reference Books

1. Quin A. (1961), Planning and Construction of Docks and Harbors, Mc-Graw Hill Company, New York.
2. Stubbs F. W., (1971). Hand Book of Heavy Construction, Mc-Graw Hill Inc, US 2nd edition.
3. Boyes R.G.H, (1975). Structural & cut off Diaphragm Walls, Applied Science Publishers Ltd. London.
4. Ataev S. S., (1999). Construction Technology, Mir Publishers, Mascow.

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

CO:1 Understand the planning of new project with site accessibility and services required.

CO:2 Comprehend the various civil construction equipment's.

CO:3 Familiar with layout of RMC plant, production, capacity and operation process.

CO:4 Recognize various aspect of road construction, construction of diaphragm walls, railway track construction etc.

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BTCVC704 Professional Practices

Teaching Scheme :(3 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: Introduction of Estimate **(8 Lectures)**

Introduction to estimating, purpose, types, items of inclusion, modes of measurement for different works, administrative approval and technical sanction to estimates; Quantity Surveying: Specifications: purpose general and detailed specifications for various

items of work, prime cost, provisional sums and provisional quantities, taking out quantity, P.W.D. method, recording of measurements

Module 2: Costing **(8 Lectures)**

Analysis of rates for various items of construction of civil engineering works, standard schedule of rate, price escalation, detailed and approximate estimates for buildings, R.C.C works, culverts, earthwork for canals, roads including hill roads and other civil engineering works

Module 3: Tendering **(8 Lectures)**

Types, preparation of tender papers, conditions of contracts, competitive bidding, types of bids, invitation of tenders, scrutiny and acceptance of tenders, award of jobs, introduction to B.O.T. and similar other basis of execution,

Module 4: Contracts **(6 Lectures)**

Essentials of legally valid contract, types and forms of contract between various agencies, organizational set up of P.W.D. classification of works, method of carrying out work in P.W.D. mode of payment, bill forms, introduction to arbitration

Module 5: Valuation **(6 Lectures)**

Principles, types, price and cost, attributes of value, valuer and his duties, factors affecting the valuation of properties, methods of valuation, different types of lease

Valuation from yield and from life, gross yield and net yield, sinking fund, depreciation, different methods of calculating depreciation, depreciated cost, obsolescence

Text Books

1. Dutta B. N. (2012) "Estimating and Costing", UBS Publishers Distributors, New Delhi
2. Namavati R. H. (2016) "Professional Practice Estimating and Valuation", Lakhani book Depot, Mumbai
3. Patil B. S. (2015) "Civil Engineering Contracts and Estimates", Universities Press, Hyderabad
4. Bhasin P. L. (1987) "Quantity Surveying", S. Chand & Co. Ltd., Mumbai
5. Rangwala S. C. (1990), "Elements of Estimating and Costing", Charotar Publication, Anand
6. Birdi G. S. (2014) "Estimating and Costing", DhanpatRai& Sons, N. Delhi
7. Chakroborty M. (2010) "Estimating, Costing & Specification in Civil Engineering", M.Chakraborty Publication, Nepal
8. Rangwala S. C. (2011) "Valuation of real Properties", Charotar Publication, Anand

References

1. Govt. of Maharashtra P.W. and Housing Department Publication edition 1979 and 1981
2. P. W. D. Maharashtra, "Standard Specifications", Volumes I & II
3. C.P.W.D. Specifications
4. C.P.W.D. Schedule of Rates
5. P.W.D. Maharashtra Schedule of Rates
6. Publications of Bureau of Indian Standards: IS 1200 all parts, and other relevant

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

CO1: Understand the importance of preparing the types of estimates under different conditions for various structures.

CO2: Know about the rate analysis and bill preparations and to study about the specification writing.

CO3: Know the various types of contract, accounts in PWD, methods for initiating the works in PWD and tendering.

CO4: Understand the valuation of land and buildings, various methods and factors affecting valuation.

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BTCVE705A Engineering Economics

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 **(06 Lectures)**

Introduction to engineering economics, importance, demand and supply, types of costs, types of interests, value of money – time and equivalence, tangible and intangible factors, introduction to inflation,

Module 2 **(06 Lectures)**

Cash Flow diagram, Nominal and effective interest – continuous interest, Single Payment Compound Amount Factor, Uniform series of Payments, comparing alternatives, Present worth Analysis, Annual worth Analysis, Future worth Analysis, Rate of Return Analysis, Break Even Analysis, Benefit/Cost Analysis

Module 3 **(06 Lectures)**

Economics of Project Parameters, Equipment Economics, Operating Costs, Buy, Rent and Lease Options, |Replacement Analysis, Cost Estimates, Type of Estimates, Parametric Estimate, Management Accounting, Financial accounting principles, basic concepts, Financial statements, accounting ratios

Module 4 **(08 Lectures)**

Investment Evaluation and Financing Projects, Taxation, Depreciation, switching between different depreciation methods, Inflation, Sources of finance, equity, debit, securities, borrowings, debentures, Working capital requirement, financial institutes

Module 5 **(08 Lectures)**

Financial Management, Introduction, Charts of Accounts, Balance Sheet, Financial Ratios, Working Capital Management, Budgeting and budgetary control, Performance budgeting. Profit & Loss, statement, Ratio analysis, Appraisal through financial statements, International finance forward

Text Books

1. Blank, L.T., and Tarquin, A. J., (1988). Engineering Economy, Mc-Graw Hill Book Co.
2. Collier C. and GlaGola C. (1998). Engineering Economics & Cost Analysis, Addison Wesley Education

Publishers,

3. Patel, B. M., (2000). Project management- strategic Financial Planning, Evaluation and Control,Vikas Publishing House Pvt. Ltd. New Delhi,
4. Shrivastava, U. K., (2000). Construction Planning and Management, Galgotia Publications Pvt. Ltd. New Delhi.

References

1. Van Horne, J.C. (1990). Financial Management and Policy, Prentice-Hall of India Ltd.
2. Taylor, G.A. (1968). Managerial and Engineering Economy. East-West Edition.
3. Thuesen, H.G. (1959). Engineering Economy, Prentice-Hall, Inc.
4. Brigham, E.F. (1978). Fundamentals of Financial Management, the Dryden Press, Hinsdale, Illinios,
5. Kolb, R.W. and Rodriguez, R.J. (1992). Financial Management, D.C. Heath & Co.
6. Walker, E.W. (1974). Essentials of Financial Management, Prentice Hall of India Private Limited, New Delhi.

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

CO1: Adopt as per principles of economics and financing

CO2: Analyze available alternatives and propose best suitable among them

CO3: Apply various models of financial management and accounting

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BTCVE705B Finite Element Method

Teaching Scheme: (3Lectures) hours/week

Course Contents

Module 1: Introduction to FEM & Approximate Methods **(06 Lectures)**

Introduction, Overview of Various Methods to Solve Integral & Differential Equations (Point Collocation Method, Method of Least Square, Weighted Residual Method, Galerkin's Method), Variational Calculus (Hamilton's Variational Principle, Minimum Potential Energy Principle, Euler Lagrange Equation), Partial FEM (Kentorvich Method/ Finite Strip Method/ Semi-Analytical Method), Local & Global Finite Element Methods (Rayleigh-Ritz Method), Stepwise Procedure.

Module 2: One Dimensional FE Analysis **(06 Lectures)**

Application of FEM to Solve various 1-D problems (Shape Functions for 1-D Elements, Properties of Shape Functions, Lagrange Interpolating Polynomials), C0 Continuity, 1-D FE Analysis (Discretization, Selection of Shape Function, Defining Gradients of Primary Unknowns & Constitutive Equations, Derivation of Element Equations, Assembly & Application of Boundary Conditions, Computation of Primary and Secondary Unknowns), Direct Approach for Assembly, Boundary Conditions (Geometric, Natural), Concept of Sub-Structuring (Static Condensation), Stiffness Matrix for Basic Bar & Beam Element, Representation of Distributed Loading, The Assembly Process within the PMPE Approach, Element Stresses)

Module 3: FE Analysis by Direct Approach **(06 Lectures)**

C1 Continuity, Formulation of 1-D Beam Element, Classical Beam Theory, Element Equation Formulation (Galerkin's Approach, Rayleigh-Ritz Approach), Derivation of Scalar Functional from Differential Equation and Vice Versa, Simple applications to Beams.

Module 4: Two Dimensional FE Analysis **(06 Lectures)**

Conditions of Symmetry & Anti Symmetry (Applications), 2-D FE Analysis, Review of Theory of Elasticity, CST Element (3-Node Triangular Element), Pascal's Triangle and Pyramid, Area Co-ordinate, Stepwise Formulation, Equivalent Load Vector, Plane Stress Problems using CST Elements, 2-D Stress Analysis using 4-noded Rectangular Element, Stepwise Formulation, Effect of Aspect Ratio, Explicit & Implicit Iso-parametric Formulation, Iso-parametric Elements for Plane Problems

Module 5: Three Dimensional FE Analysis **(04 Lectures)**

3-D Stress Analysis using FEM, Iso-parametric Formulation, 3-D Brick Element, FEA of Axi-symmetric Solids Subjected to Axi-symmetric and Asymmetric Loads (all contents at introductory level)
Computer Implementation of FEM, Application of FEM to Time Dependent Problems, Partial FEM, h-version of FEM, p-version of FEM, Adaptive Meshing, Exposure to Hybrid FEM (Mixed/ Hybrid Formulation, Unidirectional Composites), Introduction to software's, elementary problem-solving using freeware

References:

1. Mukhopdhyay, M., (1984). Concept and Application of Finite Element Analysis, Oxford and IBH Publishing Co. Pvt. Ltd.
2. Zienkiewicz, O.C and Taylor R.L., (2000). The Finite Element Method, Vol 1 & 2; 5th Ed, Butterworth- Heinemann,
3. Reddy J. N. (2005). An Introduction to Finite Element Method, McGraw Hill , 3rd Ed,
4. Cook R.D., Malcus D.S. and Plesha, (1997). Concepts and Applications of Finite Element Analysis,4th Ed, Wiley.
5. Hutton D.V., (2004). Fundamentals of Finite Element Analysis, Tata McGraw Hill Pub.
6. Desai C. S. & Abel J. F., (1974). Introduction to the Finite Element Method, CBS Pub.
7. Krishnamoorthy C. S, (1994). Programming in the Finite Element Method, Tata McGraw Hill.
8. Chandrupatla T. R. and Belegundu,(2002). Introduction to the Finite Element in Engineering, Pearson Education.
9. Bathe K.J., (1996). Finite Element Procedures, PHI learning pvt.ltd
10. Desai Y.M., and Eldho T.I, (2011). Finite Element Method with application in Engineering, Pearson, Delhi
11. Bhavikatti S. S. (2015). Finite Element Analysis, New Age International Publication.

Course Outcomes: Upon completion of the course the students will be able to:

CO1: Understand the different energy methods in structural analysis and basic concepts of finite element method.
CO2: Analyze 1-D problems related to structural analysis like Bars, Trusses, Beams and Frames using finite element approach.
CO3: Find solution to problems using direct approach methods like Rayleigh – Ritz or Galerkin's Method.
CO4: Solve 2-D problems using knowledge of theory of elasticity.
CO5: Students will be able to implement the knowledge of numerical methods in FEM to find the solution to the various problems in statics and dynamics.

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BTCVE705C Limit State Design of Steel Structures

Teaching Scheme: (3Lectures) hours/week

Course Contents

Module 1: Introduction **(4 Lectures)**
Introduction, advantages & disadvantages of steel structures, permissible stresses, factor of safety, methods of design, types of connections, various types of standard rolled sections, types of loads and load combinations

Module 2: Connections **(4 Lectures)**
Types: Riveted, Bolted, Welded; Analysis of axially & eccentrically loaded connections (subjected to bending & torsion), Permissible Stresses, Design of connections, failure of joints

Module 3: **Axially Loaded Members** **(6 Lectures)**
Tension members: Common sections, net effective area, load capacity, connection using weld / bolts, design of tension splice
Compression members: Common sections used, effective length and slenderness ratio, permissible stresses, load carrying capacity, connection using weld / bolt

Module 4: Beams **(6 Lectures)**
Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections

Module 5: Industrial Roofing **(6 Lectures)**
Gantry girder: Forces acting on a gantry girder, commonly used sections, introduction to design of gantry girder as laterally unsupported beam, connection details
Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, design of hinge & roller supports

Note: Contents in Module 1 to part of 5 shall be taught with help of relevant text or reference books based on elastic **design concept and shall be taught with reference to IS 800 2007**

Use of IS 800: 1984 and 2007, IS 875 (All Parts), IS: Handbook No.1 for Steel Section and Steel Table is permitted for theory examination.

Text Books

1. Duggal S. K. (2017) "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
2. Gambhir M. L. (2017) "Fundamentals of Structural Steel Design", Tata McGraw Hill Pub. Co. Ltd., New Delhi
3. Negi L. S. (2017) "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
4. Chandra Ram (2016) "Design of Steel Structures", Vol. I & Vol. II, Standard Book House, New Delhi
5. Subramanian N. (2010) "Steel Structures: Design and Practice" Oxford Univ. Press, Delhi
6. Sai Ram K. S. (2015) "Design of Steel Structures", Pearson Education, Delhi

Reference Books

1. Arya A. S. and Ajamani J.L. (2014) "Design of Steel Structures", Nemchand and Brothers, Roorkee
2. Vazirani V.N. and Ratwani M.M. (1988) "Design of Steel Structures", Standard Book House, New Delhi
3. Publications of Bureau of Indian Standards, New Delhi, IS 800:1984, 2007, IS 875 (Part I to V)
4. Gaylord E.H. and Gaylord C.N. (1991) "Design of Steel Structures" McGraw Hill, New York
5. Salmon C. G. and Johnson J. E. (2008) "Steel Structures: Design and Behaviour", Harper and Row, New York
6. Steel Designers Manual.

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

CO1: Identify and compute the design loads and the stresses developed in the steel member.
CO2: Analyze and design the various connections and identify the potential failure modes.
CO3: Analyze and design various tension, compression and flexural members.
CO4: Understand provisions in relevant BIS Codes.

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BTCVE705D Rock Mechanics

Teaching Scheme: (3Lectures) hours/week

Course Contents

Module 1: Introduction **(Lectures 08)**

Introduction, Development, Objective, and Scope of Rock Mechanics, Applications of Rock Mechanics: Slopes, Underground Excavations, Foundations, and Rock Support Systems. Physical and Mechanical Properties of Rocks, Factors Affecting the Strength and Deformation of Rocks, Lineaments, Discontinuities in Rocks, and Associated Problems.

Module 2: Rock Testing **(Lectures 08)**

Introduction; Rock Sampling, Laboratory Testing, and In-Situ Determination of Strength of Rock Samples and identifying its Properties like Density, Porosity, and Water Absorption, Using Methods like Uniaxial Compressive Strength, Tri-Axial Compressive Test, Tensile Strength, Shear Strength, Flexural Strength, Swelling and Slake Durability, Permeability, and Point Load Strength.

Module 3: Engineering Classification Rock Mass **(Lectures 08)**

Concept of Rock Mass, Geological Strength Index, Rock Quality Designation, Classification systems, Rock Mass Rating, Rock Structure Rating, Deere and Miller classification, Geo-mechanics and NGI Classification Systems, and Applications in Civil Engineering Projects.

Module 4: Rock Mass Behavior at Slope **(Lectures 06)**

Stability of Rock Slopes, Modes of Failure, Methods of Analysis, Prevention, and Control of Rock Slope Failure, and Slope Monitoring Techniques.

Module 5: Strength Criteria and Improvement Techniques of Rock Mass **(Lectures 06)**

Mohr-Coulomb criterion, Hoek and Brown criterion, Barton's Theory of Rock Mass Stability, Methods of Improving Rock Properties, Rock Reinforcement & Rock Bolting: Rock Bolts, Rock Anchors, Steel Mats, Precast Concrete Segments, Shotcrete, and Grouting, etc.

Text Books

1. Ramamurthy, T (2007). "Engineering in Rocks for Slopes, Foundation, and Tunnels." N. Delhi, PHI Pvt. Ltd.
2. Singh, B and Goel RK (2011). "Engineering Rock Mass Classification" Oxford, UK, Elsevier Inc.
3. Sivakugan, N, Shukla, SK and Das, BM (2013). "Rock Mechanics: an introduction". Boca Raton, FL, CRC Press.

Reference Book

1. Goodman R. E., "Introduction to Rock Mechanics", John Wiley and Sons, India
2. Obert and Duvall, "Rock Mechanics and Hydraulic Structures", John Wiley and Sons, India
3. Winterkorn and Fang, "Foundation Engineering Hand Book" Springer, Boston, MA.
4. Relevant Indian Standards.

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

CO1: Understand about rock mechanics and its applications.

CO2: Able to determine the engineering properties of rocks and sub-surface conditions.

CO3: Identify various causes of slope failure and suggest some preventive measures for them.

CO4: Categorize rock mass into various classes for recognizing overall rock mass quality.

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BTCVPE705E Applications of Drone Technology

Teaching Scheme: (3Lectures) hours/week

Course Contents

Module 1: Introduction to Drone Technology (6 Lectures)

Overview of drone technology and its versatility, Importance of drones in civil engineering projects,, Understanding the role of data in drone applications, Examples of successful drone applications in civil engineering, Introduction to different types of drones and their capabilities, Brief introduction to relevant drone regulations and certifications

Module 2: Drone Data Acquisition (8 Lectures)

Comparison of drones with traditional surveying and inspection methods.Flight planning fundamentals for civil engineering projects, Understanding the importance of mission objectives and data requirements, Factors influencing drone flight, such as weather conditions and airspace restrictions,, Introduction to LiDAR (Light Detection and Ranging) technology and its applications, Data acquisition for various civil engineering projects, including surveying, construction, Water Management and infrastructure inspection, Safety precautions and emergency procedures during drone operations.

Module 3: Drone Application in Civil Engineering (8 Lectures)

Overview of drone applications in civil engineering disciplines, including surveying, construction, inspection, and environmental monitoring, Importance of drones in enhancing efficiency and accuracy in civil engineering projects, Benefits and limitations of using drones in civil engineering projects, Construction site management using drones: Progress monitoring, material tracking, and site safety assessment.

Module 4: Drone Data Processing and Analysis (6 Lectures)

Data processing software and tools, 3D modeling and point cloud analysis, GIS integration and mapping, Data interpretation and visualization, Emerging trends in drone technology, Discussion on drone payload options for various data collection needs, Case studies illustrating the economic and environmental advantages of using drones in civil engineering projects

Module 5: Advanced Topics in Drone Technology (8 Lectures)

Drones in transportation engineering: Road and highway planning and monitoring, Surveying and mapping with drones: Topographic mapping and contour generation, Infrastructure inspection and monitoring with drones: Bridges, buildings, dams, and roads, Drones in water resources engineering: Flood modeling and hydrological monitoring, Drones in flood mapping, forest monitoring and post-disaster damage assessment.

Text Books

1. Randal W. Beard and Timothy W. McLain: Small Unmanned Aircraft
2. Theory and Practice, Princeton University Press, 2012
3. Kimon P. Valavanis: Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy, Springer, 2007

Reference Books

1. Drone Technology in Architecture, Engineering, and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation by Daniel Tal and Jon Altschuld, 2021
2. Drones: Technology and Business Plan for Civil Engineering by Thiago Prudêncio and Gleydson Carlos Almeida, 2023
3. Small Unmanned Aircraft Systems Guide: Exploring Designs, Operations, Regulations, and Economics by Brent Terwilliger, 2017

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

CO1: Understand about drone technology and its applications.
CO2: Able to understand drone data acquisition techniques.
CO3: Able to understand application of drone in Civil Engineering Project.
CO4: To analyze different drone data processing software and tools.
CO5: To understand different advanced methods used in drone technology.

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BTCVPE705F Advanced RC Design

Teaching scheme: (3 Lectures) hour/week

Course Contents

Module 1: Circular Slabs **(10 Lectures)**

Introduction, Slabs freely supported at edges and carrying UDL, Slabs fixed at edges and carrying UDL, , Slabs simply supported at the edges with load UDL w Uniformly distributed along the circumference of a concentric circle, Slab simply supported at edges with UDL inside a concentric circle, Slab simply supported at edges with a central hole and carrying UDL Slab simply supported at edges with a central hole and carrying w Uniformly distributed along the circumference of a concentric circle.

Module 2: Flat Slabs **(10 Lectures)**

Introduction, Components of Flat Slab Construction, IS Code Recommendations (IS: 456-2000), Direct Design Method, Equivalent Frame Method, Shear in Flat Slab, Slab Reinforcement, Openings in Flat Slab.

Module 3: Domes **(5 Lectures)**

Introduction, Nature of Stresses in Spherical Domes, Analysis of Spherical Domes, Stresses due to Wind load, Design of RC Domes, Conical Domes.

Module 4: Bunkers and Silos **(5 Lectures)**

Introduction, Janssen's theory, Airy's theory ,Bunkers, Hopper Bottom, Indian Standard on Design of Bins(IS :4995-1968)

Module 5: Chimneys **(6Lectures)**

Introduction, wind pressure, stresses in chimney shaft due to self weight and wind, stresses in horizontal reinforcement due to wind shear, stresses due to Temperature difference ,combined effect of self load ,wind and temperature, temperature stresses in horizontal reinforcement, Design of RC Chimneys.

Text Books

1. IS: 456, IS 1343, SP16, SP24, SP34 of Recent Editions, Bureau of Indian Standards, New Delhi
2. Karve & Shah, "Limit State Theory & Design", Structures Publications, Pune
3. Lin T.Y., "Prestressed Concrete", John Willey & Sons New York
4. Jain A.K., "Reinforced Concrete Design (Limit State)", Nemchand Brothers, Roorkee.
5. Sinha S.N., "Reinforced Concrete Design", Vol. I, II, Tata Mc-Graw Hill
6. Sinha& Roy, "Fundamentals of Reinforced Concrete", S. Chand & Co. New Delhi
7. Sinha& Roy, "Prestressed Concrete", S. Chand & Co. New Delhi
8. Krishnaraju N., "Prestressed Concrete", Tata Mc-Graw Hill

Reference Books:

1. Punmia B.C., "Reinforced Concrete Design", Vol. I, II, Laxmi Publications
2. Varghese P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi
3. Relevant Publications by Bureau of Indian Standards, New Delhi
4. Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.

Course Outcomes: On completion of the course, the students will be;

1. Able to identify the behavior, analyze and design of circular slabs, flat slab.
2. Able to analyze design domes, bunkers and silos and Chimneys.

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BTCVPE705G Applied Hydrology and Flood Control

Teaching scheme: (3 Lectures) hour/week

Course Contents

Module 1: (6 Lectures)

Precipitation: Types of precipitation, measurement, Presentation of rainfall data mass rainfall curves, Hyetograph, Concepts of depth area duration analysis, Frequency analysis frequency of point rainfall and plotting position, Intensity duration curves, Maximum Intensity duration frequency analysis.

Module 2: (6 Lectures)

Runoff, Introduction, Factors affecting runoff, Rainfall Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall, Unit hydrograph theory, S curve hydrograph, uses and limitations of Unit Hydrograph

Module 3: (6 Lectures)

Floods: Types of floods, Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods.

Module 4: (6 Lectures)

Flood Estimation and Routing: Estimation of design flood, SPF/MPF empirical methods, Statistical methods, Frequency analysis, Unit hydrograph method, Flood estimation in small watersheds and mountainous region, Estimation by lumped, distributed model, Routing, Lumped, Distributed, Hydraulic and hydrological routing.

Module 5: (6 Lectures)

Flood Control and Management: Flood routing, Hydrological channel routing by Muskingham method, Hydrologic reservoir routing. Flood control methods, Structural and non-structural measures Flood plain Zoning, Flood disaster monitoring and mitigation procedure, Methods of forecasting, Data analysis and warning, Flood fighting Remote Sensing for flood management.

Text books:

1. Das G., Hydrology and Soil Conservation Engineering 2nd Edition. Prentice Hall of India Pvt. Ltd. New Delhi. 2009.
2. Subramanya K., Engineering Hydrology, Tata McGraw-Hill Book Co., New Delhi. 1984.
3. Chow V.T., Maidment D.R., and Mays L.W., Applied Hydrology, McGraw Hill, 1998.
4. Applied Hydrology by K.N. Mutreja, Tata Mc-Graw Hill Book Co., New Delhi. 1985.

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

CO1: Understand the hydrologic extremes of floods.

CO2: Estimate severity and extent of damages and mitigation measures to combat them.

CO3: Understand the climate system, being aware of the impact of climate change on society.

CO4: Understand role of hydrological cycle precipitation and runoff in civil engineering systems.

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BTCVPE705H Legal Aspects in Civil Engineering Contracts

Teaching scheme: (3 Lectures) hour/week

Course Contents

Module 1: **(08 Lectures)**

Professional Practice and Administration Contracts: The standard form of building contracts, Indian contract Act, The right of building owner, Right of Contractor, Types of Civil Engineering contracts, RERA

Module 2: **(08 Lectures)**

Bailment: Nature of Transactions, Delivery of Bailee, care to be taken, Bailee's Responsibility, Termination, Bailment of pledges. **Injunction:** Types Temporary, Perpetual, Mandatory when referred, Indemnity and Guarantee: Difference between the two, The Contract of Guarantee and Indemnity,

Module 3: **(06 Lectures)**

Industrial Acts and Labour Laws: Indian factories Act, Industrial Dispute Act, Payment of Wages Act, Work Compensation Act, Trade Union Act, The Building and Other Constructions Workers' (Regulation of Employment and Conditions of Service) Act, 1996

Module 4: **(06 Lectures)**

Arbitration and Award: Indian Arbitration Act, Arbitration Agreement, Conduct of Arbitration, Power and Duties of Arbitration, Rules of Evidence, E- Tendering, Preparation and publication of ward, Methods of Enforcement impending and Awards.

Module 5: **(08 Lectures)**

Safety Engineering: Sources, Classification, Cost of Accident and Injury Workmen's Compensation Act, Safety Programme, Safety Organization. Employers Liability Act, Employers Insurance Act, Safety and Health Standards Occupations Hazards, personal Protective equipments, preventive measures Factory Act, Fatal accidents

Course Outcome (CO):

CO1: Students will learn Indian contract act, Arbitration act and contract administration
CO1: Student will gain knowledge about bailment and FIDIC
CO1: Students will understand the labour laws
CO1: Students will be exposed to safety engineering and relevant act

Text Books

1. Indian arbitration Act by B. S. Patil
2. Indian Contract Act.
3. Safety Engineering, Govt. of India Publication
4. Professional Practice, Roshan Namavati.
5. Legal Aspects of building and Engineering Contracts by B. S. Patil

Reference Books

1. Indian Contract Act Avatar singh
2. Indian contract Act Jhamb

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BTCVPE705I Bridge Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction **(6 Lectures)**

History of bridges, components and definitions, classification of road bridges, span length, classicalexamples of each type, people involved in the total process, history of analysis

Module 2: Selection of site and initial decision process **(8 Lectures)**

Survey and alignment, geotechnical investigations and interpretations River Bridge: Selection of bridge site and planning, collection of bridge design data, hydrological calculation, waterway calculation, scour calculation, depth of foundation, freeboard. Road Bridge: Selection of bridge site and planning, collection of bridge design data, vertical clearance.

Module 3: Standard loading for bridge design as per different codes **(6 Lectures)**

Road Bridges: IRC, BS code, AASHTO code. dead load, live load, impact factor, centrifugal force, windloads, hydraulic forces, longitudinal forces, seismic forces, earth pressure, buoyancy, lane concept,equivalent loads, traffic load, width of roadway and footway, use of influence lines for maximum forces in members, transverse distribution of live loads among deck longitudinal, load combinations for different working state and limit state designs.

Railway Bridges: Loadings for railway bridges, rail road data, pre-design considerations, rail road v/shighway bridges.

Module 4: Superstructures **(8 Lectures)**

Selection of main bridge parameters, design methodologies, choices of superstructure types:orthotropic plate theory, load distribution techniques, grillage analysis, finite element analysis(Preferable), different types of superstructures (RCC and PSC), Longitudinal analysis of bridge, slab bridge and voided slab bridge, beam-slab bridge, box girder bridge

Different types of bridge bearings and expansion joints, Design of bearings and joints.
Parapets for highway bridges: Definitions, classification of bridge parapets, various details

Module 5: Substructure **(6 Lectures)**

Pier, abutment, wing walls, importance of soil structure interaction
Foundations: open foundation, pile foundation, well foundation, examples - simply supported bridge,continuous bridge.

Text/Reference Books

1. Victor D. J., Essentials of Bridge Engineering, Oxford & IBH.
2. Raju N. K., Design of Bridges, Oxford & IBH.
3. Ponnuswamy S., Bridge Engineering, Tata McGraw Hill
4. Raina V K, “Handbook for Concrete Bridges” Vol. 1 and 2, Shroff Publishers, Mumbai
5. Raina V. K., Concrete Bridge Practice, (Analysis, Design Economics), 4th Edition, Shroff Publishers, Mumbai
6. Raina V. K., Concrete Bridge Practice, (Construction, Maintenance, Rehabilitation), 2nd Ed., Shroff Publishers, Mumbai.
7. Raina V. K., Field Manual for Highway and Bridge Engineers”, 3rd Edition, Shroff Publishers, Mumbai
8. Raina V. K., “World of Bridges”, Shroff Publishers, Mumbai

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

1. Understand components of bridges and its various types.
2. Understand site selection criteria and comprehend various forces acting on bridges.
3. Analyze bridge structures using different analysis techniques.
4. Understand the importance of different types of bridge bearings.

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BTCVOE706A Advanced Structural Analysis

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Review of basic concepts in structural analysis **(06 Lectures)**

Type of structure, loads, response, statically determinate structures, principle of virtual work and displacement-based and force-based energy principles deriving stiffness and flexibility coefficients, Force method, Displacement Methods

Module 2: Matrix concepts and Matrix analysis of structures **(06 Lectures)**

Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; eigenvalues andeigen vectors. Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches

Module 3: Matrix analysis of structures with axial elements: **(08 Lectures)**

Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof);One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method(single dof); Analysis by flexibility method;

Plane trusses: Analysis by conventional stiffness, method (four dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method;

Space trusses: Analysis by conventional stiffness method (six dof per element) and reduced element stiffness method (single dof).

Module 4: Matrix analysis of beams and grids **(10 Lectures)**

Conventional stiffness method for beams: Beam element stiffness (four dof); generation of stiffness matrix for continuous beam; dealing with internal hinges, hinged and guided-fixed end supports; accounting for shear deformations;

Reduced stiffness method for beams: Beam element stiffness (two dof); dealing with moment releases, hinged and guided-fixed end supports;

Flexibility method for fixed and continuous beams: Force transformation matrix; element flexibility matrix; solution procedure (including support movements); Stiffness method for grids: Introduction; torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element with six dof; analysis by reduced stiffness method (three dof per element);

Module 5: Matrix analysis of plane frames: **(06 Lectures)**

Conventional stiffness method for plane frames: Element stiffness (six dof); generation of structure stiffness matrix and solution procedure; dealing with internal hinges and various end conditions;

Reduced stiffness method for plane frames: Element stiffness (three dof); ignoring axial deformations; dealing with moment releases, hinged and guided fixed end supports;

Flexibility method for plane frames: Force transformation matrix; element flexibility matrix; solution procedure(including support movements);Ignoring axial deformations;

References

1. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2009.
2. Asslam Kassimali, "Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA, 1999.
3. Amin Ghali, Adam M Neville and Tom G Brown, "Structural Analysis: A Unified Classical and Matrix Approach", Sixth Edition, 2007, Chapman & Hall.
4. DevdasMenon, "Structural Analysis", Narosa Publishing House, 2008

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

CO1: To analyse the indeterminate structures by force and displacement methods of analysis.

CO2: To understand the fundamental concepts of the matrix for analysis of structures.

CO3: To analyse the one-dimensional axial structures by matrix approach.

CO4: To analyse the beams and grid structures by matrix approach.

CO5: To analyse the plane frames by matrix approach

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BTCVOE706B Air Pollution Control

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction to Air Pollution **(06 Lectures)**

The Structure of the atmosphere, Composition of dry ambient air and properties of air. BIS Definition and scope of Air Pollution, Scales of air pollution, Types of exposures. Air Pollutants,

Module 1: Classification **(08 Lectures)**

Classifications, Natural and Artificial, Primary and Secondary, point and Non-Point, Line and Area Sources of air pollution. Stationary and mobile sources, composition of particulate& gaseous pollutant, units of measurement. Effect of different air pollutants on man, animals, vegetation, property, aesthetic value and visibility, air pollution episodes. Global effects of air pollution- global warming, ozone depletion, acid rain and heat island effect.

Module3: Meteorology and Air pollution **(08 Lectures)**

Solar radiation, wind circulation, factors affecting dispersion of pollutants, Lapse rate, stability conditions, wind velocity profile, Maximum mixing depth (MMD), visibility, Wind rose diagram, General characteristics of stack plume (Plume behaviour). Gaussion diffusion model for finding ground level concentration. Plume rise. Formulae for stack height and determination of minimum stack height.

Module4: Air Sampling and Analysis (06 Lectures)

Air pollution survey, basis and statistical considerations of sampling sites. Devices and methods used for sampling gases and particulates. Stack emission monitoring, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring.

Module5: Photochemical Smog, Odour Pollution & Indoor Pollution (08 Lectures)

Chemistry of air pollution, Chain reactions of hydrocarbons, nitrogen oxide, Sulphuric oxides and intermediates, photochemical smog formation, air pollution indices -aerosols, fog, smog index. Odour pollution: Theory, sources, measurement and methods of control of odour pollution. Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems.

Text Books

1. Wark K. and Warner C. F. (1997) "Air pollution: Its Origin and Control" Pearson Education, Delhi
2. Rao M. and Rao H. V. N. (2017) "Air Pollution" Tata McGraw Hill Pub. Co. Ltd., New Delhi
3. Peavy S. H. and Rowe D. R. (2017) "Environmental Engineering" Tata McGraw Hill Pub. Co. Ltd., New Delhi
4. Muralio Krishna K. V. S. G. (2017) "Air Pollution and Control" Jain Brothers, Mumbai

Reference Books

1. Crawford M. (1984) "Air pollution Control Theory" McGraw Hill, New York
2. Anjaneyulu Y. (2002) "Air Pollution and Control Technologies" Allied Publishers, Mumbai
3. Raju B. S. N. (2018) "Fundamentals of Air Pollution" CBS Publishers and Distributors Pvt. Ltd., N. Delhi

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

1. Identify the sources of air pollutants and their effect on human, plants and materials.
2. Apply knowledge of meteorology for controlling air pollution
3. Design air pollution controlling equipment.
4. Apply knowledge of legislation for prevention and control of air pollution.

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BTCVOE706C Applications of AI and ML in Civil Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction to AI and ML in civil Engineering (5 Lectures)

Understanding the fundamentals of AI and ML, Overview of AI techniques and Algorithms, AI and ML applications in Civil Engineering, Modeling concept

Module 2: AI and ML Techniques (8 Lectures)

Artificial Neural Networks, Machine Learning Algorithm, Neural Language Processing, Concurrent Neural Networks, Linear regression, Descriptive statics- Data exploration (histograms, scatter Plot etc), measure of central tendency, positions, dispersion and other measures, statistical analysis- measure of distribution (Skewness and Kurtosis), relation between attributes and other statistical graphs, data management- data acquisition, data pre processing and preparation, data quality and transformation.

Module 3: AI and ML in Transportation Engineering and Construction Planning (6 Lectures)

AI applications in Traffic flow optimization and analysis, intelligent transportation systems and traffic control, real time traffic prediction using ML Algorithms

Resource allocation and optimization in construction projects, Implementing AI based construction planning tools

Module 4: AI and ML in Water Resource Engineering and Environment Engineering (7 Lectures)

Model application in Water Resource Engineering- Classification, prediction and forecasting: time series data, Fuzzy model application in Water Resources Engineering: Runoff Hydrograph Simulation, Hydrograph Simulation at watershed scale, Peak discharge prediction

Predictive models for Air pollution levels, Water availability, climate change impacts, Waste management data analysis,

Module 5: AI and ML in Structural design and structural health monitoring (7 Lectures)
Implementing AI and ML in Structural Design task, AI and ML for structural analysis and simulation, Structural design optimization, Importance of predictive maintenance in civil infrastructure, Models for structural health assessment

Text Books

1. Gebrail Bekdas (2019), "Artificial Intelligence and Machine Learning applications in Civil, Mechanical and Industrial Engineering" IGI Global Publication
2. G. Tyfure (2012), "Soft Computing in Water Resources Engineering", WIT Press, Southampton, UK
3. N. K. Bose and P. Liang (1996), "Neural Networks Fundamentals with Graphs, Algorithms, and applications" Tata McGraw-Hill Publication.

Reference Books

1. B. Kosko (1993), "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", Prentice- Hall.
2. Publications in peer reviewed international unpaid journals.

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

CO1: Understand the fundamental concepts of artificial intelligence and machine learning and their relevance to civil engineering applications.

CO2: Analyze real-time traffic data and apply machine learning models to optimize traffic flow and control in transportation systems.

CO3: Implement AI-based approaches to optimize water resource management and predict water demand, air quality model, climate change in civil engineering projects.

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BTCVOE706D Introduction to Earthquake Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 (6 Lectures)
Elements of seismology: Terminology, structure of the earth, causes of an earthquake, seismic waves, magnitude and intensity, seismograph, strong motion earthquakes, Accelerogram, prominent earthquakes of India.

Module 2 (6 Lectures)
Structural dynamics: Free and forced vibrations of single degree of freedom systems, un-damped and viscously damped vibrations, equations of motion, Duhamel integral.

Module 3: (6 Lectures)
Response Spectrum Theory: construction of Design Response Spectrum, effect of foundation and structural damping on design spectrum, design spectrum of IS 1893, evaluation of lateral loads.

Module 4 (6 Lectures)
Principles of Earthquake Resistant Design (EQRD), planning aspects, resistance of structural elements and structures for dynamic load, design criteria, ductile detailing of RCC members, energy absorption, provisions of IS 13920.

Module 5 (10 Lectures)
Construction aspects of masonry and timber structures, retrofitting and strengthening techniques of low cost and low-rise buildings, provisions of IS 4326.

Dynamic properties of soils, field and Laboratory tests, site evaluation, behavior under dynamic loads, effect on bearing capacity, settlement, liquefaction.

Text Books

1. IS 456, IS 1498, IS 1893, IS 1905, IS 2131, IS 13920, IS 4326 of recent editions, Bureau of IS,New Delhi.
2. Chopra A.K. (2001). *Dynamics of Structures*, 2nd Edi, Pearson Education Pvt. Ltd., India, ISBN 81-7808-472-4.

3. Mario Paz, (1985). *Structural Dynamics*, CBS Publication.
4. Arya A.S., (1987). *Elements of Earthquake Engineering*, South Asian Pub., New Delhi.

Reference Books

1. Clough R.W. and Penzien J.(1993), Dynamics of Structures, McGraw Hill New York
2. Humar J. L., (2002). Dynamics of Structures, 2nd Edition Swets and Zeitlinger, Netherlands.
3. Farzad Naiem, (2001). The Seismic Design Handbook, Kluwer Academic Pub. Massachusetts, ISBN: 0-7923- 7301-4.
4. Dowrick D. J., (1977). Earthquake Resistant Design for Engineers & Architects, John Wiley and Sons Ltd.
5. Pauley T. and Priestley M.J.N., (1992). Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons Inc., USA, ISBN 0-471-54915-0.
6. Nayak N. V., (1985). Foundation Design Manual, Dhanpat rai and Sons, Delhi.
7. Housner G.W. & Hudson D. E., (1950). Applied Mechanics- Dynamics, East-West Edition, N. Delhi.
8. Kramer S. L., (2003). Geotechnical Earthquake Engineering, Pearson Education.

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

CO1 Capture complexities in earthquake resistant design of structures
CO2 Grasp Nature of earthquake vibration and associated forces on structures
CO3 Understand importance of designing the building to targeted seismic performance.

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BTCVOE706E Internet of Things

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(7 Lectures)**
Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Machine to Machine, Difference between IoT and M2M, Software define Network

Module 2: **(5 Lectures)**
Network & Communication aspects, Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Module 3: **(6 Lectures)**
Challenges in IoT Design challenges, Development challenges, Security challenges, Other challenges.

Module 4: **(7 Lectures)**
Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications

Module 5: **(7 Lectures)**
Developing IoTs Introduction to Python, Introduction to different IoT tools, developing applications through IoT tools, developing sensor-based application through embedded system platform, Implementing IoT, concepts with python.

Text Books:

1. Pethuru Raj and Anupama C. Raman "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by (CRC Press).
2. Samuel Greengard "The Internet of Things" MA: MIT Press, 2015.

Reference Books

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice

Course Outcomes: On completion of the course, the students will be able to:
CO1: Understand the concepts of Internet of Things
CO2: Analyze basic protocols in wireless sensor network
CO3: Design IoT applications in different domain and be able to analyze their performance
CO4: Implement basic IoT applications on embedded platform

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BTCVOE706F Tunnelling and Underground Excavation

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 Tunneling Methods **(06 Lectures)**
Types and purpose of tunnels; factors affecting choice of excavation technique; Methods - soft ground tunneling, hard rock tunneling, shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered and remedial measures.

Module 2 Tunneling by Drilling and Blasting: **(08 Lectures)**
Unit operations in conventional tunneling; Drilling – drilling principles, drilling equipment, drilling tools, drill selection, specific drilling; Blasting - explosives, initiators, blasting mechanics, blast holes nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance - powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.

Module 3 Tunneling by Road headers and Impact Hammers **(08 Lectures)**
Cutting principles, method of excavation, selection, performance, limitations and problems. Tunneling by Tunnel Boring Machines: Boring principles, method of excavation, selection, performance, limitations and problems; TBM applications.

Module 4 Excavation of large and deep tunnels Introduction **(06 Lectures)**
Purpose and use of large and deep tunnels; excavation issues governing large and deep tunnels; excavation methods of large and deep tunnels - unit operations, different equipment, types of rock
pressure and methods to deal, roof and wall supports, case studies from hydel, road and rail tunnels.

Module 5 Shield Tunneling **(08 Lectures)**
Introduction; advantages of shield tunneling; classification; different types of shield tunneling techniques – open shield, close shield, half shield; conventional shields, special features in shield tunneling; factors affecting selection of a shield; slurry shield, earth pressure balance shield, slime shields, other shield development methods, problems encountered with possible remedies.

Text Books:

1. Srinivasan R., (2016). *Harbour, Docks and Tunnel Engineering*, Charotar Pub. House.
2. Saxena S. C. (2015). *Tunnel Engineering*, DhanpatRai Publications.
3. Tatiya R. R., (2013), *Surface and Underground Excavation*, CRC Press.

References:

1. Stack, B. (1982). Handbook of Mining and Tunnelling Machinery, Wiley, New York.
2. Chugh, C.P., (1977). Drilling Technology Handbook, Oxford & IBH Publication.
3. Bickel J.O. and. Kuesel T.R, (2018). Tunnel Engineering Handbook, CBS Publishers and Distributors Pvt. Ltd.
4. Brebbia C.A., Kaliampakos D., Prochazka P., (2008). Underground Spaces Design, Engineering and Environmental Aspects, WIT Press,

Web links:

1. https://www.isrm.net
2. www.nirm.in
3. http://umich.edu/~gs265/tunnel.html
4. http://se.sze.hu/images/ngm_se108_1/Tunnels_2015-03-20_Toth_1-Excavation.pdf
5. https://www.usbr.gov/ssle/safety/RSHS/sec23.pdf
6. https://www.osha.gov/Publications/osha3115.html

Course Outcomes: On completion of the course, the students will be able to:
CO1: Understand types of tunnels and tunneling methods conforming to site conditionsCO2: Investigate various tunneling operations and relevant machinery required
CO3: Understand methods and operations of excavating large and deep tunnels
CO4: Propose suitable tunneling and excavations methods to optimize the same

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BTCVOE706G Bamboo Construction Technology

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module – 1: Understanding bamboo plant **(lecture 6)**
Understanding Bamboo anatomy, Bamboo species in India & worldwide, Traditional use of bamboo in India & worldwide, Field visit to understand bamboo plant

Module – 2: Environmental impact **(lecture 6)**
Understanding environmental issues, Carbon Foot print of various building materials, Energy analysis, Response to Climate Change, environmental benefit of bamboo house

Module – 3: Bamboo as a construction material **(lecture 6)**
Various properties of bamboo, comparative analysis with steel, timber etc. structural properties of various bamboo species, Bamboo preservation techniques, Field visit to understand preservation of bamboo

Module – 4: Understanding bamboo **(lecture 6)**
Various joints in bamboo, Preparation of drawing for bamboo structures, structural analysis of bamboo structure, Various components in bamboo e.g. door, window, sky light, trusses etc. , Case study, Field visit to understand Bamboo house

Module – 5: Bamboo economy **(lecture 6)**
Estimation of bamboo structure, pre fabrication in bamboo construction, income generation from bamboo plantation, Case study – well known bamboo structure

Text books

1. David Farrelly, "The book of Bamboo ", Sep 2002, University of California press
2. Vinu Kale, " (Venu Bharati) '', CAPART publication , New Delhi
3. Jain A.K., "The Idea of Green Building" Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-256-4

Reference books

1. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi (Part 6 – section 3)
2. IS 9096 (2006) Preservation of Bamboo

Course Outcomes: On completion of the course, the students will be able to:
CO1: Understand need of Bamboo in construction.
CO2: Understand bamboo as a construction material.
CO3: Develop construction techniques in bamboo

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BTCVHM707A Essence of Indian Traditional Knowledge

Teaching Scheme: 1 Lecture / week

Course Contents

Module I **(04 Lectures)**
Ancient Education System in India, History of Indian Knowledge System, Sources of knowledge transmission and preservation, Indian Artistic Tradition: Chitrakala, Moorthikala, Vasthukala, Sthapthya, Sangeetha, Nruthya, Sahithya

Module II **(04 Lectures)**
Indian Linguistic Tradition (Phonology, morphology, syntax & semantics), Yoga & Holistic Health care

Module III **(04 Lectures)**
Philosophical Traditions in ancient India, Relevance in today's life

Module IV **(04 Lectures)**
Glimpses of ancient Indian science and technology, Ancient structures in India, Traditional materials, Construction styles and Techniques, Developments in construction materials, living styles and habitation, Town Planning, Case Studies

Module V **(06 Lectures)**

Developments in water supply, sanitation, irrigation and agriculture, Case Studies
Developments in transportation and communication, Case Studies

Text / Reference Books

1. V. Sivaramakrishna, "Cultural Heritage of India", Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edi., 2014
2. Swami Jitatmanand, "Modern Physics and Vedant", Bharatiya Vidya Bhavan
3. Fritz of Capra, "Tao of Physics"
4. Fritz of Capra, "The wave of Life"
5. 5Jha V. N. (English Trans,), "Tarkasangraha of Annam Bhatta", Inernational Chinmay Foundation, Velliarnad, Arnakulam
6. "Yoga Sutra of Patanjali", Ramakrishna Mission, Kolkatta
7. Jha GN (English Trans.), R N Jha, "Yoga-darshanam with Vyasa Bhashya", Vidyanidhi Prakasham, Delhi, 2016
8. Jha RN, "Science of Consciousness Psychotherapy and Yoga Practices", Vidyanidhi Prakasham, Delhi, 2016
9. P R Sharma (English translation), "Shodashang Hridayam"
10. Indian Journal of Traditional Knowledge
11. https://www.niscair.res.in/sciencecommunication/researchjournals/rejour/ijtk/ijtk0.asp
12. Swayam Course by Prof. D. P. Mishra, IIT Kanpur: https://swayam.gov.in/nd1_noc19_ae07/preview

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BTCVHM707B Foreign Language

Student may take foreign language course from online platform NPTEL/SWAYAM/any other approved foreign language course by University such as;

German I https://onlinecourses.nptel.ac.in/noc19_hs51/preview
Spanish https://onlinecourses.swayam2.ac.in/cec19_lg03/preview
French https://onlinecourses.swayam2.ac.in/cec19_lg04/preview
Japanese https://onlinecourses.nptel.ac.in/noc19_hs52/preview

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BTCVL708 Design and Drawing of Prestressed Concrete Structures Lab

Practical:2 Hours / Week Term Work: 50 Marks

Term work shall be based on the syllabus of BTCVC701. It consists of

1. Assignment on prestress Loss calculation
2. Assignment on stress calculation
3. Assignment on resistance of PSC members against shear and torsion.
4. Design, detailing and drawing of prestressed slab
5. Design, detailing and drawing of prestressed girder
6. Two site visit reports of R.C.C. and P.S.C structure.

There should be separate design data for a group size of **maximum four** students.

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BTCVL709 Professional Practices Lab

Practical:2 Hours / Week

Term work include detailed study and working of following set of assignments
1) Detailed estimate for a two storied RCC or load bearing wall building
2) Preparing detailed estimate for any four of the following:
   a) A small culvert
   b) A stretch of a road about 1 Km. long including earthwork
   c) A reach of canal about 1 Km. long
   d) A percolation tank
   e) A factory shed of steel frame
   f) Water supply scheme
   g) Drainage scheme
   h) Water Treatment plants.
3) Valuation report including valuation certificate for any one of the following:
   a) A building for residential purpose or commercial purpose
   b) A hotel
   c) A theatre
   d) Any one construction machine.
4) Drafting of Detailed specification for any five civil engineering items. This shall include at least one item each from Roads, Irrigation works, Water Supply, Sanitation and buildings
Assignment (1) and (2) shall include Rate Analysis of at least two items.

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BTCVP 610

Field Training /Internship /Industrial Training (Evaluation)

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. A neat detailed report on activities carried out during training is expected. Students should undergo training for minimum 4 weeks which can be completed partially in V Semester and VI Semester or in at one time after VI Semester. Evaluation will be done in VII Semester.

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BTCVS710 Seminar III

Teaching Scheme: 2 hours per week

Student shall visit to ongoing construction sites in field to witness and collect information from works of execution of roads. It is desirable to collect basic information on components of roads, construction machinery, etc. Intention of the work is to introduce the student to the sequential order of execution of road works, preparation of road alignment and various surveys

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BTCVM711 Project Stage I

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarise the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student.

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Semester VIII

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme$				Credits
			L	T	P	CA	MSE	ESE	Total	

BTCVSS801A	(Self-Study Course) #	Characterization of Construction Materials	02**	--	--	20	20	60	100	3
BTCVSS801B		Geo synthetics and Reinforced Soil Structures								
BTCVSS801C		Higher Surveying								
BTCVSS801D		Maintenance and Repair Of Concrete Structures								
BTCVSS801E		Structural Dynamics								
BTCVSS801F		Engineering Systems & Development								
BTCVSS801G		Sustainable River Basin Management								
BTCVSS801H		Modern Construction Materials								
BTCVSS801J		Advanced Town & Urban Planning								
BTCVSS802A	(Self-Study Course) #	Energy Efficiency Acoustics and Day lighting in Building	02**	--	--	20	20	60	100	3
BTCVSS802B		Environmental Remediation of Contaminated Sites								
BTCVSS802C		Remote Sensing Essentials								
BTCVSS802D		Mechanical Characterization of Bituminous Materials								
BTCVSS802E		Soil Structure Interaction								
BTCVSS802F		Design of Water Supply Systems								
BTCVP803	Project Stage-II	Project Stage II or Internship	--	--	24	100	--	100	200	12
		Total	04	--	24	140	40	220	400	18

BTCVSS801 A Characterization of Construction Materials

By Prof. Manu Santhanam, Prof. Piyush Chaunsali IIT Madras

The objective of the course is to introduce students to the characterization of construction materials and their behaviour, with a view of developing their understanding of the mechanisms that govern the performance of these materials. The course will be focused primarily on cement and concrete, and include the following techniques; the physics of the techniques and their application to cement science, including lab demonstrations and experiments will be covered.

Week 1: Introduction to course; Structure of Construction Materials – An Overview
Week 2: Calorimetry
Week 3: X-ray diffraction
Week 4: X-ray diffraction
Week 5: Thermal analysis
Week 6: Surface area measurement
Week 7: Optical microscopy
Week 8: Scanning electron microscopy

Week 9: Image analysis
Week 10: Spectroscopic techniques
Week 11: Mercury intrusion porosimetry
Week 12: Impedance analysis and ultrasonic methods

https://archive.nptel.ac.in/content/syllabus_pdf/105106200.pdf

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BTCVSS801 B Geo-synthetics and Reinforced Soil Structures

https://archive.nptel.ac.in/content/syllabus_pdf/105106052.pdf

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BTCVSS801 C Higher Surveying

https://archive.nptel.ac.in/content/syllabus_pdf/105103176.pdf

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BTCVSS801 D Maintenance and Repair of Concrete Structures

https://archive.nptel.ac.in/content/syllabus_pdf/105106202.pdf

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BTCVSS801 E Structural Dynamics

https://archive.nptel.ac.in/content/syllabus_pdf/105106151.pdf

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BTCVSS801 F Engineering systems and development

https://archive.nptel.ac.in/content/syllabus_pdf/110104074.pdf

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BTCVSS801 G Sustainable River Basin Management

https://nptel.ac.in/content/syllabus_pdf/105106145.pdf
https://onlinecourses-archive.nptel.ac.in/noc15_ce03/preview

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BTCVSS801 H Modern Construction Materials
https://archive.nptel.ac.in/content/syllabus_pdf/105106053.pdf

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BTCVSS802 A
Energy Efficiency Acoustics and Daylighting in Building
https://archive.nptel.ac.in/content/syllabus_pdf/105102175.pdf

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BTCVSS802 B Environmental Remediation of Contaminated Sites
https://archive.nptel.ac.in/content/syllabus_pdf/105107181.pdf

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BTCVSS802 C Remote Sensing Essentials
https://archive.nptel.ac.in/content/syllabus_pdf/105107201.pdf

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BTCVSS802 D Mechanical Characterization of Bituminous Materials
https://archive.nptel.ac.in/content/syllabus_pdf/105106203.pdf

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BTCVSS803 E Soil Structure Interaction
https://archive.nptel.ac.in/content/syllabus_pdf/105105200.pdf

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BTCVP803 Project Stage II or internship

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarise the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student in Industry based project or In-house project or Internship.

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