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
Telephone and Fax.: 02140 - 275142
www.dbatu.ac.in

Draft Copy of Curriculum for Undergraduate Degree Programme

B. Tech. in Civil and Infrastructure Engineering

With effect from (Third Year) AY 2023-24

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

Dr. Babasaheb Ambedkar Technological University, Lonere-Raigad

Teaching & Evaluation Scheme

for Third Year B. Tech. Civil & Infrastructure Engg.

Semester- V										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 10	BTCIC 501 / BTCVC 501	Design of Steel Structures	2	1	-	20	20	60	100	3
PCC 11	BTCIC 502	Soil Mechanics & Foundation Engineering	2	1	-	20	20	60	100	3
PCC 12	BTCIC 503	Bridge and Tunnel Engineering	2	1	-	20	20	60	100	3
PCC 13	BTCIC 504 / BTCVC 504	Concrete Technology	2	-	-	20	20	60	100	2
ESC 9	BTCIC 505	Artificial Intelligence (NPTEL/SWAYAM)	3	-	-	20	20	60	100	3
PEC 1	BTCIPE 506	A. Advanced Environmental Engg. B. Applied Geology C. Applied Hydraulics D. Advanced Water Resources E. Geomatics F. Town and Urban Planning G. Material, Testing and Evaluation H. Construction Economics & Finance I. Ropeway Engineering J. Road Safety Audits	3	-	-	20	20	60	100	3
ESC10	BTCIES507 / BTCVES507	Software applications in Civil Engineering	2	-	-	50	-	-	50	Audit
LC 7	BTCIL508	Soil Mechanics & Foundation Engineering Lab	-	-	2	20	-	30	50	1
LC8	BTCIL509	Concrete Technology Lab	-	-	2	20	-	30	50	1
Internship	BTCIP410	Internship – 2 Evaluation	-	-	-	-	-	-	-	Audit
		Total	**16**	**3**	**4**	**210**	**120**	**420**	**750**	**19**

Semester- VI										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 14	BTCIC601 / BTCVC601 /	Design of RC Structures	2	1	-	20	20	60	100	3
PCC 15	BTCIC602	Airport Engineering	2	1	-	20	20	60	100	3

HSSMC3	BTHM603	Project Management	3	-	-	20	20	60	100	3
PCC 16	BTCIC604	Railway Engineering	3	-	-	20	20	60	100	3
PEC 2	BTCIPE605	A. Industrial Waste Treatment B. Managerial Techniques C. Open Channel Flow D. Water Power Engineering E. Soil Exploration & Ground Improvement Techniques F. Structural Audit G. Intelligent Transportation Systems H. Plastic Analysis of Structures I. Numerical Methods in Civil & Infrastructure Engg. J. Engineering Management K. Integrated Region and Smart City L. Pavement Design and Management	3	-	-	20	20	60	100	3
OEC 2	BTCIOE606	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 K. Development Engineering L. Graphs, Groups and Network M. Introduction to Nanomaterials N. Robotics & Robot Applications	3	-	-	20	20	60	100	3
LC 9	BTHM607	Indian Constitution	2	-	-	50	-	-	50	Audit
LC 10	BTCIL608	Structural Design Lab.	-	-	2	20	-	30	50	1
HSSMC4	BTCIL609	Infrastructure Engineering Lab	-	-	2	20	-	30	50	1
Project	BTCIM610	Mini Project	-	-	2	20	-	30	50	1
Internship	BTCIP611	Field Training/ Internship/Industrial Training	-	-	-	-	-	-	-	Credits to be

		(minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time)								evaluated in VII Semester
		Total	**18**	**2**	**6**	**230**	**120**	**450**	**800**	**21**

Detailed Syllabus

Semester- V										
Course Category	**Course Code**	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				**Credit**
			L	**T**	**P**	**CA**	**MSE**	**ESE**	**Total**	
PCC 10	BTCIC 501 / BTCVC 501	Design of Steel Structures	2	1	-	20	20	60	100	3
PCC 11	BTCIC 502	Soil Mechanics & Foundation Engineering	2	1	-	20	20	60	100	3
PCC 12	BTCIC 503	Bridge and Tunnel Engineering	2	1	-	20	20	60	100	3
PCC 13	BTCIC 504 / BTCVC 504	Concrete Technology	2	-	-	20	20	60	100	2
ESC 9	BTCIC 505	Artificial Intelligence (NPTEL/SWAYAM)	3	-	-	20	20	60	100	3
PEC 1	BTCIPE 506	K. Advanced Environmental Engg. L. Applied Geology M. Applied Hydraulics N. Advanced Water Resources O. Geomatics P. Town and Urban Planning Q. Material, Testing and Evaluation R. Construction Economics & Finance S. Ropeway Engineering T. Road Safety Audits	3	-	-	20	20	60	100	3
ESC10	BTCIES507 / BTCVES507	Software applications in Civil Engineering	2	-	-	50	-	-	50	Audit
LC 7	BTCIL508	Soil Mechanics & Foundation Engineering Lab	-	-	2	20	-	30	50	1
LC8	BTCIL509	Concrete Technology Lab	-	-	2	20	-	30	50	1
Internship	BTCIP410	Internship – 2 Evaluation	-	-	-	-	-	-	-	Audit
		Total	**16**	**3**	**4**	**210**	**120**	**420**	**750**	**19**

BTCIC 501 / 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.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIC 502 Soil Mechanics & Foundation Engineering

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

Course Contents

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

Introduction to Soil Mechanics: 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

Introduction to Foundation Engineering: General requirements to be satisfied for satisfactory performance of foundations, Soil exploration: Necessity, Planning, Exploration Methods, Soil Sampling Disturbed and undisturbed.

Module 2: Soil Consistency **(8 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

Module 3: Shear Strength **(8 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 4: Foundation **(8 Lectures)**

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

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,

Caissons Foundations: Box, Pneumatic, Open Caissons, Forces, Grip Length, Well Sinking, Practical Difficulties and Remedial Measures
Sheet Piles: Classification, concept of sheet piles, Cellular Cofferdams: Types, Cell Fill Stability Considerations

Module 5: Slope Stability **(6 Lectures)**
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:

- Arora K.R., "Soil Mechanics and Foundation Engineering", Standard publication 2009
- Murthy V.N.S., "Soil Mechanics & Foundation Engineering", U.B.S. Publishers and Distributors N. Delhi
- Punmia B.C., "Soil Mechanics & Foundation Engineering", Laxmi Publications
- Kasamalkar B. J., "Geotechnical Engineering", Pune Vidyarthi Griha Prakashan Pune
- Nayak N.V., "Foundation Design Manual", Dhanpat Rai And Sons
- Brahma S.P., "Foundation Engineering", Tata McGraw-Hill 5th Edition
- Braja Das, "Principles of Geotechnical Engineering", Engage Learning 9th edition

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
- Teng W.C., "Foundation Design", Prentice-Hall Inc
- Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall; 7th edition
- Lee, "Sheet Piles" Concrete Publication,1961

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

CO1: Understand different soil properties and behaviour
CO2: Understand stresses in soil and permeability and seepage aspects.
CO3: Understand different types foundations
CO4: Analyze the stability of slope by theoretical and graphical methods.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIC 503 Bridge and Tunnel Engineering

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

Course Contents

Module 1: Introduction **(6 Lectures)**
History of bridges, components and definitions, classification of road bridges, span length, history of analysis, 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 2: 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, wind loads, 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/s highway bridges.

Module 3: Superstructures & Substructure (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

Substructure: Pier, abutment, wing walls, importance of soil structure interaction Foundations: open foundation, pile foundation, well foundation, examples - simply supported bridge, continuous bridge

Module 4: Tunnel Engineering (08 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 5: Tunneling methods (08 Lectures)

Tunneling by Drilling and Blasting: 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.

Tunneling by Road headers and Impact Hammers: 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.

Text Books:

- D.J. Victor, Essentials of Bridge Engineering, Oxford & IBH Publishing Co. Pvt. Ltd.
- S. Ponnuswamy, Bridge Engineering, McGraw Hill Education.
- N. Krishna Raju, Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd.
- Saxena S. C. (2015). Tunnel Engineering, DhanpatRai Publications
- Srinivasan R., (2016). Harbour, Docks and Tunnel Engineering, Charotar Pub. House

Reference Books:

- Raina V K, "Handbook for Concrete Bridges" Vol. 1 and 2, Shroff Publishers, Mumbai
- Raina V. K., Concrete Bridge Practice, (Analysis, Design Economics), 4th Edition, Shroff Publishers, Mumbai

- Raina V. K., "World of Bridges", Shroff Publishers, Mumbai
- Stack, B. (1982). Handbook of Mining and Tunnelling Machinery, Wiley, New York
- Bickel J.O. and. Kuesel T.R, (2018). Tunnel Engineering Handbook, CBS Publishers and Distributors Pvt. Ltd.

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

CO1: Understand components of bridges and its various types.
CO2: Understand site selection criteria and comprehend various forces acting on bridges.
CO3: Analyze bridge structures using different analysis techniques
CO4: Understand types of tunnels and tunneling methods conforming to site conditions
CO5: Investigate various tunneling operations and relevant machinery required

☑☑☑☑☑☑☑☑☑☑☑

BTCIC 504 /BTCVC 504 Concrete Technology

Teaching Scheme: (2 Lectures) hours/week

Course Contents

Module 1: Introduction **(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: Fresh Concrete **(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: Admixtures In Concrete **(4 Lectures)**

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: Special concrete and Concreting methods **(8 Lectures)**

Desired Properties of Concrete, Strength, Durability & 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: Mix design of Concrete **(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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIES505 Artificial Intelligence (NPTEL/SWAYAM)

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 Lectures)**
Introduction: Philosophy of AI, Definitions; Modelling a Problem as Search Problem, Uninformed Search; Heuristic Search, Domain Relaxations

Module 2: **(6 Lectures)**
Local Search, Genetic Algorithms; Adversarial Search; Constraint Satisfaction

Module 3: **(6 Lectures)**
Propositional Logic & Satisfiability; Uncertainty in AI, Bayesian Networks

Module 4: **(6 Lectures)**
Bayesian Networks Learning & Inference, Decision Theory; Markov Decision Processes

Module 5: **(6 Lectures)**
Reinforcement Learning; Introduction to Deep Learning & Deep RL

Reference Books

- Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, Third Edition (2009) (required).
- Ian Good Fellow, Yoshua Bengio & Aaron Courville, Deep Learning, MIT Press (2016).
- An Introduction to Artificial Intelligence course by Prof. Mausam, IIT Delhi (https://onlinecourses.nptel.ac.in/noc22_cs56/preview)

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 A. Advanced Environmental Engg.

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:

CO 1. Determine the sewage characteristics and design various sewage treatment plants.

CO 2. Understand municipal water and wastewater treatment system design and operation.

CO 3. Apply environmental treatment technologies and design processes for treatment of industrial waste water.

CO 4. Understand the rural sanitation schemes.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 B. Applied Geology

Teaching Scheme: (3 Lectures) 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.
- Sathya Narayan Swami B. S., "Engineering Geology", Dhanpat Rai& 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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 C. Applied Hydraulics

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Basic Concepts **(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, Darcy Weisbach, 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: Impact Jet **(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: Pumps **(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

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 D. 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

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 E. Geomatics

Teaching Scheme: (3 Lectures) hours/week

Course 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 & 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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 F. Town and Urban Planning

Teaching Scheme: (3 Lectures) 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, Growth Centre Approach, Area Development Approach, Integrated Rural Development Approach

Text Books:

- Hiraskar G.K. (2018) “Town and country Planning” DhanpatRai Publication, N. Delhi
- Rangawala S.C. (2015) “Town Planning”, Charotar Publications, Anand
- Sundaram K.V. (1978) “Urban and Regional Planning in India”, Vikash Publishing House P.L
- MRTP Act 1966 & 2002
- Land Acquisition Act - 1894

- Misra S. N. (1984) "Rural Development Planning-Design and Method", Satvahan Publications, N. Delhi

Reference Books

- 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:

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

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 G. Material, Testing and 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.

Text 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

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 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: Analyse available alternatives and propose best suitable among them
CO3: Apply various models of financial management and accounting

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 I. Ropeway Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 **(8 Lectures)**

Historical background of ropeway transport, types of ropeways and their components, surface ropeway for passengers, aerial ropeway for passengers & goods gravity ropeway for goods, socio-economic and technical study, topographic study and engineering survey, geological and geotechnical study.

Module 2 **(8 Lectures)**

Design of ropeway system - General design requirements and design provisions.
Wire-Rope Design: Introduction to wire-ropes and their specifications loads on wire-rope wire-rope geometry deformation of wire-rope and its calculation nonlinear behavior of wire-rope and its analysis & design.

Module 3 **(8 Lectures)**

Design of Towers, design of tower foundation and wire-rope anchorage, Introduction to electro-mechanical system design, rate analysis, cost estimate, estimating and costing of gravity goods ropeway.

Module 4 **(6 Lectures)**

Planning, construction and maintenance of ropeway system construction planning setting out construction equipment transportation, handling and hoisting of wire-rope construction, installation and maintenance test operation and commissioning.

Module 5 **(4 Lectures)**

Quality Control and Safety, material testing, safety measures.

References:

- IS 9706:1997, IS code for aerial ropeway for transport of material
- IS 5229:1998, IS code for aerial ropeway for transport of passengers
- "Technical Guidelines for Gravity Goods Ropeway"; Do LIDAR, Ministry of Local Development Gyawali, D. & Dixit, A, "Ropeways in Nepal",
- "Technical Brief Gravity Ropeway", Practical Action Nepal
- Approved code of practice for passenger ropeways in New Zealand, 1998
- Aerial ropeways and funicular railways — ZBIGNIEW SCHINEIGET, Pergsmon press, Oxford London
- M. Kazakevitch. Zakora, "Cable Stabilization for Wind and Moving Load Effect", Journal of Wind Engineering and Industrial Aerodynamics (1998)

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

CO1: To introduce ropeway transport, types of ropeways and their components.
CO2: To make acquainted with the planning, analysis, design and construction of aerial and surface ropeway for passengers.
CO3: To make capable to plan, analyse, design and construct gravity ropeway for goods.

Course Objectives:

- To introduce ropeway transport, types of ropeways and their components.
- To make acquainted with the planning, analysis, design and construction of aerial and surface ropeway for passengers.
- To make capable to plan, analyze, design and construct gravity ropeway for goods.

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE506 J. Road Safety Audits

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 **(6 Lectures)**

Road safety in India – an overview, international road safety comparison, road traffic injury as a public health problem, traffic safety legislations and enforcement, education and road safety (non-engineering measures), Planning for network, land use and road environment for safety.

Module 2 **(6 Lectures)**

Designing for safety, road Link designs, junctions, accident and injury data recording, statistical issues in road safety, risk assessment models, speed and safety, evaluation of safety measures, highway safety (roadside hazard management), highway construction zone safety.

Module 3 **(6 Lectures)**

Safe urban roads and traffic calming at intersections, pedestrian safety and vulnerable road users (VRUs), variables influencing driver speed, ITS and asset management, road accident costing prehospital care, urban road safety audit, highway blackspots identification highway blackspot inspection.

Module 4 **(8 Lectures)**

Road safety audit process, design stage road safety audit, road safety audit in road works & pre-opening safety audit, safety audit of existing roads, road safety audit checklists, audit of construction site, most frequent problems, experiences in other countries, benefits of road safety measures what works and what does not work.

Module 5 **(8 Lectures)**

Introduction to road crash investigation: The importance of crash investigation for road safety, crash causation–causes, the relationship between crashes and traffic offences, definitions, investigations and prosecutions, series of events, pre-crash, crash, and post-crash factors, the human element, perception and reaction, crash reporting and its importance for predictive policing and engineering interventions.

References:

- Practical Road Safety Auditing, 3rd edition by Martin Belcher, Steve Proctor, Phil Cook, ICE Publishing USA.
- Road Safety in India: Status Report 2020 by Dinesh Mohan, Geetam Tiwari, Kavi Bhalla, Transportation Research & Injury Prevention Programme, Indian Institute of Technology Delhi. Link - http://tripp.iitd.ac.in/assets/publication/Road_Safety_in_India2018.pdf
- IRC: SP:88-2019, “Manual on road safety audit”, Indian Roads Congress Aug 2019.
- Advancing Road Safety in India Implementation is the key by National Institute of Mental Health and Neuro Sciences Bengaluru - 560 029, India

Link - https://nimhans.ac.in/wp-content/uploads/2019/02/UL_BR_b007_Summery-rprt.pdf

- Importance of Road Safety in India, by Lok Sabha Secretariat
  Link - http://164.100.47.193/Refinput/New_Reference_Notes/English/Road_Safety.pdf
- Road Safety and Traffic Management Policies, Regulations and Strategies by D P Gupta
  Link - http://tripp.iitd.ac.in/assets/newsimage/1-RoadSafetyPresentation-August2018.pdf

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

CO1: To teach road safety audit methodology at different stages of the road project i.e., feasibility, planning, designing, construction, pre-opening and for existing roads.

☑☑☑☑☑☑☑☑☑☑☑

BTCIES507 / 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/41/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 software's

CO2: Use applications of various software's in specialized works of civil engineering

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIL508 Soil Mechanics & Foundation Engineering Laboratory

Practical: 2 Hours / Week

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

1) Determination of moisture content & specific gravity

2) Field density test

3) Grain Size analysis – Sieve analysis & Hydrometer analysis

4)Determination of Atterberg's consistency limit

4) Determination of coefficient of permeability – Constant & Falling Head

5) Procter compaction test

6) Vane Shear Test

7) Direct shear box test

8) Tri-axial test

9) Unconfined compression test

10) One dimensional consolidation test

11) California bearing ratio test

12) Determination of modulus of subgrade reaction (k-value) of soils in field

13) Standard Penetration Test (SPT)

14) Pressuremeter test to determine in-situ stress strain response of soil

Note: Subject faculty can plan field visit to see plate load test and standard penetration 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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIL509 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.

☑☑☑☑☑☑☑☑☑☑☑

Evaluation of (BTCIP410) 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.

☑☑☑☑☑☑☑☑☑☑☑

Detailed Syllabus

Semester- VI										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 14	BTCIC601 / BTCVC601 /	Design of RC Structures	2	1	-	20	20	60	100	3
PCC 15	BTCIC602	Airport Engineering	2	1	-	20	20	60	100	3
HSSMC3	BTHM603	Project Management	3	-	-	20	20	60	100	3
PCC 16	BTCIC604	Railway Engineering	3	-	-	20	20	60	100	3
PEC 2	BTCIPE605	M. Industrial Waste Treatment N. Managerial Techniques O. Open Channel Flow P. Water Power Engineering Q. Soil Exploration & Ground Improvement Techniques R. Structural Audit S. Intelligent Transportation Systems T. Plastic Analysis of Structures U. Numerical Methods in Civil & Infrastructure Engg. V. Engineering Management W. Integrated Region and Smart City X. Pavement Design and Management	3	-	-	20	20	60	100	3
OEC 2	BTCIOE606	O. Environmental Impact Assessment P. Basic Human Rights Q. Business Communication and Presentation Skills R. Composite Materials S. Experimental Stress Analysis T. Python Programming U. Operation Research V. Applications of Remote Sensing and Geographic Information Systems W. Civionics: Instrumentation & Sensor Technologies for Civil Engineering X. Planning for Sustainable	3	-	-	20	20	60	100	3

		Y. Development Engineering Z. Graphs, Groups and Network AA. Introduction to Nanomaterials BB. Robotics & Robot Applications								
LC 9	BTHM607	Indian Constitution	2	-	-	50	-	-	50	Audit
LC 10	BTCIL608	Structural Design Lab.	-	-	2	20	-	30	50	1
HSSMC4	BTCIL609	Infrastructure Engineering Lab	-	-	2	20	-	30	50	1
Project	BTCIM610	Mini Project	-	-	2	20	-	30	50	1
Internship	BTCIP611	Field Training/ Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time)	-	-	-	-	-	-	-	Credits to be evaluated in VII Semester
		Total	**18**	**2**	**6**	**230**	**120**	**450**	**800**	**21**

BTCIC601 / BTCVC601 Design of RC Structures

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

Course Contents

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

Basic Aspects of Structural Design, Introduction to Design Philosophies, Stress Strain behaviour 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: Behaviour 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:
CO1: comprehend the various design philosophies used in design of reinforced concrete.
CO2: Analyze and design the reinforced concrete sections using working stress and limit state method.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIC602 Airport Engineering

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

Course Contents

Module 1 **(8 Lectures)**
General: History, development, policy of air transport, aircrafts, aerodromes, air transport authorities, air transport activities, air crafts and its characteristics, airport classifications as per ICAO.

Module 2 **(10 Lectures)**
Airport Planning: Regional planning-concepts and advantages, location and planning of airport as per ICAO and FAA. Airport Master plan, Airport site selection, Zoning laws,
Airport Elements -airfield, terminal area, zoning laws, classification of obstructions, approach zone, turning zone, airport capacity, runway capacity, estimation of future air traffic, development of new airport, requirements of an ideal airport layout.

Module 3 **(10 Lectures)**

Run Way Design: Wind rose and orientation of runway, wind coverage and crosswind component, factors affecting runway length, basic runway length and corrections to runway length, runway geometrics and runway patterns (configurations), Runway marking, threshold limits cross section of runway.

Taxiway Design: Controlling factors, taxiway geometric elements, layout, exit taxiway, location and geometrics, holding apron, turnaround facility.

Aprons: locations, size, gate positions, aircraft parking configurations and parking systems, hanger-site selection, planning and design considerations, Fuel storage area, blast pads. Wind direction indicator. LCN system of Pavement Design,

Airfield Pavement: Failures, Maintenance and Rehabilitation.

Module 4 **(10 Lectures)**

Terminal Area: Elements and requirements, terminal building functions, space requirements, location planning concepts, vehicular parking area and circulation network

Grading and Drainage: Airport grading-importance, operations, airport drainage aims, functions, special characteristics, basic requirements, Deign of drainage - surface and subsurface drainage systems,

Module 5 **(10 Lectures)**

Air Traffic Control and Visual Aids: Need of Air traffic control, Air traffic control network,
Air traffic control aids: landing information system, airport markings and lighting.

Text Books

- Dr. S. K. Khanna, M.G.Arora and S.S. Jain, "Airport Planning & Design", Nem Chand & Bros., Roorkee 5.
- G.V. Rao, "Airport Engineering", Tata McGraw Hill Pub. Co., New Delhi 6.
- S.C. Rangwala, P. S. Rangwala,"Airport Engineering", Charotar Publishing House Pvt. Ltd, Anand 7.
- Robert Horonief, Francis X. McKelvey, William J. Sproule, Seth B. Young, "Planning & Design of Airports", Mc Graw Hill Publication.

References Books

- Seth Young, Alexander T. Wells, "Airport Planning & Management", Macgraw Hill Professionals
- Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, "Airport Engineering: Planning, Design and Development of 21st Century Airports", John Wiley & Sons
- Richard de Neufville, Amedeo Odoni, "Airport System: Planning, Design and Management", Mc Graw Hill Education.

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

CO1: To understand the fundamentals of planning and design of Airport structures.
CO2: To design of runway and taxiways for Airport
CO3: To comprehend the use of Air Traffic Control and Visual Aids in the air traffic operation.

☑☑☑☑☑☑☑☑☑☑☑☑

BTHM603 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:

CO1: Understand various steps in project Management, different types of charts.
CO2: Construct network by using CPM and PERT method.
CO3: Determine the optimum duration of project with the help of various time estimates.
CO4: Know the concept of engineering economics, economic comparisons, and linear break even analysis problems.
CO5: Understand the concept of total quality Management including Juran and Deming's philosophy.

☑☑☑☑☑☑☑☑☑☑☑

BTCIC604 Railway Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(6 Lectures)**

Introduction: History, Indian Railways, recent developments, Importance of railways

Railway Track Gauge: Different gauges on Indian Railways, affecting factors, Uniformity of gauge loading gauge, construction gauge, Problems caused by change of gauge.

Module 2 **(6 Lectures)**

Alignment of Railway lines: Importance, Basic requirements of an ideal alignment, selection of a good alignment, Rack railway, Survey for track alignment

Track and Track stresses: Components, requirements, Cross section of permanent way, Track modulas Forces acting on Track, coning of wheels

Rails: Functions, requirement, types of rails, Standard rail sections, Causes of creep, Effects of creep, Measures to reduce creep, bulking, kinks, failure, wear

Module 3 **(8 Lectures)**

Sleeper: Functions, requirements, types of sleepers, sleeper density and spacing of sleepers.

Ballast: Function, requirement, specifications of track ballast.

Track fittings: Fittings and fastening

Module 4: **(8 Lectures)**

Geometric design of Track: Necessity for geometric design, Details of geometric design of track, Track, Gradients, Grade compensation on curves. Degree of Curve,safe speed on curves, Transition curve, Compound curves, Reverse curves, Extra clearance on curves, widening of gauge on curves, vertical curves, cheek rails on curves. and Super elevation

Resistance to Traction: Resistance to-friction, wave action, speed, track irregularity, wind, gradient, curvature,

Module 5: **(8 Lectures)**

Points and crossings: Functions, Turnout, points or switches, Crossings, Gauntleted track, triangle, double junctions, Single slip, double slip

Signal: Objectives – Classification – Fixed signals – Stop signals – Signalling systems – Mechanical signalling system – Electrical signalling system – System for Controlling Train Movement – Interlocking – Modern signaling Installations.

Text Books

- Satish Chandra and M.M. Agrawal, "Railway Engineering", Oxford University Press, New Delhi
- S.C. Saxena and S. P. Arora, "A Text Book of Railway Engineering", Dhanpat Rai & Sons, New Delhi
- S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, "Principles of Railway Engineering", Charotar Publishing House, Anand.

Reference Books

- Arora S. P. and Saxena (2001), "Railway Engineering", Dhanpat Rai Publishers, New Delhi, 2001

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

CO1: Know about railway track components, their materials, size, function and importance

CO2: Carry out geometric design of railway track

CO3: Recognize about various components in diverging, merging and crossings of railway tracks, stations, yards, signaling, interlocking and control systems.

BTCIPE605 A. 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

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 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 sigmas, 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.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 C. Open Channel Flow

Teaching Scheme: (3 Lectures) 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:

CO1: Understand phenomena of hydraulic jump.
CO2: Compute Discharge through various open channel sections.
CO3: Discuss different applications of gradually varied flow profiles.

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 D. Water Power Engineering

Teaching Scheme: (3 Lectures) 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, Behaviour, 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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 E. Soil Exploration & 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.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 F. 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 non-destructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.

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

CO1: Gain the knowledge of Bye laws, procedure of Structural audit and study the typical problems in structures.

CO2: Aware of causes and types of deterioration in structures.

CO3: Develop skills for use of various Non-destructive tests required during auditing of structures.

CO4: Strength evaluation of existing structures.

CO5: Acquire knowledge of legal procedure to conduct structural audits.
CO6: Prepare a Structural audit report.

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 G. Intelligent Transportation 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, traveller 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 platoons, 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 books

References

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

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

CO1: Gain the knowledge Intelligent transport components
CO2: Understand functional areas of ITS
CO3: Management of ITS and correlated systems

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 H. 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

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 I. Numerical Methods in Civil & Infrastructure Engg

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

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 J. Engineering Management

Teaching Scheme: (3 Lectures) hours/week

Course Contents

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

Scientific, human behaviour, 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.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 K.Integrated Region and Smart City

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Fundamental of smart city & Infrastructure **(Lectures 8)**

Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment

Module 2: Planning and development of Smart city Infrastructure **(Lectures 7)**

Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.

Module 3: Intelligent transport systems **(Lectures 08)**

Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing

Module 4: Management of water resources and related infrastructure **(Lectures 06)**

Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system

Module 5: Infrastructure Management system & Policy for Smart city (Lectures 07)
Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city.
Worldwide policies for smart city
Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.

Text Books

- Smart City on Future Life - Scientific Planning and Construction by Xianyi Li
- The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos
- Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend
- Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988
- Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997

Reference Books

- Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
- Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf

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

CO1: Understand the necessity of infrastructural development for smart cities.
CO2: Identify components of infrastructure and Prepare infrastructure plan for smart city.
CO3: Understand smart transport system for smart cities and its application
CO4: Study of water resources systems for smart city and its application.
CO5: Understand National and Global policies to implement for smart city development.

☑☑☑☑☑☑☑☑☑☑☑

BTCIPE605 L. Pavement Design and Management

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 (Lectures 8)
INTRODUCTION: Definition-Components of Pavement Management Systems, Pavement Management Levels and functions: Network and Project levels of PMS Influence Levels-PMS Functions-Function of Pavement evaluation - Requirements of PMS;
Pavement Management Data Needs: Classes of Data Required- Importance of Construction and Maintenance History Data- Importance of Pavement Evaluation;
Inventory Data: Purpose of Inventory Data-Types of Inventory Data -Selection and Referencing of Pavement Management Sections- Collecting and Processing Section and Network Data-Traffic and Truck Load Data.

Module 2 (Lectures 7)
PAVEMENT PERFORMANCE: Serviceability-Performance Concept - Pavement Roughness - Equipment for Evaluating Roughness - IRI - Relating Roughness to Serviceability - Structural Condition – Non

destructive Measurement and Analysis - Deflection Measurements - Ground Penetrating Radar - Destructive Structural Evaluation - Structural Capacity Index Concepts - Network versus Project Level Applications of Structural Capacity Evaluation; Pavement Surface Distress Condition Surveys: Purpose - Manual Methods of Survey - Automated Survey Methods - Types of Distress

Module 3 **(Lectures 08)**

EVALUATION OF PAVEMENT SAFETY: Major Safety Components - Skid Resistance Evaluation - Basic Concepts of Skid Resistance and the importance of Pavement Texture - Methods of Measuring and Reporting Skid Resistance - Change of Skid Resistance with Time, Traffic and Climate;

Combined Measures of Pavement Quality: Concept – Combined Indexes

Database Management: Introduction - Key Components – Advantages of Integrated Data Base Management - Success Factors for Effective Data Base Management

Pavement Deterioration Models: Clarification of Performance and deterioration Prediction- Parameters to be Predicted - Types.

Module 4 **(Lectures 06)**

REHABILITATION AND MAINTENANCE ALTERNATIVES: Identification of Alternatives - Pavement Preservation – Decision Process and Expert Systems Approach to identifying Feasible Alternative - Deterioration Modeling;

Priority Programming: Basic Approaches - Program Period - Functions - Methods - Budget Level Evaluation - Final Program Selection;

Framework for Pavement Design: Introduction - Focus on MEPDG - Structural Response Models - Characterization of Design Inputs - Variability, Reliability & Risk - Generating Alternative Design Strategies

Module 5 **(Lectures 07)**

MEPDG PROCESS FOR PAVEMENT DESIGN: Introduction - Calibration Issues - MEPDG Software - Levels of Use in the MEPDG - Life cycle pavement management - Principles - Design Inputs – Traffic Inputs - Climate Inputs - Pavement Performance;

MEPDG Rehabilitation of Existing Pavements: Introduction - Suggested Evaluation Data - Design with HMA - Design with PCC

Implementation of Pavement Management Systems: Key Components of Implementation - Role of Construction - Role of Maintenance - Research Management;

HDM-4: Functions - Structure - Program Analysis - Project Analysis;

Costs and Benefits of Pavement Management: Introduction - Quantifiable Benefits - Benefit/Cost of Developing and Using PMS – Examples

Text Books

- Ralph Haas, Ronald W. Hudson and Lynne Cowe Falls, ***Pavement Asset Management*** , Scrivener Publishing (Wiley) Co. 2015.
- Ralph Haas and Ronald W. Hudson, ***Pavement Management System*** , McGraw Hill Book Co. 1978

Reference Books

- Ralph Haas, Ronald Hudson Zanieswki. Modern Pavement Management, Kreiger Publications,2012.
- Proceedings of North American Conference on Managing Pavement.
- Proceedings of International Conference on Structural Design of Asphalt Pavements NCHRP, TRR and TRB Special Reports.

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

CO1: Illustrate components Inventory of Pavement Management Systems.

CO2: Describe the process of Pavement Performance like Roughness & Structural evaluation.

CO3: Illustrate the Evaluation of Pavement Safety & Quality.
CO4: Explain the concepts of design alternatives, Rehabilitation and Maintenance.
CO5: Describe about Implementation of Pavement Management Systems.

☑☑☑☑☑☑☑☑☑☑☑

BTCIOE 606A 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, Checklist's methods, Matrices methods, Network's methods, Overlay's 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

☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606B 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, Rights of 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 behaviour, 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

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

☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606C 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 Non-native 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

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606D 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

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606E 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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606F 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 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

☑☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606G 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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606H 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.

☑☑☑☑☑☑☑☑☑☑☑☑

BTCVOE606I 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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606J 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 06)**

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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIOE606K 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 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.

BTHM607 Indian Constitution

Teaching Scheme: (2 Lectures) hours/week

Course Contents

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.

☑☑☑☑☑☑☑☑☑☑☑

BTCIL608 Structural Design Laboratory

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

☑☑☑☑☑☑☑☑☑☑☑

BTCIL609 Infrastructure Engineering Laboratory

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. 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:

CO1: Perform tests on various road construction materials.

CO2: Perform CBR tests on local soils to determine subgrade properties needed for roadways

☑☑☑☑☑☑☑☑☑☑☑

BTCIM610 Mini Project

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

☑☑☑☑☑☑☑☑☑☑☑

BTCIP611 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.

☑☑☑☑☑☑☑☑☑☑☑