Syllabus for B.Tech. Civil Engineering (2020-24)

Third Semester

BB0025: VALUE, ETHICS & GOVERNANCE [2 0 0 2]

Relevance of Value Education in day-to-day life. Mantra for success - Value, Moral and Ethics. Determinants of human nature (Three Gunas) and its impact on human life. Relevance of Personality, Attitude, Behavior, Ego, Character, introspection, Motivation, Leadership and 4 Qs with relevant Case Studies*.Governance: Understanding of Public and Private sector Governance systems; Courts & CAG. Public Sector Governance: Need, relevance, stakeholders. Private Sector Governance: Proprietary, Partnership, Company (Pvt Ltd & Ltd), Company' Act 2013, Board of Directors; its Roles and Responsivities. Regulatory bodies; its role in ethical governance. Projects on PPP mode-relevance
& prospects. CSR: Relationship with Society, Philanthropy and Business strategy, CSR Policy, Triple Bottom Line. Suggestive Case Studies: Uphar Theatre Tragedy- Engineering Ethics, Bhopal Gas Tragedy- Operational Engineering Ethics, Satyam Case- Financial Reporting Ethics, Enron Case- Business Ethics, Navin Modi Case- Financial Fraudulence.

References:

1. Professional Module of ICSI.
2. B. N. Ghosh, *Business Ethics & Corporate Governance*, (1e) McGraw Hill, 2011.
3. S. K. Mandal, *Ethics in Business & Corporate Governance*, (2e), McGraw Hill, 2012.
4. C. K. Ray, *Corporate Governance, Value & Ethics*, Vaya Education of India, 2012.
5. Abha Chatterjee, *Professional Ethics*, (2e) Oxford Publications.

MA2104: ENGINEERING MATHEMATICS III [2 1 0 3]

Gradient, divergence and curl. Line, surface and volume integrals. Green's, Gauss divergence and Stokes' theorems. Fourier series of periodic functions. Half range expansions. Harmonic analysis. Fourier integrals. Sine and cosine integrals, Fourier transform, sine and cosine transforms. Partial differential equation- Basic concepts, solutions of equations involving derivatives with respect to one variable only. Solutions by indicated transformations and separation of variables. One dimensional wave equation, one dimensional heat equation and their solutions. Introduction to probability: finite sample space, conditional probability and independence. Bayes' theorem, One dimensional random variables: Mean and variance. Two and higher dimensional random variables: mean, variance, correlation coefficient and regression

References:

1. R. Spiegel Murray, *Vector Analysis*, Schaum Publishing Co., 1959.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, (9e), Wiley Eastern, 2006.
3. P. L. Meyer, *Introduction to Probability and Statistical Applications*, (2e), Oxford and IBH Publishing, Delhi, 1980.
4. B.S. Grewal, *Higher Engineering Mathematics*, 43(e), Khanna Publishers, 2014.

CV 2101: FLUID MECHANICS [3 1 0 4]

Introduction, Fluid Properties and Classification of Fluid, Pressure and its Measurement using manometers, Hydrostatics, Kinematics of Fluid Motion, Dynamics of Fluid Motion, Laminar Flow, Turbulent Flow, Flow Measurement, Dimensional Analysis, Flow in open Channels, Gradually varied flow rapidly varied flow.

References:

1. V. L. Streeter, E. B Wiley, *Fluid Mechanics*, McGraw Hill book Co., New York. 1998
2. A. Çengel Yunus, John M Cimbala, *Fluid Mechanics Fundamentals and Applications*, Tata McGraw Hill Education Pvt. Limited New Delhi, 2011
3. P. N. Modi, S. M. Seth, *Hydraulics and Fluid Mechanics*, Standard Book House, New Delhi. 2005
4. R. K. Bansal, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publishers, New Delhi. 2010
5. R.J. Garde, *Fluid Mechanics through problems*, New age international Pvt. Ltd., Publishing, New Delhi. 2003

CV 2102: BUILDING MATERIALS & CONSTRUCTION TECHNOLOGY [3 1 0 4]

Building Materials: Lime; Bricks; Tiles; Tar; FRP; Glass; Ferro-cement; Ceramics; Paints; Timber. Cement – Types, composition, properties and uses, physical tests on cement. Concrete: Ingredients and production, properties & tests on fresh and hardened concrete as per IS codes. Construction Technology: Classification of buildings, load bearing and framed structure; Sequence of construction activity; building components and its type, viz. foundations (shallow and deep), flooring, stairs, arches & lintels, roofs (trusses); Brick and Stone Masonry; Damp Proofing; Construction joints; Temporary

structural support viz. shoring, shuttering, underpinning and scaffolding; Fabrication and Erection work; Construction practices for plastering, pointing, painting, flooring.

References:

1. B. C. Punmia, A. K. Jain, A. K. Jain*, Building Construction*, Laxmi Publications, 11th Edition, 2016.
2. A. M. Neville, *Properties of Concrete*, McGraw-Hill, Singapore, 2012.
3. SP 20, *Handbook on Masonry Design and Construction*, B.I.S. Publication, 1991.
4. SP 62 (S&T), *Handbook on Building Construction Practices*, B.I.S. Publication, 1997.
5. B. C. Punmia, *Building Construction*, Lakshmi Publications, New Delhi, 2008.
6. S. K. Duggal, *Building Materials*, TMH Publication, 2010.

CV2103: SURVEYING [3 1 0 4]

Principles of surveying, Classification of surveying; Errors and their adjustment; Maps - scale, coordinate system; Chain surveying, compass surveying, Plane table surveying -Radiation and intersection methods; Levelling , trigonometric levelling; theodolite surveying and tachometry surveying; Traversing and triangulation survey, Contouring, using Total Station; curve setting-Horizontal and vertical curves. Photogrammetry - scale, flying height; Remote sensing - basics, platform and sensors, visual image interpretation; Electronic Distance Measurement., Basics of Geographical information system (GIS), Differential Geographical Positioning system (GPS/DGPS), Hydrographic Survey and surveying using Lidar.

References:

1. T. P. Kanetkar, S. V. Kulkarni, *Surveying and Levelling*, Part I and II, Pune Vidyarthi Griha Prakashana – Pune, 1996
2. B. C Punmia, *Surveying,* Vol. I, Lakshmi Publications, New Delhi, 2005.
3. Satheesh Gopi , R. Sathikumar, N. Madhu, *Advanced Surveying: Total Station, GIS and Remote Sensing*

CV2104: STRUCTURAL ANALYSIS [3 1 0 4]

Introduction, Thick Cylinders and Shells, Stresses due to Impact and Suddenly Applied Load, Compound Bars. Mohr's circle of stress and strain. Failure theories, analysis of Plane Truss: Method of joints and section, Shear force and bending moment diagrams for statically determinate beams. Influence line diagram. Determination slope and deflection using Macaulay's method, moment-area method and conjugate beam method. Stability of Columns- Euler's formula, Rankine-Gordon formula. Torsion of circular shaft. Analysis of Arches and Suspension Bridge.

References:

1. R. C. Hibbler, *Structural Analysis*, (8e), Pearsons, 2014
2. S. S. Bhavikatti, *Structural Analysis – II*, (4e), Vikas Publishing House Pvt. Ltd., 2018.
3. E. J. Hearn, *Mechanics of Materials, Vol. I*, (3e), Pergamon Press, 2008.
4. R. K. Rajput, *Strength of Materials*, (7e), S Chand & Co., 2018.
5. P. S. Gahlot, D. Gehlot, *Fundamentals of Structural Mechanics*, (1e), CBS Publishers & Distributors Pvt. Ltd., 2012.
6. R. Subramanian, *Strength of Materials*, (3e), Oxford University Press, 2016.

CV2130: MATERIAL TESTING LABORATORY [0 0 2 1]

Tension, shear and torsion test on mild steel, Compression test on cast iron, timber. Hardness test by Rockwell and Brinell's method. Impact test by Izod and Charpy method. Test on Bricks - Compressive Strength, Absorption, Efflorescence. Tests on Flooring and Roofing Tiles: Wear resistance (Dorry's abrasion Test), Knife Edge Load, Absorption. Determination of specific gravity, Fineness, standard consistency, setting time and soundness of cement. Determination of specific gravity and fineness modulus of fine aggregates. Determination of bulking and clay (or silt) content in sand. Determination of workability of concrete by slump test, compaction factor test and Vee - Bee consistometer method. Determination of compressive, tensile and flexural strength of concrete. Determination of permeability and modulus of elasticity of concrete. Introduction to Non-Destructive test of concrete.

References:

1. A.V.K Suryanarayana, *Testing of Metallic Materials*, Prentice Hall of India, New Delhi, 2007.
2. Technical Teachers, Training Institute, *Laboratory Manual of Strength of Materials*, Oxford University Press, 2010.
3. M.S Shetty, *Concrete Technology*, S. Chand and Co, 2018.
4. Neville, Brooks, *Concrete Technology*, Pearson Education, 2010.
5. G. Singh, *Materials of Construction*, Std. Publishers, 2017.

CV2131: SURVEYING PRACTICE [0 0 3 1]

Compass Survey-determine the magnetic bearing of a line, Plane table surveying - Radiation and intersection methods, Solving three point problem by Bessel's solution, Levelling; profile levelling, fly levelling, reciprocal levelling, Theodolite - Measurement of vertical angles and horizontal angles; Method of repetition, Method of reiteration, Distance between inaccessible points, height measurement by theodolite, triangulation survey, tachometric surveying, remote elevation measurements, measurement of area using planimeter and total station. Stereoscopy.

References:

1. T. P. Kanetkar, S. V. Kulkarni, *Surveying and Levelling*, Part I and II, Pune Vidyarthi Griha Prakashana – Pune, 1996
2. B. C Punmia, *Surveying,* Vol. I, Lakshmi Publications, New Delhi, 2005.
3. Satheesh Gopi, R. Sathi kumar, N. Madhu, *Advanced Surveying: Total Station, GIS and Remote Sensing*

Fourth Semester

EO2001: ECONOMICS [3 0 0 3]

Introduction: Definition, nature and scope of economics, introduction to micro and macroeconomics; Microeconomics: Consumer behaviour, cardinal and ordinal approaches of utility, law of diminishing marginal utility, theory of demand and supply, law of demand, exceptions to the law of demand, change in demand and change in quantity demanded, elasticity of demand and supply, Indifference curve, properties, consumer equilibrium, Price and income effect; Production: Law of production, production function, SR and LR production function, law of returns, Isoquant curve, characteristics, Isocost, producer's equilibrium; Cost and revenue analysis: Cost concepts, short run and long- run cost curves, TR, AR, MR; Various market situations: Characteristics and types, Break-even analysis; Macro Economics: National Income, Monetary and Fiscal Policies, Inflation, demand and supply of money, consumption function and business cycle.

References:

1. H.L Ahuja, *Macroeconomics Theory and Policy*, (20e), S. Chand Publication.
2. H.C. Peterson, *Managerial Economics*, (9e), 2012.
3. P.L. Mehta, *Managerial Economics*, Sultan Chand & Sons.
4. G.J. Tuesen, H.G. Tuesen, *Engineering Economics*, PHI.
5. J.L. Riggs, D.D. Bedworth, Sabah U Randhawa, *Engineering Economics*, Tata McGraw Hill.

MA2207: Engineering Mathematics IV [2 1 0 3]

Numerical solutions of partial differential equations by finite difference methods, five-point formula, Laplace Poisson Equations, Heat equation, Crank Nicolson's method, Wave equation., Introduction to calculus of variations, geodesics, isoperimetric problems, approximate methods, Weighted Residual Approach, Least square method. Application of Finite Difference technique: Statically determinate and indeterminate beams, Buckling of columns. Introduction to Tensor Analysis, Distributions: binomial, Poisson, uniform, normal, gamma, chi-square and exponential. Moment generating function, Functions of one dimensional and two dimensional random variables, Sampling theory, Central limit theorem and applications. Optimization Techniques: Introduction to Linear programming, Formation of Linear Programming problem, solution by graphical method, Simplex method. Two phase simplex method, Transportation problems.

References:

1. S. M. Rajasekaran, *Numerical methods for Science and Engineering*, Wheeler and Co. Pvt. Ltd., Allahabad, 1992.
2. S. S. Sastry, *Introductory methods of Numerical Analysis*, Prentice Hall of India, New Delhi. 1995.
3. A. R. Mitchel, R. Wait, *Finite Element Methods in Partial Differential Equations*, John Wiley, 1997.
4. P. L. Meyer, *Introduction to Probability and Statistical Applications*, (2e), Oxford and IBH Publishing, Delhi, 1980.

CV2201: ENGINEERING GEOLOGY [3 0 0 3]

Geology in Civil Engineering. Earth as a planet, internal structure and composition. Identification of rock-forming minerals and Ores, their physical and special properties. Sources of rocks, classification

of rocks, rock-cycle, Rock as building material. Rock folds, joints, faults, and unconformity, their recognition and importance in Civil Engineering field investigation. Weathering types, agencies, causes and products of weathering. Origin and development of river systems, geological action of wind and its geomorphic features. Hydrological cycle, distribution of ground water in the earth crust, selection of sites for well locations, geophysical techniques of ground water exploration, artificial recharge of groundwater methods, rain water harvesting. Plate tectonics, earthquake, seismic waves, characteristics of strong ground motions and attenuation. Tsunami and landslides. Geological considerations in selection of sites for Dams, Reservoirs, Tunnels, Bridges and Highways.

References:

1. P. Singh, *Engineering and General Geology*, (8e), New Delhi, India: S. K. Kataria and Sons, 2013.
2. D. V. Reddy, *Engineering Geology for Civil Engineering*, New Delhi, India: Oxford and IBH Publishing Co. Pvt. Ltd., 2012.
3. P. K. Mukherjee, *A Text Book of Geology*, Kolkata, India: World Press, 2005.

CV 2202: WATER SUPPLY ENGINEERING [3 1 0 4]

Introduction, Sources of water, Water collection works, Water demand, Population forecasting, Variation in water demand, Factors affecting water demand, Characteristics of water and its analysis, Drinking Water Standards (BIS and WHO), Design capacities for various water supply components. Treatment of Water: Primary, Secondary & tertiary treatment, Design of sedimentation tanks, Coagulation, flocculation & their design criteria including other treatment processes. Filtration theory & design, Disinfection-theory, methods of disinfection, softening, removal of taste, colour & odour, desalination, reverse osmosis, de-fluoridation and removal of other dissolved impurities. Design and layout of distribution systems & transmission, Hydraulic analysis of distribution systems, Pipe appurtenance & Design of plumbing system.

References:

1. S. K. Garg, *Environmental Engg.-I*, Khanna Publishers, New Delhi, 2012.
2. G. S. Birdie, *Water Supply and Sanitary Engineering*, Dhanpath Rai and Sons, New Delhi, 2012.
3. B. C. Punmia, *Water Supply and Sanitary Engg*., Dhanpath Rai and Sons, New Delhi, 2010
4. Modi, Sethi, *Water Supply and Sanitary Engg,* Dhanpath Rai and Sons, New Delhi, 2010.
5. Manual on water supply and treatment CPHEEO, Ministry of Urban development, New Delhi, 1991.

CV2203: ANALYSIS OF INDETERMINATE STRUCTURES [3 1 0 4]

Introduction to indeterminate structures, degrees of freedom per node, static and kinematic indeterminacy. Analysis of beams and frames by slope deflection method, analysis of fixed and continuous beams by theorem of three moments. Analysis of structures using moment distribution methods. Portal frame method, Cantilever method of analysis of frames. Unit load method. Unit load method. Strain energy for gradually applied, suddenly applied and impact loads, Strain energy due to axial loads, bending, shear and torsion; Introduction to matrix method of structural analysis.

References:

1. C. K. Wang, *Indeterminate Structural Analysis*, Indian Ed., McGraw Hill Education, 2017
2. S. Timoshenko, D. H. Young , *Mechanics of Structures*, (3e), Mc Graw Hill Book Co., 2015
3. R. C Hibbler , *Structural Analysis*, (8e), Pearsons, 2014
4. B. C. Punmia, *Strength of Materials and Mechanics of Structures: Vol. I*, (10e), Laxmi Publications (P) Ltd., 2018
5. S. B. Junarkar, H. J. Shah, *Mechanics of Structures Vol.-I*, (3e), Charotar Publishing House, 2013
6. S. P. Gupta, G. S. Pandit, R. Gupta, (3e), Str*uctural Analysis – A Matrix Approach-Volume 2*, McGraw Hill, New Delhi, 2016.

CV2230: Geology Lab [0 0 2 1]

Identification and description of rock-forming minerals with uses and distribution in India. Megascopic study of rocks with their properties and their importance in Civil engineering. Interpretation of horizontal, inclined and vertical rock beds with fold, fault and unconformity from geological maps. Determination of thickness of sub-surface rock-strata on horizontal ground, dip and strike problems, Borehole problems and their uses in dams, tunnels and reservoir site.

References:

1. R. J. Lisle, *Geological Structures and Maps: A Practical Guide*, (3e), Burlington MA, USA, Elsevier, 2004.
2. M. T. M. Reddy, *Engineering Geology Practicals*, New Delhi, India: New Age International

Publishers, 2002.
3. W. Gokhale, *Manual of Geological Maps*, New Delhi, India: CBS Publications, 1987

CV2231: FLUID MECHANICS LAB [0 0 2 1]

Calibration of V - Notch, Rectangular notch, Cippoletti Notch, Broad crested weir, curved weir, orifices, mouth pieces, Venturimeter, orifice meter, Venturi flume, standing wave flume, Determination of Friction factor of pipes, Tests on Impact of jet on Vanes, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine.

References:

1. P. N. Modi, S. M. Seth, *Hydraulics and Fluid Mechanics,* Standard Book House, New Delhi, 2005
2. V. L. Streeter, E. B. Wiley, *Fluid Mechanics*, McGraw Hill Co. New York, 1998.

CV2232: BUILDING PLANNING AND DRAWING PRACTICE [1 0 3 2]

Foundations: Masonry foundations, RCC Footings - Isolated, Combined and Raft footings; Doors and Windows: Wooden and Aluminium doors, PVC and Steel doors such as Collapsible Doors, Wooden windows, Aluminium windows; Designing and Drawing of Residential Buildings/ Studio apartments: Plan, Elevation and Sectional views, Designing and Drawing of Public Buildings: Plan, Elevation and Sectional views of School, Bank, and Health Centre for the given Line Diagram; Introduction to Auto cad: Drafting plan and elevation of single bed room RCC building with flat roof.

References:

1. T. S. Balagopal Pabhu, K.V Paul and C Vijayan, *Building Design of Civil Engg. Drawing,* Spades Publishers, Calicut, 1999.
2. M. G Shah, C. M Kale, & S Patki, *Building Drawing: with an integrated approach to built environment*. Tata McGraw-Hill Education, 2002.
3. S. C Rangwala, *Elementary and Advanced Building Construction*, 2009.
4. V. B Sikka, *A course in civil engineering drawing*, S.K. Kataria & Sons, Reprint 2013.

OPEN ELECTIVE – I

CV2080: ENVIRONMENTAL IMPACT ASSESSMENT [3 0 0 3]

Introduction and concepts: Definitions and concepts, rationale and historical development of EIA, EIA laws and regulations, The Environmental Protection Act, The Water Prevention Act, The Air (Prevention & Control of Pollution Act.), Wild life Act etc. EIA Methodologies: introduction, Criteria for the selection of EIA Methodology, EIA methods, Effect of human activity on environment, concept of eco-system imbalances, definition of EIA, EIS, EMP, industrial policy of the Govt. of India. Prediction and Assessments of Impacts: Impacts on air, water, biota, noise, cultural and socio-economic environment. Air Quality Impact: Air quality indices, air quality impact of industry transport systems, human settlements. Methods of assessment, mitigation of impact. Water quality impact: Water quality criteria, standards and indices, Impacts on water quality of development projects. Biota and noise: Impact on flora and fauna, mitigation measures, alternatives. Effects of noise on people, noise scales and rating methods. Estimating transportation noise impacts. Cultural and socio economic impacts: Effect of developmental projects on cultural and social settings and economic profile of the community. Methodologies for EIA: Preliminary assessment, quantification, comparison of alternatives and comprehensive EIA's. Environmental audit: meaning and importance.

References:

1. C. C. Lee, S. D. Lin, *Handbook of Environmental Engineering Calculations*, McGraw Hill, New York, 1999.
2. C. N. Sawyer, P. L. McCarty, *Chemistry for Environmental Engineering and Science*, 5th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2003.
3. A.C. Stern, *Air Pollution*, Academic Press, Inc. New York, 1991.
4. P. Wathern, *Environmental Impact Assessment: Theory and Practice*, Taylor & Francis, New York, 2002.
5. Y. Anjaneyulu, *Environmental Impact Assessment Methodologies*, B.S. Publications; New Delhi, 2 editions, 2010.

CV2081: CONTRACT MANAGEMENT [3 0 0 3]

Project Cost Estimation, rate analysis, overhead charges, bidding models and bidding strategies, Owner's and contractor's estimate; Pre-qualification of bidders and enlistment of contractors; Tendering and contractual procedures: Indian Contract Act1872, Definition of Contract and its applicability, Types of contracts, International contracts, FIDIC, Conditions and specifications of contract; Contract administration, Duties and responsibilities of parties; Claims, compensation and

disputes; Dispute resolution techniques, Arbitration and Conciliation Act 1996, Arbitration case studies, Negotiation

References:

1. B. S. Patil, *Civil Engineering Contracts and Estimates*, University Press, 2009.
2. G. Betty John, *Engineering Contracts*, McGraw Hills 19
3. B. J. Vasavada, *Engineering Contracts and Arbitration*, Jubilee Publications, 2nd Edition, 1996.
4. K. N. Vaid, *Global perspective on International Construction Contracting Technology and Project Management*, NICMAR.

CV2082: BUILDING PLANNING [3 0 0 3]

Introduction: Significance of building planning, NBC Classification of buildings, Orientation: Meaning, factors affecting orientation, orientation criteria for tropical climate. Sun Considerations: Different methods of drawing sun chart, sun shading devices, energy conservation in buildings, passive solar cooling and heating of buildings. Climatic and comfort Consideration: Elements of climate, introduction to global climate, climatic zones of India, comfort conditions, bi-climatic chart, climate modulating devices. Building Bye Laws: Objective of by-laws, NBC Regulation regarding; means of access, lines of building frontages, covered area, floor area ratio, open spaces around buildings, height & sizes of rooms, plinth regulation and sanitation provisions. Principles of Planning: Different factors affecting planning, prospect, furniture requirement, roominess, grouping, circulation, elegance, privacy. Residential Buildings: Anthropometry, activities and their spatial requirements; Area planning, living area, sleeping area, service area; Bubble diagram showing sequence of arrangement of area, plan, elevation, sectional elevation. Buildings Services: Lighting and ventilation, doors and windows, lifts, Acoustics, sound insulation and noise control, Firefighting provisions.

References:

1. Bureau of Indian Standards, National Building Code, 2016
2. M. Karlen, *Space Planning Basics*, John Wiley & Sons; 2nd Edition, 2003.
3. O. H. Koenigsberger, T. G. Ingersoll, A. Mayhew, S. V. Szokolav, *Manual of Tropical Housing and Buildings*, Universities Press, 2014.
4. S. S. Bhavikatti, M. V. Chitawadagi, *Building Planning and Drawing*, I K International Publishing House, 2014.
5. SP41

Fifth Semester

BB0026: ORGANISATION AND MANAGEMENT [3 0 0 3]

Meaning and definition of an organization, Necessity of Organization, Principles of Organization, Formal and Informal Organizations. Management: Functions of Management, Levels of Management, Managerial Skills, Importance of Management, Models of Management, Scientific Management, Forms of Ownership, Organizational Structures, Purchasing and Marketing Management, Functions of Purchasing Department, Methods of Purchasing, Marketing, Functions of Marketing, Advertising. Introduction, Functions of Personal Management, Development of Personal Policy, Manpower Planning, Recruitment and Selection of manpower**.** Motivation – Introduction, Human needs, Maslow's Hierarchy of needs, Types of Motivation, Techniques of Motivation, Motivation Theories, McGregor's Theory, Herzberg's Hygiene Maintenance Theory. Leadership - Introduction Qualities of a good Leader, Leadership Styles, Leadership Approach, Leadership Theories. Entrepreneurship-Introduction, Entrepreneurship Development, Entrepreneurial Characteristics, Need for Promotion of Entrepreneurship, Steps for establishing small scale unit**.** Data and Information; Need, function and Importance of MIS; Evolution of MIS; Organizational Structure and MIS, Computers and MIS, Classification of Information Systems, Information Support for functional areas of management.

Reference:

1. H. Koontz, *Essentials of Management*, Tata McGraw Hill, New Delhi, 1990.
2. S.P. Robbins, M. Coulter, *Management, Prentice Hall*, New Delhi, 2002.
3. E. S. Buffa, R. K. Sarin, *Modern Production / Operations Management*, (8e), Wiley, 1987.
4. H. J. Arnold, D. C. Feldman, *Organizational Behavior*, McGraw – Hill, 1986.
5. K. Aswathappa, *Human Resource and Personnel Management*, Tata McGraw Hill, 2005.
6. W. Wether, K. Davis, *Human Resource and Personnel Management*, McGraw Hill, 1986.

CV3101: GEOTECHNICAL ENGINEERING [3 1 0 4]

Introduction: Definition, Historical development of Geotechnical Engineering. Basic Definitions and Relationships: Phase relationships of soil, Basic definitions, Volume relationships, Weight relationships, Relative density. Determination of Index Properties: Particle size distribution by sieve and sedimentation analysis and Consistency limits. Classification of Soils: Gradation of soil, Particle size classification, Unified Soil Classification and Indian Standard Classification. Soil Structure and Clay Mineralogy: Inter-particle forces; Diffused Double Layer, Clay minerals and their properties. Flow through Soils: Darcy's law, Factors affecting and Determination of permeability. Stress in Soil Mass: Total, effective and neutral stress, Effective stress principle, Stress point and Stress path, Calculation of stresses, Soil-water systems-capillarity and Quick sand phenomenon. Seepage Analysis: Seepage forces, One dimensional and two dimensional flow, Laplace equation, Stream and potential functions, Uses of flow net, Determination of phreatic line of an earthen dam and Design of filters. Compaction of Soils: Theory of compaction, Laboratory compaction tests, Factors affecting compaction, Methods of compaction and types of equipment used in field. Shear Strength of Soils: Mohr's circle, Mohr's strength theory, Mohr-Coulomb's strength theory, Determination of shear strength parameters: Direct Shear Test, Unconfined Compression Test, Vane Shear Test, and Tri-axial Shear Test.

References:

1. V. N. S. Murthy, *Soil Mechanics and Foundation Engineering: A Book for Students and Practicing Engineers,* Dhanpat Rai, 1977.
2. K. R. Arora, *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, New Delhi, 2005
3. Alam Singh, *Soil Engineering in Theory and practice*, CBS Publishers and Distributors, Delhi, 2006
4. K. Terzaghi, R. B. Peck, Messi Gholamreza, *Soil Mechanics in Engineering Practice*, Wiley India (P) Ltd., New Delhi, (3e), 2013
5. T. W Lambe, R. V. Whitman, *Soil Mechanics*, John Wiley and Sons, Inc., 1969

CV3102: HIGHWAY ENGINEERING [3 1 0 4]

Highway classifications, design of road length as per 20 year plans, Geometric design. Sight distance-stopping and overtaking, horizontal curve, extra widening. Super elevation, transition curve, vertical curves-summit and valley Curves, design problems, design of cross drainage structures. Pavement materials, design of bituminous mixes. Design of flexible pavements, rigid pavement design, stresses in rigid pavement, joints and failures of rigid pavement. Highway economics and finance: Methods of Economic Analysis-benefit cost ratio, net present value method. Transport planning. Introduction to pavement overlay. Traffic engineering: Traffic engineering, vehicular and road user characteristics. Traffic studies, relation between speed, travel time and traffic volume. Traffic density and passenger car units, traffic signs and traffic signals, design of traffic signals. Accident studies – overview, objectives, causes, accident analysis and road safety

References:

1. S. K. Khanna, C.E.G. Justo, *Highway Engineering*, Nemchand and Bros., Roorkee, 2013
2. L. R. Kadiyali, *Traffic Engineering and Transportation Planning*, Khanna Publisher, New Delhi 2002
3. C. S. Papacoastas, P. D. Prevedouros, *Transportation Engineering and Planning,* Prentice Hall, 2002.
4. Jotin Khisty, B. Kent Lal, *Introduction to Transportation Engineering*, Prentice Hall, edition 2002

CV3103: DESIGN OF REINFORCED CONCRETE STRUCTURES [3 1 0 4]

Introduction: Overview and scope of the subject. Limit state method design and analysis of singly reinforced, doubly reinforced, and flanged beams. Analysis and design of flexural members in shear. Limit state Design of one way and two way slabs. Design of columns. Limit state design of footings. Determination of short term, long term deflections of R.C beams & Crack width; Use of SP16 handbook.

References:

1. J. N Bandyopadhyay, *Design of Concrete Structures*, Prentice Hall of India, New Delhi.
2. S. U. Pillai, D. Menon, *Reinforced Concrete Design*, Tata McGraw Hill, 2017.

3. N. Krishna Raju, *Design of Reinforced Structures IS 456:2000,* 4e, CBS Pub. and Distributors Ltd., 2016
4. P. C. Verghese, *Limit State Design of Reinforced Concrete*, Prentice Hall of India, New Delhi, 2009.
5. H. J. Shah, *Reinforced Concrete, Vol. I*, Charotar Publishing house, Anand, 2016.
6. M. L. Gambhir, *Design of Reinforced Concrete Structures*, PHI Learning, 2012.

CV3104: WASTE WATER MANAGEMENT [3 1 0 4]

Overview and general terms. Characteristics of sewage, standards of disposal into natural waters and on land, Indian standards. Collection of sewage, components of sewerage systems and layout, quantity of sanitary sewage and variations. Hydraulic design of sewers. Treatment of sewage: Various units and their purposes, layout of different units, preliminary treatment, screening and grit removal units, oil and grease removal, primary treatment, secondary treatment, activated sludge process, Membrane bioreactor technology, Sequencing batch reactor, trickling filter, sludge digestion and drying beds, stabilization pond, septic tank, soakage systems, recent trends in sewage treatment. Advanced wastewater treatment - nutrient removal. Waste water disposal and reuse: Disposal of sewage by dilution, self- purification of streams, sewage disposal by irrigation, sewage farming and waste water reuse. Plumbing of building and layout of house drainage

References:

1. C. Sawyer, P, McCarty and G. Parkin, *Chemistry for Environmental Engineering and Science*, 5/e, McGraw Hill, New Delhi, 2003.
2. IS Standards 2490 - 1974, 3360 – 1974, 3307 – 1974, Indian Standard Institution, Manak Bhavan, New Delhi.
3. *Manual on sewage and sewage treatment CPHEO*, Ministry of Urban development, New Delhi.
4. Metcalf, Eddy, *Waste Water Engg, Treatment and Reuse*, Tata McGraw Hill, New Delhi, 1974.
5. *Standard Methods*, APHEA, American Public Health Association, 1015 Fifteenth Street, NW Washington DC.
6. S. K. Garg, *Environmental Engg- II*, Volume – II, Khanna Publishers, New Delhi, 2015.
7. G. S. Birdie, *Water Supply and Sanitary Engineering*, Dhanpat Rai and Sons, New Delhi, 2012

CV3130: GEOTECHNICAL ENGINEERING LABORATORY [0 0 2 1]

Determination of water content, specific gravity, particle size distribution of coarse and fine grained soils; Atterberg's limits of soil; Determination of dry density of natural soil; Determination of relative density of coarse grained soils; Determination of compaction characteristics of soils using standard Proctor and modified Proctor method; Determination of California Bearing Ratio (CBR) of soil in dry and wet condition; Determination of Unconfined Compressive Strength (UCS) of soil; Determination of shear strength parameters of soil using direct shear test; Determination of shear strength of clay by using Vane shear test; Determination of the coefficient of permeability of soils by constant and falling head method; Determination of shear strength parameters of soils using Triaxial tests; Determination of compressibility characteristics of soil by using one dimensional oedometer test.

References:

1. Relevant IS codes.
2. J. E. Bowles, *Engineering properties of soil and their measurement*, (2e), McGraw – Hill Book Company, New York, 1986
3. T. W. Lambe, *Soil testing for Engineers*, John Wiley and Sons, INC, 1951.
4. Liu Cheng, B. Evett Jack, *Soil properties, Testing, Measurement and Evaluation*, Prentice-Hall, Inc. Englewood Cliffs, New Jersey, 1987
5. K. R. Arora, *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, New Delhi, 2005

CV3131: ENVIRONMENTAL ENGINEERING LABORATORY [0 0 2 1]

Determination of solids - total solids, suspended solids, dissolved solids, volatile solids, fixed solids, settle able solids. Determination of turbidity in water sample and Jar test for determination of optimum coagulant dose. Determination of pH, alkalinity, acidity and chloride in the given water sample. Determination of Calcium, Magnesium and total hardness in the given water sample. Determination of dissolved oxygen in the given water sample. Residual chlorine and chlorine demand in the given water sample. Determination of percentage available chlorine in Bleaching powder. Determination of

Fluorides in the given water sample. Determination of Biochemical Oxygen Demand in the given water sample. Determination of Chemical Oxygen. Total count test and determination of most probable number in the given water sample. Determination of PM10 and PM2.5, sulphur dioxide and oxides of nitrogen from ambient air. Measurement of noise level. Demonstration of pipes, joints and fixtures, sanitary fittings.

References:

1. Standard Methods for the Examination of Water and Waste Water - ALPHA - AWWA – WPCF.
2. C. McCarty, P. Sawyer, G. Parkin, "*Chemistry for Environmental Engineering",* McGraw Hill, New York. 1994.
3. IS - 3025 - 1964 - *Methods of Sampling and Test (Physical and Chemical) for Water Used in Industry*, IIT New Delhi.
4. Drinking water Standards IS - 10500-1991.

Sixth Semester

CV3201: APPLIED GEOTECHNICAL ENGINEERING [3 1 0 4]

Stress Distribution in Soils: Elastic theories of stress distributions in soils, Pressure distribution diagram, vertical pressure under uniformly loaded circular and rectangular area, Newmark's influence chart; Contact Pressure. Consolidation of soils: Terzaghi's one dimension consolidation theory, Normally, under and over consolidated soils, Laboratory one-dimensional consolidation test, Compressibility characteristics, Determination of void ratio, Coefficient of volume change, Coefficient of consolidation and settlement, Estimation of pre-consolidation pressure, Time factor, Degree of consolidation, and Factors influencing compressibility behaviours of soils. Stability of Slopes: Classifications of slopes, Mode and causes of slope failures, Stability analysis of infinite slopes, Stability analysis of finite slopes by Swedish circle method, Stability analysis by Taylor's stability number, Bishop's method of stability analysis. Earth Pressure: Theories of earth pressure, Culman's graphical methods for earth pressure for vertical and inclined back retaining walls horizontal and inclined cohesionless back fill. Shallow Foundations: Bearing capacity and its types, Types of foundations, Terzaghi and Meyerhoff's theory for bearing capacity, Skempton's method for cohesive soil, Effect of eccentricity and water table on bearing capacity. Deep Foundations: Types of piles, Load carrying capacity of piles, Static and dynamic formulae; Group behaviour of piles; Negative skin friction and Pile testing. Site Investigations: Methods of explorations; Plate load and Penetration tests for determining bearing capacity, Introduction to geophysical methods of investigations.

References:

1. V. N. S. Murthy, *Soil Mechanics and Foundation Engineering: A Book for Students and Practicing Engineers*, Dhanpat Rai, 2015
2. K. R., Arora*, Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, New Delhi, 2009
3. Alam Singh, *Soil Engineering in Theory and practice*, CBS Publishers and Distributors, Delhi, 2009
4. K. Terzaghi, R. B. Peck, Gholamreza Messi, *Soil Mechanics in Engineering Practice*, Wiley India (P) Ltd., New Delhi, (3e), 2013
5. J. E. Bowles, *Foundation Analysis and Design*, McGraw Hill, New York, 2017

CV3202: DESIGN OF STEEL STRUCTURES [3 1 0 4]

Scope and use of structural steel. Structural fasteners: Bolted and welded connections. Design of Tension members. Sections with welded and bolted connections, lug angle. Design of compression member. Design of column splices. Design of column base. Design of beams- laterally supported and laterally unsupported compression flange. Plastic analysis. Design of Industrial buildings.

References:

1. N. Subramanian, *Design of Steel Structures*, Oxford University press, New Delhi, 2016.
2. S.K. Duggal, *Limit State Method of Design of Steel Structures*, Tata McGraw-Hill, New Delhi, 2017.
3. M.R. Shiyekar, *Limit State Design in Structural Steel*, PHI Learning Pvt. Ltd., 2017.
4. K.M. Ghosh, *Analysis and Design: Practice of Steel Structures*, PHI Learning Pvt. Ltd., 2014.

CV 3204: WATER RESOURCE ENGINEERING [3 0 0 3]

Introduction: Scope and need of the subject, Hydrology, rainfall and runoff process, infiltration. Flood studies and hydrographs, River Engineering, Methods of design of stable channels, Energy

dissipation, Reservoir Planning, Design of Diversion and Storage works, River training works, Dams and basic principles of design. GIS application in Water Resources Engineering.

References:

1. Viessman, Knapp, *Introduction to Hydrology*, Harper and Row Publishers, Singapore. 2015
2. H. M. Raghunath, *Hydrology*, Wiley Eastern publications, Delhi. 2015
3. S.K. Garg, *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers, Delhi. 2012
4. P. N. Modi, *Irrigation, Water resource and Water Power*, Standard book house publications, Delhi. 2014
5. H. J. Shah, *Reinforced Concrete*, Vol. I, Charotar Publishing house, Anand, 2016.
6. M. L. Gambhir, *Design of Reinforced Concrete Structures*, PHI Learning, 2012.

CV3230: COMPUTER AIDED DESIGN LAB [0 0 2 1]

Introduction to STAAD Pro. Software package- it is widely used for structural analysis and design of civil engineering structures. Modeling, analysis and design of continuous beams, plane trusses, plane frames, space frames, G+4 building using STAAD Pro.

References:

1. "*STAAD.Pro V8i (SELECTseries 4) Technical Reference Manua*l," no. November, 2012.
2. M. N. S. Prakash and G. S. Suresh, *Reference book on computer aided design laboratory : civil engineering : application of C-Graphics and Excel included*. Laxmi Pub, 2006.
3. D. Rajendran, *Analysis & Design of a Multistorey Building using STAAD.Pro & E-TABS (with Manual Calculation),* First Edition. Designtech Publishers, 2016.

CV3231: HIGHWAY ENGINEERING LAB [0 0 2 1]

Determination of Penetration value, Ductility value, softening point, Flash and Fire point and Specific Gravity of Bitumen. Determination of Flakiness and Elongation index of aggregates.Determination of Abrasion value, Specific gravity and water absorption of aggregates. Determination of Marshall Stability and flow value of Hot Mix Asphalt (HMA). Determination of Optimum binder content (OBC) of HMA. Determination of viscosity of Bitumen using Brookfield viscometer. Demonstration of Pavement maintenance management system (PMMS) using HDM-IV software. Demonstration of Highway Alignment using MXRoads software.

References:

1. S. K. Khanna, C. Justo, A. Veeraragavan. *Highway materials and pavement testing* (Laboratory Manual). Nemchand and Bros, Roorkee (2000).
2. IRC SP 057:2000- Guidelines on Quality Systems for Roads, Indian Roads Congress, New Delhi.

CV3233: ESTIMATION COSTING PRACTICE [0 0 3 1]

Estimation of Earthwork for building foundation, brickwork for masonry work, RCC work, Plastering work, painting and water proofing work. Anti-termite treatment, skirting, door and windows, staircase. Rate Analysis for earthwork, brickwork, RCC, flooring and plastering work. Bill of quantity.

References:

1. B. N. Dutta, *Estimating and Costing in Civil Engineering*, UBS Publishers' Distributors Ltd. Sixteenth reprint, 2000.
2. M. Chakraborti, *Estimating, Costing, Specification & Valuation in Civil Engineering*, Published by the Author, Sixteenth edition, 2003.

CV3270: PROJECT BASED LEARNING [0 0 2 1]

Students are required to work on projects relevant to Civil Engineering discipline under the guidance of mentors. Project work will be done in VI semester. The educational value of project-based learning is aimed to build students creative capacity to work through different scenario, commonly in small teams. Typically, project-based learning takes through the following phases or steps: identifying a problem and potential solution based on feedback from experts, instructors, and/or peers. Depending on the goals of the instructor, the size and scope of the project can vary accordingly.

PROGRAM ELECTIVES- I & II

CV 3240: FINITE ELEMENT ANALYSIS [3 0 0 3]

Introduction to finite element analysis: Basic concept, theory of elasticity - constitutive relationships - plane stress and plane strain. Concept of an element, types of elements, displacement models -

compatibility and convergence requirements, displacement models by generalised coordinates, Lagrangian polynomials and Hermitian polynomials. Variational method of formulation, Application of Finite element method to pin jointed and rigid jointed structures, Application to plane stress and plane strain problems.

References:

1. K. J. Bathe, *Numerical methods in Finite Element Analysis*, Prentice-Hall, 1976.
2. D. Robert, C. David, S. Malkus, *Concepts and applications of Finite Element Analysis,* 1987.
3. O. C. Zienkiewicz, R. L. Taylor, J. Z. Zhu, *The Finite Element Method: Its Basis and Fundamentals*, Butterworth-Heinemann, 2005.
4. J. Chaskalovic, *Finite Elements Methods for Engineering Sciences*, Springer Verlag, 2008

CV3241: ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES [3 0 0 3]

Introduction, Design of a Continuous beams. Design of single span and continuous deep beams with and without opening, Design example of a typical Silo, Design of bunker. Design of retaining walls, Design of water tanks (elevated and underground). Introduction to types of trusses and a design example of a fink type Truss. Design of the curved beam. Various types of stresses in chimney and design of concrete chimney

References:

1. J. N. Bandyopadhyay, *Design of Concrete Structures*, Prentice Hall of India, New Delhi, 2008.
2. S. S Bhavikatti, *Advanced RCC Design,* (Vol II), New Age International Publishers, 2016.
3. P. C. Verghese, *Advanced Reinforced Concrete*, Prentice Hall India, New Delhi, 2010.
4. N. Krishna Raju, *Design of Reinforced Structures*, CBS Publishers & Distributors, 2016.
5. P. C. Verghese, *Limit State Design of Reinforced Concrete*, Prentice Hall of India, New Delhi, 2009.

CV3242: ENVIRONMENTAL IMPACT ASSESSMENT [3 0 0 3]

Definitions and concepts, rationale and historical development of EIA, EIA process in India and other countries, EIA laws and regulations, The Environmental Protection Act, The Water Prevention Act, The Air (Prevention & Control of Pollution Act.), Wild life Act etc. EIA Methodologies: introduction, Criteria for the selection of EIA Methodology, EIA methods, Adhoc methods, Matrix methods, Network method, Environmental Media Quality Index method, Overlay methods and Cost/benefit Analysis. Planning and Management of impact studies; Impact identification: Matrices, Networks, and Checklists. Description of affected environment, Indices and indicators for describing affected environment; Prediction and Assessment of Impacts: Air, Surface water, Soil and groundwater, Noise, Biological, Cultural and socio-economic environment, Decision methods for evaluation of alternatives, Public participation in environmental decision making; Documentation and environmental monitoring: Case studies, Environmental audit, Meaning, Importance.

References:

1. L. W. Canter, *Environmental Impact Assessment*, (2e), McGraw-Hill, 1997
2. Y. Anjaneyulu, *Environmental Impact Assessment Methodologies*, by, B.S. Publication, Sultan Bazar, Hyderabad, 2006.
3. P. Judith, G. Eduljee, *Environmental Impact Assessment for Waste Treatment and Disposal Facilities*, John Wiley & Sons, 1994
4. G. Burke, B. R. Singh, L. Theodore. *Handbook of Environmental Management and Technology*, (2e), John Wiley & Sons, 2000.

CV3243 AIR POLLUTION AND CONTROL [0 0 3 3]

Air Pollution: Definition of Air Pollution, Global effects of air pollution, Air Pollution Episode, Sources and types of air pollutants, Effect of air pollutants on human beings, plants, animals and economic aspects. Sampling of sir pollution: Air pollution control acts, ambient air quality standards, sampling and measurement of particular and gaseous pollutants. Meteorology: Environmental factors affecting meteorology, elemental properties of the atmosphere. Influence of meteorological phenomena on air quality. Plume dispersion phenomenon, Air modelling, maximum mixing depth, Design of stack. Controlling of air pollution: Controls – particulate pollutants, Source control. Controlling equipment, settling chambers, ESP, Particulate scrubbers and filters. Gaseous pollutants – absorption, adsorption devices, combustion and condensation devices.

References:

1. H. V. N. Rao, M. N. Rao, *Air Pollution*, Tata McGraw Hill, New Delhi, 2001.
2. Air Pollution, *Sampling and Analysis*, APHA, 1989.

3. C. S. Rao, *Environmental Pollution Control*, Wiley Eastern Ltd. Delhi, 1995.
4. N. De. Nevers, *Air Pollution Control Engineering*, McGraw Hill, Inc. New York, 1995.
5. S.P. Mahajan, *Pollution Control in Process Industries*, TMH Publishing Co., New Delhi, 2000.

CV 3244: REMOTE SENSING AND GIS APPLICATIONS [3 1 0 4]

Basics of Remote Sensing, Characteristic of remote sensing systems, Platforms-Satellites. Indian remote sensing satellites, Sensors, Satellite Retrievals. Elements of image interpretation, Concepts of Digital Image Processing. Geographical Information System (GIS), Elements of GIS, GIS Analysis: Vector and raster data model, mapping concept, map overlay, overlay operation, data storage and database management. Remote sensing and GIS applications in Energy and Environmental Engineering.

References:

1. B. Bhatta, *Remote Sensing and GIS*, (2e), Oxford University Press, 2011.
2. K. C. Clarke, B. O. Parks, M. P. Crane, *Geographic Information Systems and Environmental Modeling*, Prentice-Hall of India, 2005.
3. P.A. Burrough, *Principle of Geographical Information Systems for Land Resources Assessment*, Clarendon Press, Oxford, 2000.
4. A. N. Patel, Surendra Singh, *Remote Sensing Principles and Applications*, Jodhpur, India, Scientific Publisher, 1999.
5. T. M. Lillesand, R. W. Kiefer, *Remote Sensing and Image Interpretation*, New York, USA, John Wiley & Sons, 1999

CV 3245: HYDRAULICS AND HYDRAULIC MACHINES [3 0 0 3]

Review of Fundamentals of Open Channel Flow Gradually varied flow, rapidly varied flow: Introduction to spatially varied flows, Boundary layer theory, Flow through immersed bodies, Impulse Momentum Principle and Its Applications, hydro power plants, Hydraulic turbines, Hydraulic Pumps: Reciprocating Pumps.

References:

1. Chow Ven Te, *Open Channel Flow*, McGraw Hill Company Ltd., New York, 1985
2. K. Subramanya, *Flow in Open Channels*, Tata McGraw Hill Publishing Company, New-Delhi, 2005
3. P. N. Modi, S. M. Seth, *Hydraulics and Fluid Mechanics*, Standard Book House, New Delhi, 2005
4. R. K. Bansal, *Fluid Mechanics and Hydraulic Machines*, Laxmi Publishers, New Delhi. 2010

CV3246: SANITATION TECHNOLOGY [3 0 0 3]

Onsite sanitation treatment technologies :- Carbon, nitrogen and phosphorus removal & recovery; sludge treatment, Case Studies in Sanitation, Faecal sludge treatment technologies, Innovation processes, Onsite Sanitation, collection and transport, Urban Drainage and Sewerage.

References:

1. L. Strand, D. Brdjanovic, *Faecal Sludge Management: Systems Approach for Implementation and Operation* [Book]. - EAWAG – Swiss Federal Institute of Aquatic Science and Technology, Switzerland: IWA Publishing, 2014.
2. M. Henze, C.M. van Mark, D. Brdjanovic, *Biological Wastewater Treatment* [Book] - Delft: IWA Publishing, 2008.

CV3248: RAILWAYS AND AIRPORT ENGINEERING [3 0 0 3]

Introduction, gauges, resistance to traction and stresses in track. Permanent way: Types and requirements of rails, sleepers, ballasts, introduction to rail fastenings, tests and defects of rails. Geometric design: Right of way, Super elevation, curves, points and crossing, design of turn out, diamond and scissor crossing. Track Layout: Track layout, Introduction to signalling and interlocking Railway equipment (triangle and turntable), Introduction to Accident studies, High speed Railways. Airport engineering: Introduction, Technical terms relating to airways and airport, aircraft characteristics, site selection. Airport obstruction and runway design: Layout, obstructions and zoning laws, runway orientation and geometric design of runway. Taxi way design and navigational and landing aids: Exit taxiway, Apron, Drainage, Lighting system, Visual aids, and Air traffic control aids.

References:

1. S. Chandra, M. M. Agarwal, *Railway Engineering*, (4e), Oxford University Press, 2014
2. S. C. Rangwala, *Airport Engineering*, (7e), Charotar Publishing House, 2018
3. S. C. Saxena, S. P. Arora, *A Text Book of Railway Engineering*, (4e), Dhanpatrai publication

2004
4. S. K. Khaana, M. G. Arora, *Airport Planning and Design*, (4e), Nem chand & Bros, 2000
5. H. Robert, Mc. K. Francis, *Planning and Design of Airport*, (5e), Mcgraw hill, 2010.

OPEN ELECTIVE – II & III

CV3080: GEOGRAPHICAL INFORMATION SYSTEM [3 0 0 3]

Introduction and concepts of Remote Sensing, Spectral response pattern, aerial photography. Satellite remote sensing: Data acquisition, digital image processing, spectro-radiometer. Remote sensing satellites: Land observation satellites and applications. Types of remote sensing and image interpretation: optical remote sensing, visible, infrared, thermal sensors, concept of microwave remote sensing and sensors, SLAR, SAR scatterometer, image interpretation characters. Geographical Information System (GIS): Database, raster and vector data, database management system, Digital Elevation Models (DEM) and applications, strategies involved in GIS, GIS applications; land use and land cover, water and land resources, environment and traffic system.

References:

1. M. N. Demers, *Fundamentals of Geographic Information Systems*, (3e), John Wiley and Sons, 2012.
2. B. Bhatta, *Remote Sensing and GIS*, (2e), Oxford University Press, 2011.
3. K. T. Chang, *Introduction to Geographic Information Systems*, McGraw-Hill Book Company, 2006.
4. J. B. Cambell, *Introduction to Remote Sensing*, UK, Taylor & Francis, 2002.
5. P. A. Burrough, R. A. McDonnell, *Principles of Geographical Information Systems*, (2e), Oxford University Press, 1998.
6. F. F. Sabins Jr, *Remote Sensing - Principles and Interpretation*, New York, USA, W. H. Freeman & Co., 1986.

CV3081 ENVIRONMENTAL MANAGEMENT [3 0 0 3]

Business and sustainability: Economy and sustainable development. Strategies for SD, Green business and rankings. Environmental reporting. Ecology and ecosystem: Definition, concept of ecosystems, structure and function, food chains and food webs. Features of various ecosystems and Ecological succession. Biodiversity: Introduction, types of biodiversity, threats to biodiversity. Conservation of biodiversity. Environment and its components, Pollution and Pollution control, Global warming and climate change, Environmental management system: Introduction to EMS, Scope and importance, Dimensions and Principles of EM, Sustainable Development, Environmental impact assessment and auditing. Environmental decision making. Environmental laws and policies: Chronology of environmental laws in India. Clearance and permissions for establishing industry. International agreements, laws and treaties.

References:

1. A. R. N. Sankar, *Environmental Management*, Oxford University Press, New Delhi, 2015.
2. M. M. Sulphey, *Introduction to Environmental Management*, PHI Learning, New Delhi, 2013.
3. C. C. Lee, S. D. Lin, *Handbook of Environmental Engineering Calculations*, McGraw Hill, New York, 1999.
4. C. N. Sawyer, P. L. McCarty, *Chemistry for Environmental Engineering and Science*, 5th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2003.

CV3082: ADVANCED FLUID MECHANICS [3 0 0 3]

Basic Concepts and Fundamentals, Fluid statics, Fluid Kinematics, Governing Equations of Fluid Motion, Integral and Differential Forms of Governing Equations, Laminar Boundary Layers, Turbulent Flows Turbulent boundary layer equation, Turbulent pipe flow, Compressible Flows.

References:

1. G. K. Batchelor, *An Introduction to Fluid Dynamics*, Cambridge University Press, 1983.
2. T. W. F Robert, Alan McDonald, *Introduction to Fluid Mechanics*, Fourth Edition, John Wiley & Sons, 1995.
3. M. W. Frank, *Fluid Mechanics*, Tata McGraw-Hill, Singapore, Sixth Edition, 2008.
4. K. Muralidhar, G. Biswas, *Advanced Engineering Fluid Mechanics*, Second Edition, Narosa, 2005.

CV3083 SOLID WASTE MANAGEMENT [3 0 0 3]

Introduction: Sources and classification of solid waste, Causes of solid waste pollution, Generation and composition of waste, characteristics of solid waste, collection, transport and storage, concept of waste segregation at source, recycling and reuse of waste. Technology: waste treatment technologies, source reduction techniques, product recycling and recovery, incineration and energy recovery, recovery of biological conversion of product. Disposal and Management: waste disposal, management of leachate and landfill gases, hazardous and biomedical waste management and treatment. Rules and Regulation: regulatory requirement applicable to solid waste management.

References:

1. A. D. Bhide, B. B. Sundaresan, *Solid Waste Management for Developing Countries*, Indian National Scientific Documentation Centre, 1983.
2. T. V. Ramachandra, *Management of Municipal Solid Waste*, The Energy and Resources Institute (TERI), 2009.
3. G. Tchobanoglous, F. Kreith, *Integrated Solid Waste Management*, McGraw Hill Education; 1st Edition, 2014.
4. Manual on SWM, GOI, CPHEEO

CV3084: RURAL WATER SUPPLY AND SANITATION [3 0 0 3]

General: Importance of protected water supply, investigation and selection of water sources, Hand pump Technology, its operation and maintenance. Rain water harvesting techniques and uses. Quality of water: drinking water quality standards, estimation of total water requirement including cattle water demand. Communicable Diseases: Terminology, classification, methods of communication, general methods of control. Water Treatment: slow sand filter, horizontal roughing filter and their combination, disinfection of rural water sources, fluoride and its removal. Milk and Food sanitation: Essentials of dairy farm and cattle shed sanitation, Fly and Mosquito control: Life cycle of flies and mosquitoes, various methods of flies and mosquito control. Rural Sanitation: Conservancy, Village latrines, VIP latrines, pour flush latrines, materials, construction and cost of the latrines, concept of eco-sanitation. septic tank, soak pit, storm water and sludge disposal problems, animal waste, method of composting, Biogas, collection and disposal of wastes. Reuse collection and disposal: Garbage, ash, rubbish, collection, transportation, disposal methods. Botulism.

References:

1. H. T. Mann, D. Williamson, *Water Treatment and Sanitation – Simple Method for Rural Area*, Intermediate Technology Publications, 1973.
2. E. W. Steel, *Municipal and Rural Sanitation*, Mc Graw Hill Book Co. 1927
3. E. G. Wanger, J. N. Lanoix, *Water Supply for Rural Areas & Small Communities*, World Health Organization 1959
4. F. Brikké, *Operation and maintenance of rural water supply and sanitation systems*, 2000.

Seventh Semester

CV4170 MINOR PROJECT [0 0 3 1]

In-house student projects will be offered in various domains pertaining to Civil Engineering

CV4171 INDUSTRIAL TRAINING [0 0 0 1]

Students will undertake industrial / site training in the domain pertaining to Civil Engineering for a minimum period of 30 days during the summer break after 6th Semester

CV4172 SURVEY CAMP [0 0 3 1]

Group field survey exercise will be undertaken at a designated location to gain hands-on experience in different types of surveys in Civil Engineering.

PROGRAM ELECTIVES – III, IV, V, VI & VII

CV4140: EARTHQUAKE RESISTANT DESIGN OF STRUCTURES [2 1 0 3]

Introduction: Plate tectonics, Elastic rebound theory of earthquake, Seismic zoning map of India, Seismic waves, Seismograms, Earthquake magnitude and intensity. Introduction to theory of vibrations: Free vibration of single degree un-damped and damped systems, Forced vibration (Harmonic Loading) of single degree un-damped and damped systems; Resonance. Introduction to MDOF system,

(Stodola's method) Primary and secondary effects of earthquake; Calculations of modes and mode shapes. Effect of structural irregularities on the performance of RC buildings during Earthquakes: Vertical irregularities, Plan configuration problems; Numerical Method of analysis- Time stepping method, Central Difference Method, Newmark's method. Equivalent static method (IS 1893); Seismic Coefficient method, Introduction to Pushover analysis; Ductile detailing of RC frames as per IS 13920 (1993).

References:

1. P. Agarwal, M. Shrikhande, *Earthquake Resistant Design of Structures*, Prentice-Hall of India Private Limited, New Delhi. 2006.
2. S. K. Duggal, *Earthquake-Resistant Design of Structures*. Oxford University Press, 2013.
3. A. K. Chopra, Dynamics *of structures: theory and applications to earthquake engineering* (Vol. 2). Englewood Cliffs, NJ: Prentice Hall, 2013.
4. Mario Paz, William Leigh. *Structural dynamics*. New York: Van Nostrand Reinhold, 1985.
5. C.V.R Murty, *Earthquake Tips- Learning Earthquake Design and Construction*, National Information Centre of Earthquake Engineering, IIT Kanpur 2005.
6. IS: 1893 (Part 1) - 2016, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
7. IS: 13920 - 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces- Code of Practice, Bureau of Indian Standards, New Delhi.

CV4141: DESIGN OF PRESTRESSED CONCRETE STRUCTURES [2 1 0 3]

Introduction & Basic principles of pre-stressing: Load balancing concept, Stress concept, Centre of thrust, Pre- tensioning and Post tensioning systems, Tensioning methods and end anchorages. Analysis of sections for flexure: Stresses in concrete due to pre-stress and loads, Stresses in steel due to loads. Losses of pre-stress, Short term and long term deflections of un-cracked members, I.S. code provisions; Limit state of collapse and serviceability: I.S. Code recommendations- Ultimate flexural and shear resistance of sections; shear reinforcement Limit state of serviceability: Control of deflection and cracking, Transmission length, Bond stress, Anchorage stresses, I.S. code provisions for the design of end block reinforcements. Design of pre-tensioned and post-tensioned symmetrical and unsymmetrical sections: Permissible stresses, Design of pre-stressing force and eccentricity, Limiting zone of pre-stressing force and eccentricity, Cable profile - Magnels chart.

References:

1. N. K. Raju, *Pre-stressed Concrete*, Fourth Edition, Tata McGraw Hill, New Delhi, 2007.
2. P. Dayaratnam, *Pre-stressed Concrete Structures*, Oxford and IBH Publications, New Delhi, 1996.
3. G. S. Pandit, S. P. Gupta, *Pre-stressed Concrete*, CBS Publishers & Distributors Pvt. Ltd., 2009.
4. IS: 1343-1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 1981.
5. SP16:1980, Design Aids for Reinforced Concrete, Bureau of Indian Standards, New Delhi, 1992.

CV4142 SOLID AND HAZARDOUS WASTE MANAGEMENT [2 0 1 3]

Classification of solid wastes and its management system, Regulatory aspects of SWM, Waste generation and composition, Waste stream assessment, Waste Characteristics, Environmental and health effects, Storage and collection, Transfer stations, Waste collection system design, Waste disposal options and selection criteria, Waste Processing techniques-purpose of processing, Mechanical volume and size reduction, Component separation, Drying and dewatering, Source reduction, Product recovery and recycling, Recovery of biological conversion products, Sanitary landfill, Landfill liners, Leachate and landfill gas management, Composting, Biogasification, Incineration, Introduction to Hazardous Waste Management (HWM), Identification and classification, International regulatory framework for HWM, Storage, Transportation and Treatment of hazardous waste, Concept of Integrated waste management.

References:

1. A.D. Bhides and B.B. Sudaresan, *Solid Waste Management for Developing Countries*, Indian National Scientific Documentation Centre, 1983.
2. T.V. Ramachandra, *Management of Municipal Solid Waste*, The Energy and Resources Institute (TERI), 2009.

3. G. Tchobanoglous,H. Theisen, S.A. Vigil, *Integrated Solid Waste Management: Engineering Principles and Management Issues*, McGraw- Hill Publication, 1993.
4. C. A. Wentz; *Hazardous Waste Management*, McGraw-Hill Publication, 1995.

CV4143 INDUSTRIAL WASTEWATER TREATMENT [2 0 1 3]

Wastewater treatment quality criteria and effluent standards, characteristics, Preliminary, Primary, Biological treatment process and Advanced treatment processes: Adsorption, Chemical oxidation, Ozonation, Photo catalysts, wet air oxidation, evaporation, Ion exchange, Membrane Technologies, Concept of zero liquid discharge, Wastewater disposal in receiving bodies, Case studies: Effluent treatment plants in Textile, Tanneries, Pulp and paper, Sugar and distilleries and Pharmaceutical industries. Lab may include tests for water quality, pH, turbidity, COD, BOD, total solids, suspended solids, dissolved solids, fluoride, residual chlorine, determination of particulate matter in air, high volume sampler, determination of SO2, Determination of SPM, PM_{10} and $PM_{2.5}$ using a High volume sampler

References:

1. Metcaff, Eddy, *Wastewater Engineering: Treatment and Reuse* (5e), McGraw Hill, 2007.
2. J. D. Edwards, *Industrial Waste Water Treatment: A Guide Book* (1e), CRC Press, 1995.
3. A.D. Patwardhan, *Industrial Waste Water Treatment*, Prentice Hall India, 2008.
4. V. V. Ranade, V. M. Bhandari, *Industrial Wastewater Treatment, Recycling and Reuse* (2e), Prentice Hall India, 2017.
5. R. L. Droste, *Theory and Practice of Water and Wastewater Treatment*, John Wiley & Sons, 2005

CV4144: REPAIR AND REHABILITATION OF STRUCTURES [2 1 0 3]

Introduction and terminology: Introduction, Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures. Distress and Deterioration in structures: Types of distress and deterioration in concrete structures, causes and effects. Assessment Techniques: Visual inspection, Non Destructive and Semi Destructive Testing for assessing strength, voids, flaws, density, moisture content, cover depth, rebar corrosion and bond strength. Repair Methods and materials: material selection, compatibility between repair material and existing concrete, repair techniques for different types of structural elements and structures. Seismic evaluation and strengthening of existing reinforced concrete buildings. Retrofitting and strengthening of structural elements and structures. Case studies on distress, repair and rehabilitation of structures.

References:

1. D. C. Allen, H. Roper, *Concrete Structures, Materials, Maintenance and Repair*, Longman Scientific and Technical UK, 1991.
2. R. T. Allen, S. C. Edwards, *Repair of Concrete Structures*, Blakie and Sons, UK, 1987.
3. P. I. Modi, C. N. Patel, *Repair and Rehabilitation of Concrete Structures*, PHI Learning, India, 2015.
4. A. R. Santha kumar, *Training Course notes on Damage Assessment and repair in Low Cost Housing*, "RHDC-NBO" Anna University, July 1992.
5. P. K. Guha, *Maintenance, and Repairs of Buildings*, New Central Book Agency (P) Ltd, 2011.
6. IS 15988: 2013, Seismic evaluation and strengthening of existing reinforced concrete building – Guidelines.

CV4145: ADVANCED CONCRETE TECHNOLOGY [2 1 0 3]

Chemistry of cement: Bogue's compounds, stages of hydration and hardening of cement, heat of hydration, gel- space ratio and its significance. Fresh Concrete: Definition, Grade, water cement ratio and its role, Properties of fresh concrete, Factors affecting workability, Influence of aggregate properties on workability, methods of workability determination. Concrete Admixtures: Chemical and mineral admixtures, their types and uses, water reducers, accelerator, retarders, water-proofing plasticizers, super plasticizers, air-entraining agents. Hardened Concrete: Properties of hardened concrete, strength, permeability, creep, shrinkage, and factors influencing properties of concrete in hardened state. Durability of Concrete: Definition, parameters effecting durability. Deteriorating mechanisms, alkali aggregate reaction, freeze and thaw, carbonation, chloride attack, sulphate attack, corrosion of steel reinforcement. Modern Concrete Technology: Ready Mix Concrete, Pumpable concrete, High Strength and High performance Concrete, Self-Compacting Concrete, Light Weight Concrete, Recycled Aggregate Concrete, Geopolymer, Fiber Reinforced Concrete, waste utilization in concrete.

References:

1. A. M. Neville, *Properties of Concrete*, Pearson Education India; 5 edition, 2012
2. M. S. Shetty , *Concrete Technology*, S. Chand & Company, 2015
3. A. R. Santha Kumar, *Concrete Technology*, Oxford University Press, 2006.
4. R. Siddique, *Waste Materials and By-Products in Concrete*, Springer.

CV4146: ESTIMATION COSTING AND VALUATION [2 1 0 3]

Estimation: Introduction, definition, Types of estimate, approximate estimate, Centre line method, long wall-short wall method, units of measurement: IS 1200, work charged establishment, Plinth area, Carpet area. Estimate of building, doors and windows, RCC work, different types of roof, Measurement of earthwork by cross-sections, spot levels, contours. Mass diagram and its characteristics: Specification-definition, types, principles. Detailed specification for different components of the buildings. Rate Analysis: purpose, factors effecting, overhead charges, turn out of work, rate analysis for different items of building; Contract-Functioning and organization of PWD; Tender and its notification, EMD and security deposit; Contracts: Types of contract, termination of contract, work slip qualification of contractor, responsibilities of engineer, owner, and contractor; Valuation: Purpose of valuation, scrap value, salvage value, market value, Factors which affect the value, sinking fund, year's purchase, depreciation.

References:

1. B. N. Dutta, *Estimating and Costing in Civil Engineering*, UBS Publishers' Distributors Ltd. Sixteenth reprint, 2000.
2. M. Chakraborti, *Estimating, Costing, Specification & Valuation in Civil Engineering*, Published by the Author, Sixteenth edition, 2003.

CV4147: CONTRACT MANAGEMENT AND ARBITRATION [2 1 0 3]

Introduction to contracts: Types of contracts. Tendering and contractual procedures - Technical sanction, Notice inviting tender. Multiple bids, Evaluation of bids, Pre-requisites in an agreement, various types of bonds, etc. Contract administration; Duties and responsibilities of parties; important site documents Claims and disputes, Dispute resolution techniques, International contracts: International Competitive Bidding, Domestic Preference, FIDIC Conditions, Currency of Bid and Payment, Escalation in Foreign Currency, Financing of projects, Applicable Law and Settlement of Disputes. International Arbitration.

References:

1. B. S. Patil, *Civil Engineering Contracts and Estimates*, University Press, 2009.
2. G. Betty John, *Engineering Contracts*, McGraw Hills 19
3. B. J. Vasavada, *Engineering Contracts and Arbitration*, Jubilee Publications, 2nd Edition, 1996.

CV4148: CONSTRUCTION PROJECT MANAGEMENT [2 1 0 3]

Introduction to Construction Management- Classification of construction works, various stages in the Construction of a Project, construction team, Work Breakdown Structure for Building and infrastructural projects. Project Planning and scheduling - Objectives and stages of planning and Scheduling, types of schedules. Network Analysis- network rules, preparation, and numbering. CPM analysis- Calculation of activity times, float, critical path. Pert Analysis– Time estimates, slack, critical path, probability of completion time of project. Project Costs – Direct & Indirect Costs, Optimum Duration and Cost, Cost Slopes. Management of Construction equipment- Classification of construction equipment, earthmoving, hoisting (derrik, hydraulic, tower crane) hauling, piling, compaction, and concreting equipment, factor affecting selection of construction equipment, Owning and Operating cost of equipment.

References:

1. B. Sengupta, M Guha, *Construction Management and Planning,* McGraw Hill, 2016 Reprint
2. B. C. Punamia, K K Khandelwal, *Project Planning and Control with PERT and CPM*, Laxmi Publications Pvt Ltd, 2014 Reprint
3. S. C. Sharma, *Construction Equipment and Management*, Khanna Book Publishing Company, 2016
4. K. K. Chitkara, *Construction Project Management – Planning, Scheduling and Controlling*, Tata McGraw Hill, 1999 Reprint
5. Peurifoy, Schexnayder, Shapira, *Construction Planning, Equipment and Methods*, Tata McGraw Hill, 2015 Reprint.

CV4149: GROUND IMPROVEMENT TECHNIQUES [2 1 0 2]

Introduction: Need for ground improvement techniques, Different types of problematic soils, Classification of ground modification techniques and Emerging trends in ground improvement. Mechanical Modification: Requirements of shallow and deep compaction, Shallow, deep and dynamic compaction, Properties of compacted soil and compaction control, Vibro compaction and Vibro replacement-stone columns. Hydraulic Modification: Objectives and techniques, Dewatering methods, Design of dewatering systems and preloading methods. Vertical drains: Sand drains and prefabricated drains. Physical and Chemical Modification: Modification by admixtures, Cement, Lime, Fly ash, Industrial wastes etc., Stabilization of soil with lime columns and cement columns, Construction techniques and applications. Thermal Modification: Thermal properties of soils, Heat treatment of soils and Ground freezing. Grouting: Principles, Types of grouting, Different varieties of grout materials, Design considerations and parameters, Construction, Quality control and assurance. Modification by inclusions: Geo-synthetics: Types, Civil engineering applications of geo-synthetics. Soil Nailing and Soil Anchoring: Applications, Principles, Design consideration and parameters, Construction procedure, quality control and assurance.

References:

1. M. R. Hausmann, *Engineering principles of ground modification*, McGraw-Hill, 1990
2. J. Han, *Principles and practice of ground improvement*, John Wiley & Sons, 2015
3. Purushottam Raj , *Ground Improvement Techniques*, Tata Mc Graw Hills, Delhi
4. Mitchell, James Kenneth, Kenichi Soga, *Fundamentals of soil behaviour*, (3e), Wiley Publication, 2005.
5. Sivakumar Babu G. L., *An introduction to Soil Reinforcement and Geosynthetic*, Universities Press, Hyderabad, 2009.

CV4150 ROCK MECHANICS AND UNDERGROUND EXCAVATION [2 1 0 3]

Properties of Rock Materials: Rock materials; Physical properties; Strength behaviour; Stress-strain relationships; Factors influencing strength. Rock Mass Behaviour: Failure criteria; Coulomb, Mohr's, Griffiths and Modified Griffiths criteria; Post failure behaviour; Shear strength of jointed rock, roughness, peak and residual strengths; Strength criteria for rock mass. Classification of Rock Mass and Applications: Intact and rock mass classifications: Terzaghi, RQD, RSR and RMR classifications; CSIR classification of jointed rocks; NGI tunnelling quality index. Underground Excavations: Types and classification of underground openings; Methods of underground excavation; Factors affecting design; Design methodology. Stresses and Deformations around Underground Excavations: Component of stress, state of stresses: two dimensional and in situ; Stresses and deformation around underground excavations: single and multiple, circular and other shapes. Support Systems for Underground Excavations: Types of support system: Rockbolts, Shotcrete and mesh; Design based on analytical and empirical methods of support systems. Blasting in Underground Excavation and Instrumentation: Basic mechanics of explosive rock breaking; Creation of free space; Rock damage, and design of blasting patterns. Instrumentations: Objectives and types of underground instrumentation; Monitoring of underground excavations during and after construction.

References:

1. R. E Goodman. *Introduction to Rock Mechanics*. John Wiley and Sons, 1989
2. Evert Hoek, Jonathan D. Bray*, Rock Slope Engineering*, (3e), 1981
3. E Hoek, E. Brown, *Underground excavations in rock*, CRC Press, 1980
4. T. Ramamurthy, *Engineering in Rocks for Slopes, Foundations and Tunnels*. Prentice Hall India, 2007.
5. Z.T. Bieniawski, *Rock mechanics in mining & tunnelling*. A.A. Balkema, 1984

CV4151: URBAN TRANSPORTATION PLANNING [2 1 0 3]

Introduction to Urban Transportation, Mass transportation characteristics, Demand Characteristics: Spatial, Temporal and behavioural characteristics; Introduction to Public Transport: Public transport Travel characteristics, Trip chaining, Technology of bus, Rail, Rapid transit systems, Basic operating elements; Transit Network Planning: Planning Objectives, Principles, Considerations, Transit lines types, Transit routes and their characteristics, Timed transfer networks, Prediction of transit usage, Evaluation of network, Accessibility considerations; Transit Scheduling: Components of scheduling process, Service requirements, Scheduling procedure, Marginal ridership, Crew scheduling; Transit Agency and Economics: Organizational structure of transit agency, Management and personnel, Transit system statistics, Performance and economic measures, Operations, Fare structure; Terminals and Depots: Design of bus stops, Design of

terminals - principles of good layout, Types of layout, Truck terminal, Depot location, Twin depot concept, Crew facilities and amenities; Special Systems: People mover systems, Underground transportation, Para transit, High Speed Rail transit system, case studies.

References:

1. K. Lal, *Transportation Engineering*, (4e), PHI Delhi, 2012
2. W. W. Hay, *An Introduction to Transportation Engineering*, (2e), John Wiley & Sons, 2010
3. L. R. Kadiyali, *Traffic Engineering and Transport Planning*, (4e), Khanna Publishers, 2006
4. Hutchinson, *Urban Transport Planning*, (3e), John Wiley, 2006

CV4152: TRAFFIC SYSTEMS AND ENGINEERING [2 1 0 3]

Road Characteristics – Road user characteristics – PIEV theory – Vehicle Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town, country, regional and all urban infrastructure – towards Sustainable approach. – land use & transport and modal integration. Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non-motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance. Intersection Design – channelization, Rotary intersection design – Signal design – Coordination of signals –– Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Networking pedestrian facilities & cycle tracks. Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport. Area Traffic Management System – Traffic System Management (TSM) with IRC standards –- Traffic Regulatory Measures- Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

References:

1. L. R. Kadiyali, *Traffic Engineering and Transport Planning*, Khanna Publishers, Delhi, 2013
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
3. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, *Principles of Highway Engineering and Traffic Analysis*, Wiley India Pvt. Ltd., New Delhi, 2011
4. SP:43-1994, IRC Specification, “Guidelines on Low-cost Traffic Management Techniques” for Urban Areas, 1994
5. C. Jotin Khisty, B. Kent Lal, *Transportation Engineering*, 3rd edition

CV 4153: HYDROLOGICAL ANALYSIS [2 1 0 3]

Introduction, Hydrological cycle, Scope and application of hydrology, Geomorphology of drainage basins. Analysis of precipitation data, Abstractions: Runoff, Hydrographs, Floods, Hydrological Modelling

References:

1. Linsley, Pauler, Kohlas, *Hydrology for Engineers*, MGH Publishers, Tokyo. 1975
2. Linsley, Kohler, Paulhus, *Applied hydrology*, MGH Publications, New York. 1949
3. VenTe Chow, D. R. Maidment, L.W. Mays, *Applied Hydrology*, McGraw Hill. 1998
4. H. M. Raghunath, *Hydrology*, Wiley Eastern publications, Delhi, 1985
5. W. Viessman, J. Knapp, *Introduction to hydrology*, Harper & Row publishers, 1989

CV4154: WATER RESOURCES PLANNING AND MANAGEMENT [2 1 0 3]

Capability & requirements of multipurpose projects, Data collection Conjunctive-use management, Reservoir Planning & Operation, Canal Management: River Training methods & structures, Economics of Water Resource Projects, Cost-Benefit analysis, Socio-Legal & Environmental Aspects

References:

1. D.P Loucks, Eelco van Beek. *Water resources systems planning and management*: *An introduction to methods, models and applications*, UNESCO. 2005
2. S. Vedula, P. P. Mujumdar. *Water resources systems: Modeling techniques and analysis*, Tata McGraw Hill, New Delhi 2005.
3. L. W. Mays, Y. K. Tung, *Hydro systems engineering and management*, McGraw Hill, USA 1992.

4. S. P. Simonovic*, Managing water resources: Methods and tools for a systems approach*, UNESCO publishing, France 2009.

CV4155: BRIDGE ENGINEERING [2 1 0 3]

Introduction: Definitions, Components of a bridge, Classification, Importance and standard specifications; Investigation for bridge: Site selection, Data drawing, Design discharge linear Water way, Economical span, Location of piers and abutments, Vertical clearance above HFL, Scour depth; Traffic Projection, Investigation Report, Choice Of Bridge Type. Standard Specifications for Road Bridge: IRC bridge code, Determination of dead loads and live loads, Wind loads, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current buoyancy effect, Earth pressure, Temperature effect, Deformation stresses, Secondary stresses, Erection stresses, Seismic forces; Culverts: RCC slab culvert, Pipe culverts and box culvert; Concrete Bridges: T-beam Reinforced Concrete Bridges and Pre Stressed Concrete Bridges, Continuous bridges, Cantilever bridges; Substructures: Different types of bridge bearings, Piers and masonry abutments, Different types of foundations and their choices, Wing walls.

References:

1. D. J. Victor, *Essentials of Bridge Engineering*, Oxford & IBH Publishing Co. Pvt. Ltd., 2015.
2. N. K. Raju, *Design of Bridges*, Oxford & IBH Publishing Co. pvt. Ltd, 2008.
3. S. Ponnusamy, Bridge Engineering, Tata McGraw Hill Publishing Co., New Delhi, 2008.
4. Indian Road Congress Codes No.5-1998, Jamnagar House, Shah Jahan Road, New Delhi.
5. Indian Road Congress Codes No.6-2014, Jamnagar House, Shah Jahan Road, New Delhi.
6. Indian Road Congress Codes No.18-2000, Jamnagar House, Shah Jahan Road, New Delhi.
7. Indian Road Congress Codes No.21-2000, Jamnagar House, Shah Jahan Road, New Delhi.
8. Indian Road Congress Codes No.24-1967, Jamnagar House, Shah Jahan Road, New Delhi.

Eighth Semester

CV4270 MAJOR PROJECT [0 0 0 12]

Students will undertake a project in the domains pertaining to Civil Engineering for a minimum period of 16 weeks.