UG/PG: UG	**Department:** Civil Engineering
Course Code: -	**Course Name:** Design of Masonry Structures
Credit: 3	**L-T-P: 2-1-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course:	

Syllabus

Introduction and Historical Perspective; Behaviour of Masonry Structures: Common modes of failure, effect of unit shapes and mortar type, effect of roof and floor systems; Common deficiencies; Masonry Design Approaches; Overview of Load Conditions. Compression Behaviour of Masonry: Prism strength, Failure mechanism, types of construction and bonds; Eccentric loading; Slenderness – effective length and effective height, effect of openings. Masonry Under Lateral Loads: In-plane and out-of-plane loads, bending parallel and perpendicular to bed joints; Shear and flexure behaviour of piers; Interactions. Earthquake Resistant Measures: Analysis for earthquake forces, role of floor and roof diaphragm; Concept and design of bands, bandages, splints and ties; Reinforced masonry; IS 4326 (2013) Code provisions. Masonry Infills: Effect of masonry infills on seismic behaviour of framed buildings; Failure modes; modelling of infills – equivalent strut; Safety of infills in in-plane action – shear, compression and buckling; Code provisions. Retrofitting of Masonry Building: Techniques of repair and retrofitting of masonry buildings; IS: 13935 (2009) code provisions for retrofitting.

Course Outcomes

1. Understand engineering characteristics of different type of masonry structures.
2. Understand behavior of masonry under different type of loads.
3. Be able to apply different techniques for modelling of masonry infills.
4. Be able to select from various retrofitting techniques for masonry buildings.

Text Books

1. P. Dayaraatnam and P. Sarah, “Brick and Reinforced Structures (2/e)”, Medtech.
2. K. S. Jagadish, “Structural Masonry”, Dreamtech Press.

References

1. A. W. Hendry, “Structural Masonry (2/e)”, Palgrave Macmillan.
2. R. G. Drysdale, A. H. Hamid and L. R. Baker, “Masonry Structure: Behaviour and Design”, Prentice Hall, Englewood Cliffs.
3. T. Paulay and M. J. N. Priestley, “Seismic Design of Reinforced Concrete and masonry Buildings”, John Wiley & Sons.
4. J. E. Amrhein, “Reinforced Masonry Engineering Handbook,” Masonry Institute of America, CRC Press.
5. D. Anderson and S. Brzev, “Seismic Design Guide for Masonry Buildings,” Canadian Concrete Masonry Producers Association.
6. FEMA 356, “Prestandard and Commentry For The Seismic Rehabilitation of Buildings”, Federal Emergency Management Agency, Washington, D.C.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Dynamics of Structures
Credit: 3	**L-T-P: 2-1-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course:	

Syllabus

Theory of structural dynamics and vibration analysis. Single degree of freedom System (SDOF): Equation of motion; Undamped and damped Free vibration; Undamped and damped forced vibration; Damping in structures and its evaluation. Response of SDOF system subjected to periodic, impulsive, and general dynamic loading. Response of SDOF system subjected to earthquake and concept of response spectrum. Free and forced vibration of multi degree of freedom (MDOF) system; Methods for obtaining natural frequencies and mode shapes. Introduction to vibration of continuous systems; Introduction to seismic analysis.

Course Outcomes

1. To understand various type of degree of freedom systems in structures.
2. To understand orthogonal relationship of principle modes, Rayleigh's principle and its application.
3. To gain the knowledge about application of structural dynamics to civil engineering problems.
4. To be able to write technical reports and present topics related to structural dynamics.

Text Books

1. A. K. Jain, “Dynamics of Structures With MATLAB® Applications”, Pearson

References

1. A. K. Chopra, “Dynamics of Structures, (5/e)”, Pearson
2. J. L. Humar, “Dynamics of Structures, (3/e)”, CRC Press
3. M. Paz and Y. H. Kim, “Structural Dynamics, (6/e)”, Springer
4. A. A. Shabana, “Theory of Vibration: An Introduction, (3/e)”, Springer
5. R.W. Clough and J. Penzien, “Dynamics of Structures, (3/e)”, Computers & Structures, Inc

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Railway and Airport Engineering
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course:	

Syllabus

Railway Engineering: Introduction; Gauges; right of way, gradient, Resistance to traction and stresses in track; Track component parts their functions and requirements viz. Rails; Sleepers; Ballasts. Geometric design of railway track, Super elevation, points and crossing; requirement of rail joints. Track junctions, Design of turn out and cross-over, signaling and interlocking; high speed and ballastless tracks. Airport planning and Design, Airport Engineering: Air Transport scenario in India and stages of development, technical terms relating to airways and airport, aircraft characteristics; site selection; Airport classification; layout, Obstructions and zoning laws; Runway orientation and geometric design of runway; Taxiways; Aircraft parking, runway marking and lighting, system; drainage, apron and visual aids.

Course Outcomes

1. Acquire the Knowledge for basic aspects of railway track and its components i.e. gauge, ballast, sleepers and rails.
2. Acquire the basics to design the railway cant and know the functioning of points & crossings etc.
3. Acquire the broad knowledge of different types of railway signals, interlocking of signals.
4. Acquire the knowledge for design and analysis of airport runway length, taxiways, aprons and design of runway pavement crust.
5. Acquire the skills to understand the aircraft characteristics, wind rose diagrams and other factors necessary for selection of airport site.

Text Books

1. Railway Engineering by Saxena and Arora
2. Railway Engineering by Chandra and Agarwal
3. Airport Engineering by Arora and Khanna

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Ground Improvement Techniques
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course: Geotechnical Engineering – II	

Syllabus

Ground improvement methods: introduction and overview; Soil densification: objectives and improvements; earthworks at construction sites; replacement and staged construction; shallow stabilization; deep stabilization using vibro-floatation, dynamic compaction, chemical additives, and deep replacement; Hydraulic modification: objectives and approaches; preloading and drainage; PVDs; dewatering; electro-osmosis and ground freezing; stone columns; Physical and chemical modification: mechanical cementing and chemical stabilization; admixture soil improvement; thermal treatments; grouting – permeation, jet, soil fracture, compaction; soil mixing; Inclusions and confinement: geosynthetics and their applications; soil reinforcement; soil confinement; lightweight fills; Miscellaneous: site instrumentation, assessment and control; problematic soils and remedies; miscellaneous methods and emerging trends

Course Outcomes

1. To be able to identify, classify, and characterize difficult site conditions
2. To be able to determine the suitability of a ground modification technique to a particular site condition with respect to the proposed project from a number of options based on its engineering viability.
3. To be able to design and execute a ground modification scheme for given site conditions and nature of the civil engineering project.

Text Books

1. Nicholson PG, “Soil Improvement and Ground Modification Methods”, Elsevier, 2015
2. Huat et al., “Ground Improvement Techniques”, CRC Press, 2019
3. Maity and Chattopadhyay, “Ground Improvement Techniques”, PHI Learning, 2017
4. Han J, “Principles and Practice of Ground Improvement”, Wiley India, 2018
5. Kirsch and Bell, “Ground Improvement”, CRC Press, 3e, 2012

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Advanced Foundation Design
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course: Geotechnical Engineering – II	

Syllabus

Introduction, Foundation Choice, Definitions, Requirements, Types of foundations, Shallow foundations, Types of failures, bearing capacity, Settlement analysis, Contact stress beneath foundations, Beams on elastic foundations, Modulus of subgrade reaction, Special foundations, Foundations in expansive soils (CNS concept), Under-reamed pile foundations, Remedial measures for cracked buildings. Foundation of transmission line towers, Underpinning of foundations, Importance and situations for underpinning, methodology, Typical examples of under pinning, Pile Foundation, Bridge substructures, Maximum depth of scour, Depth of foundation, Allowable bearing pressure, loads to be considered, Well Foundation, Lateral stability of well foundation, Design of pier cap, Design of pier, Sinking stresses in wells, Design of well components, Reinforced earth.

Course Outcomes

1. Ability to understand various aspects of Design and Construction of foundation including special foundations on difficult soils
2. Knowledge to amylases shallow the deep foundation
3. Ability to design pile foundation
4. Ability to design will foundation

Text Books

1. Braja M. Das, "Principles of Foundation Engineering", PWS Publishing Company.
2. Joseph Bowles, "Foundation Analysis and Design", McGraw-Hill Book Company.
3. V.N.S. Murthy, "Advanced Foundation Engineering", CBS Publishers and Distributors, New Delhi.
4. Tomlinson, M.J. “Foundation Design and Construction”, English Language Book Society, Longman.
5. Swami Saran, “Analysis and Design of Substructures”, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Design of Hydraulic Structures
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course: Hydraulic Engineering	

Syllabus

Introduction; type of hydraulic structures and their function; consideration for their selection. Dams; Design principles of gravity and earth dams; spillway; types of spillway: Ogee, chute, shaft, side channel and siphon spillway; spillway aerators; spillways; Design of ogee spillway. Diversion head works; Components of diversion head work and their design. Channel transitions; Design of channel transitions for sub critical and super critical flows; cross and distributory head regulators; energy dissipation downstream of falls; Cross drainage structures: Super passage, aqueducts, design of cross drainage structures, Design of outlets.

Course Outcomes

1. Knowledge about various type of hydraulic structures and their function
2. Knowledge about Design principles of gravity and earth dams
3. Knowledge about Components of diversion head work and their design

Text Books

1. Water Resources Engineering by Linsley & Franzini
2. Irrigation Engineering by G.L. Asawa
3. Water Resources & Water Power Engg. By P.N. Modi.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Air and Noise Pollution
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course: 22CET101 Environmental Science	

Syllabus

Sources of air pollution; Classification of aerosols, Gases vapors, natural pollutants; Properties of air pollutants; Standards of air quality. Emission inventories & Emission factor; Meteorological factors influencing dispersion of air pollutants; Gaussian plume model for dispersion of air pollutants and its applications; Effects on man, material, vegetation, art treasure; Air pollution disasters; Economic Effects of air pollution; Global Effects of Air pollution; Air pollution Due to Automobiles and emission control; General concept of transport planning for prevention of air pollution; Control technology for particulate and gaseous pollutants. Basics of noise Pollution; Measurement of noise; permissible noise levels in different zones; effects of noise, Control of Noise Pollution.

Course Outcomes

1. Ability to understand the various sources of air pollution and their classification.
2. Knowledge about Emission inventories & Emission factor.
3. Ability to understand about Economic Effects of air pollution.
4. Ability to understand Control technology for particulate and gaseous pollutants.

Text Books

1. Air Pollution: Its Origin & Control: Wark, Warner & Davis
2. Air Pollution: Perkins.
3. Noise Pollution and Control: S P. Singhal
4. Air pollution and control, KVSG Muralikrishna, Kaushal and Co., ND.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Solid Waste Management
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Professional Track Honours Elective	
Pre-requisite Course:	

Syllabus

Introduction to Solid Waste Management: Definition and classification of solid waste; Waste generation and composition studies; Environmental and health impacts of improper waste management. Waste Collection and Transportation: Collection systems and equipment; Routing and scheduling of waste collection vehicles; Transfer stations and transportation logistics; Waste Processing: Biological treatment methods (composting, anaerobic digestion); Incineration and thermal treatment technologies; Landfilling: engineered and non-engineered landfills; landfill gas; leachate monitoring, Legacy waste, Bio remediation; Recycling and Resource Recovery: Principles of recycling and material recovery; Recycling processes and technologies; Design of recycling facilities and systems; Waste reduction and source separation; Extended producer responsibility (EPR); Circular economy approaches; Legal and Regulatory Frameworks in India; Biomedical waste; Plastic waste; E-waste; Domestic hazardous waste. Smart waste management systems; Future directions and research opportunities.

Course Outcomes

1. Comprehend the environmental and health impacts associated with improper waste management and getting knowledge about relevant laws, regulations, and policies governing solid waste management.
2. Be able to design and implement efficient waste collection and transportation systems.
3. Be able to evaluate and select appropriate waste treatment and disposal methods based on technical, environmental, and economic considerations.
4. Be able to develop effective communication and teamwork skills for collaborative waste management projects.

Text Books

1. CPHEEO. (2016). Manual on municipal solid waste management.
2. Tchobanoglous, G., Theisen, H. Vigil, S.A. (1993). Integrated solid waste management: Engineering principles and management issues. McGraw Hill; 2nd edition
3. Peavy, H., Rowe, D., Tchobanoglous, G. (2009). Environmental Engineering. McGraw Hill Education; First Edition.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Construction Information Modelling and Automation
Credit: 3	**L-T-P: 2-1-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course:	

Syllabus

3D modelling in construction, Building Information modelling concepts, software(s) used for BIM, REVIT working platform, 3D BIM Modelling execution using software, Integration of 3D models with other project management software e.g., NavisWorks, Integration of model and information within project teams, Industry 4.0 in construction, Automation in Construction, Use of Drones and sensors in Construction, Concept of intelligent and smart machinery, Use of IT for Safety in construction, Automation in construction, 3D printing concept, materials and equipment, tools and techniques for development of model for 3d Printing and its execution, delivery and management of 3D construction projects

Course Outcomes

1. Gain knowledge about various aspects of Construction Information systems.
2. Understand Management information systems in construction industry.
3. Understand web applications and e- business in construction.
4. Gain knowledge about introduction to green building software.

Text Books

1. Understanding IT in construction by Ming sun
2. BIM Handbook by Chuck Eastman
3. REVIT Tool Manuals by Autodesk
4. Construction and Building Automation from Concepts to Implementation, Benny Raphael

UG/PG: UG	**Department:** Civil Engineering
Course Code: -	**Course Name:** Finite Element Method
Credit: 3	**L-T-P: 2-1-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course:	

Syllabus

Introduction, Variational principle, Principle of virtual work, Theory of minimum potential energy, Ritz Method, Interpolation & Representation of curves, elements of elasticity, finite element formulation, Various types of elements, Bar and beam elements. Truss and frame problems, Isoperimetric formulation. Plane strain, plane stress and axis-symmetric problems. Lagrange & Serendipity elements, Solution procedures, convergence criterion, One dimensional and two-dimensional elements, Formulation of dynamics problems.

Course Outcomes

1. To understand evolution and fundamental theories of FEM.
2. To learn the basics of elasticity theory.
3. To analyze 1-D and 2-D physical problems, develop mathematical formulations and their solutions.

Text Books

1. P. N. Godbole, “Introduction to Finite Element Methods”, Dreamtech Press.
2. C. S. Krishnamoorthy, “Finite Element Analysis-Theory and programming”, McGraw Hill Education.
3. T. R. Chandrupatla and A. D. Belegundu, “Introduction to Finite Elements in Engineering”, Prentice Hall of India Pvt. Ltd.

References

1. J. N. Reddy “An Introduction to the Finite Element Method”, McGraw Hill Education.
2. T. J. R. Hughes, “The Finite Element Method: Linear Static and Dynamic Finite Element Analysis”, Dover.
3. George R. Buchanan, “Finite element analysis”, McGraw Hill Education.

UG/PG: UG	**Department:** Civil Engineering
Course Code: -	**Course Name:** Structural Analysis – II
Credit: 3	**L-T-P: 2-1-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course: Structural Analysis	

Syllabus

Degree of Static and Kinematic indeterminacy, Released and restrained structure; Matrix method using system approach – flexibility and stiffness method for analysis of continuous beams, rigid – jointed plane frame and pin-jointed plane frame; Matrix formulation: Application to beams, trusses and frames; Non-sway and sway frames; Introduction to Direct Stiffness method; Formation of member stiffness matrix; Transformation of load vector and displacement vector; Assembly of global stiffness matrix and load vectors; Boundary condition and solutions; Application to planer structures –beam and plane truss.

Course Outcomes

1. To acquire the knowledge about different types of indeterminate structures
2. To be able to analyse different types of indeterminate structures by traditional methods
3. To be able to analyse different types of indeterminate structures by advanced and computational methods
4. To be able to write technical reports and present topics related to advanced structural analysis

Text Books

1. G.S. Pandit and S.P. Gupta, “Structural Analysis- A Matrix Approach (2/e)” McGraw Hill Education.
2. R. C. Hibbeler, “Structural Analysis (9/e)”, Pearson Press.
3. C. S. Reddy, “Basic Structural Analysis (10/e)”, Tata McGraw Hill.
4. T.S. Thandavamoorthy, “Structural Analysis”, Oxford publications.

References

1. A. Kassimali, “Structural analysis (5/e)”, Cengage.
2. S. P. Timoshenko and D. H. Young, “Theory of structures”, McGraw Hill Education.
3. C. K. Wang, “Intermediate Structural Analysis”, McGraw Hill.

UG/PG: UG	**Department:** Civil Engineering
Course Code: -	**Course Name:** Design of Steel Structural Systems
Credit: 3	**L-T-P: 2-1-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course: Design of Steel Structures	

Syllabus

Structural Steels, Brittle fracture and fatigue, Stability of Beam Columns, frames and plates, advanced Plastic design of Steel Structures, design of Gantry Girders, Plate Girder bridge, Truss Girder Bridge, Steel Tanks, using latest IS codes.

Course Outcomes

1. Understanding of stability of structures
2. Knowledge about Plastic design of Steel Structures
3. Knowledge about design of Gantry Girders, Truss Girder Bridge, Steel Tanks, using latest IS codes.

Text Books

1. Plastic Analysis & Design Of Steel Structures: Wong
2. Design of Steel Structures: N Subramanium
3. Limit State Design of Steel Structures: S.K.Duggal
4. Design of Steel Structures: P Dayaratnam.

UG/PG: UG	**Department:** Civil Engineering
Course Code: -	**Course Name:** Sustainable Building Project Delivery
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course:	

Syllabus

Introduction to sustainable development ; Energy and environmental issues in built environment; Concept of eco-friendly materials and designs, Reuse-reduce and recycling of material, waste utilization in construction materials; Professionals associated in a sustainable building project, roles and responsibilities of engineers and managers, integrated project management, certified professionals for sustainable projects, project delivery and documentation for certification of sustainable buildings; Introduction to green movement and sustainable buildings, sustainable building economics, concepts of life cycle costing ; Introduction to sustainable building design and rating systems, Requirements and submittals, national and international certification processes (LEED, LEED India, GRIHA-TERI, etc.), exposure to related standards and organizations, associated tools and terminology, continual improvement, case studies.

Course Outcomes

1. Ability to understand the Concept of sustainable development.
2. Ability to understand the waste utilization in construction materials.
3. Ability to understand the Introduction to sustainable building design.

Text Books

1. Sustainable construction, design and delivery by Charles Kibert
2. LEED Green building rating System
3. GRIHA Building rating system

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Industrial Waste Treatment
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course: Environmental Engineering – II	

Syllabus

Sources and characteristics, Effects of Discharges of Industrial Waste on receiving bodies of water, land and Sewer. Effluent and stream standards. Specific Industrial Treatment Processes: Neutralization, Equalization and proportioning, Volume and strength Reduction. Raw Materials, water Requirement, Flow Sheet and treatment of Industrial Wastewater Generated form: Textile Tannery, Pulp and Paper, Dairy, Distillery, Dying and Printing, and electro-plating Industry. Provisions of various Indian standards for above Industries. Potentials for Wastewater recycle and reuse in industries, Concept of Common effluent treatment plants.

Course Outcomes

1. Ability to understand the sources and characteristics, Effects of Discharges of Industrial Waste on receiving bodies of water.
2. Ability to understand the Specific Industrial treatment Processes.
3. Ability to understand the methods of treatment of Industrial Wastewater.
4. Ability to understand the methods Potentials for Wastewater recycle and reuse in industries.

Text Books

1. Industrial Wastewater by Nelson L Nemerow
2. Industrial water pollution control, William Wesley Eckenfelder
3. Industrial Wastewater Treatment by Rao & Dutta

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Urban Water Conveyance System Design
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course: Environmental Engineering – II	

Syllabus

Urban hydrological cycle and components; Impact of urbanization on hydrological cycle; Anomalies & characterization of rainfall; Time and scale effects; Urban hydrological data requirements and analysis; Rainfall-runoff modelling and simulation using TR-20, TR-55 and SWMM/EPANET/HEC models; Planning & design aspects of storm water/drainage infrastructure; Water supply conveyance system analysis and design. Operation and maintenance of urban water conveyance system.

Course Outcomes

1. Understand and analyse the urban hydrological cycle and its components.
2. Simulate the urban watershed behaviour using different modelling tools.
3. Plan and design the storm drainage system.
4. Analyse and design the water supply distribution systems and networks.

Text Books

1. Hall, M.J., Urban Hydrology, Elsevier, 1984.
2. Optimal Design of Water Distribution Networks, P. R. Bhave, Narosa Publishing House, 2003.
3. Butler, D. & Davies, J.W. Urban Drainage, Spon Press, 2nd Edn., 2004.

References

1. Leonard, O.J. & Sherrif, J. Scope for the Control of Urban Runoff. Report 124, CIRIA, 1992.
2. DOE/NWC Design and Analysis of Urban Storm Drainage. The Wallingford Procedure. Dept. of the Environment, Standing technical Committee Report 28, 1981.
3. Shaw, E.M. Hydrology in Practice. 3rd Edn., Chapman & Hall, 1994

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Intro. to Spatial Data Collection & Analysis
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course:	

Syllabus

Remote Sensing: Basic concepts, Remote Sensing Platforms & Sensors; Remote sensing data products; Geometric & Radiometric corrections; Visual interpretation and digital image processing; Image Classification, Accuracy Assessment; Image Processing Software. Overview of GNSS techniques, Introduction to the GNSS functions, Components and operation of GNSS; Surveying and data collection using GNSS; Overview of 3D Terrestrial Scanners and Ground Penetrating Radar. Geographic al Information System; Basic concepts and components of GIS; Digital representation of geographic data, Database creation, Raster and Vector based GIS data and analysis, Database management; Operations and analysis in GIS; Introduction of GIS software. Application case studies of spatial data collection and analysis techniques.

Course Outcomes

1. Ability to understand geo-spatial data collection techniques i.e., remote sensing, satellite based positioning and laser based spatial data collection
2. Learning selection of appropriate geo-spatial data requirement and collection technique for different applications
3. Able to extract required information from the geo-spatial data through different image processing techniques, processes and methods
4. Analyzing geo-spatial data and finding solution of different geographic problems

Text Books

1. Remote Sensing & Digital Image Processing: by Lillesand & Keifer, John Wiley & Sons, Inc.
2. Introductory digital image processing: a remote sensing perspective, J. R., Jensen, Prentice Hall
3. Global Navigation Satellite Systems (GNSS), G. S. Rao, Tata McGraw Hill Publications.
4. Principles of geographical information system, P. Burrough, Oxford University Press.

References

1. Chou, Yue-Hong. 1997, Exploring spatial analysis in geographical information systems, One Word Press, USA
2. Christopher Jones. 2002, Geographical information systems and computer cartography Longman, London.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Concrete Technology
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course: Construction Materials and Construction Materials Lab	

Syllabus

Fundamental of concrete - constituents, proportioning, mixing, transportation, placing and curing., Admixtures, Properties of concrete in fresh and hardened state., Concrete mix design, Production of concrete, Quality control, Strength of concrete, Special concretes, Durability of concrete, Concrete subjected to extreme environmental conditions, Deterioration mechanisms, assessment and control of corrosion in concrete structures, In-situ assessment of concrete structures, Various NDT techniques and their applications, Repair of concrete structures.

Course Outcomes

1. To acquire knowledge of concrete making materials/ingredients and various parameters affecting properties of concrete.
2. Comprehend the behaviour of fresh and hardened concrete.
3. To be able to design concrete mix for different grades.
4. Explore special concretes for construction.
5. To acquire knowledge of various Non-destructive testing and concrete repair methods.

Text Books

1. Concrete Technology: M. L. Gambhir, Tata Mcgraw Hill Publishing Company Limited; 3rd edition (2006).
2. Properties of Concrete: A. M. Neville, Pearson education India; 5th edition (2011).
3. Testing of Concrete in Structures: J. H. Bungey, CRC Press; 4th edition (2006).
4. Concrete Technology: A.M. Neville and J.J. Brooks, Pearson India Education Service Pvt. Ltd; 2nd edition (2020).

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Prestressed Concrete
Credit: 3	**L-T-P: 3-0-0**
Elective Type: Industrial Track Honours Elective	
Pre-requisite Course: Design of RC Structures	

Syllabus

Basic philosophy of prestressing; various techniques of prestressing; different systems of prestressing; Prestressing of concrete structures; losses in prestress; deflection of prestressed concrete members; analysis and design of prestress beams; camber; deflection; cable layouts; stretching in stages, ultimate strength in flexure and shear. Design of end blocks; Statically indeterminate structures; concordant cables; linear transformation, Analysis and design of continuous beams. Tension members; circular prestressing-prestressed tanks and prestressed pipes. Compression members; piles. Partial prestressing; composite construction, analysis of composite beams, prestress slabs; Introduction to pre-cast prestressed elements like poles, railway sleepers, beams, slabs and wall panels etc. planning and economical aspects of prestressed structures, construction of prestressed concrete structures-techniques, materials and management.

Course Outcomes

1. Knowledge about pre-stressing, processes and construction of pre-stressed structural components.
2. Learned method of analysis of pre-stressed structural components.
3. Ability to design pre-stressed components for different Civil Engineering Construction Projects

Text Books

1. Prestressed Concrete Structures by T.Y. Lin
2. Prestressed Concrete Structures by Krishnaraju
3. Prestressed Concrete Structures by G.S. Pandit & S.P. Gupta.