Syllabus – III to VIII Semester B.E

Outcome Based Education Curriculum

2021-2022

Department of Civil Engineering
NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY
Mudugurki Village, Venkatagiri Kote Post**,**
Devanahalli Taluk,
Bangalore District - 562 164

DEPARTMENT OF CIVIL ENGINEERING

VISION

To transform the students as leaders in Civil Engineering to achieve professional excellence in the challenging future.

MISSION

M1: To provide the Civil Engineering knowledge and skills for students through an excellent academic environment.

M2: Adopting innovative teaching techniques using modern engineering tools for designing, modeling and analyzing the societal and environmental problems.

M3: Developing Communication skill, leadership qualities through teamwork and skills for continuing education among the students.

M4: To inculcate moral, ethical and professional values among students to serve the society.

M5: Validate engineering knowledge through innovative research projects to enhance their employability and entrepreneurship skills.

Program Educational Objectives (PEOs)

- **PEO1**: Graduates in Civil Engineering will apply the technical knowledge for sustainable societal growth.

- **PEO2**: Graduates of civil Engineering will demonstrate designing, modeling and analyzing skills.

- **PEO3**: Graduates in Civil Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.

- **PEO4**: Civil Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.

- **PEO5**: Civil engineering graduates will have the ability to become entrepreneurs thereby switching over from responsive engineering to creative engineering.
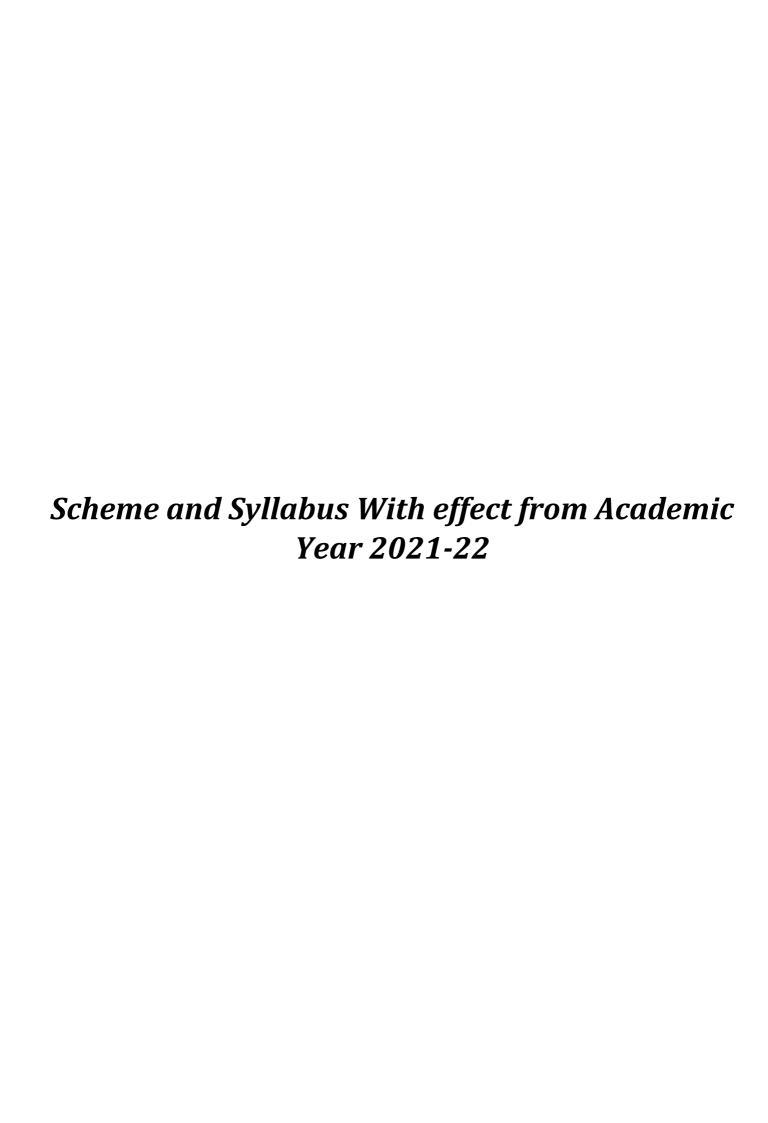
Program Outcomes (POs)

- **PO-1**: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and Civil Engineering principles to the solution of complex problems in Civil Engineering.

- **PO-2**: Problem Analysis: Identify, formulate, research literature and analyze complex Civil Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

- **PO-3**: Design/Development of Solutions: Design solutions for complex Civil Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.

- **PO-4**: Conduct Investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions related to Civil Engineering problems.

- **PO-5**: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering tools such as CAD, FEM, GIS, etc. including prediction and modeling to complex Civil Engineering activities with an understanding of the limitations.

- **PO-6**: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Civil Engineering practice.

- **PO-7**: Environment and Sustainability: Understand the impact of the professional Civil Engineering solutions in societal and environmental contexts and demonstrate the knowledge and the need for sustainable development.

- **PO-8**: Ethics: Apply ethical principles and commit to professional ethics and responsibilities while following the Civil Engineering practice.

- **PO-9**: Individual and Team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

- **PO-10**: Communication: Communicate effectively on complex Civil Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **PO-11**: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Civil Engineering projects and in multidisciplinary environments.

- **PO-12**: Life Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO)

- **PSO-1:** Apply the knowledge of Civil Engineering in Sustainable Infrastructure developments.

- **PSO-2:** Identify, analyze and manage Civil Engineering problems with ethical and social responsibilities.

- **PSO-3:** Implementation of relevant codes/ specifications/ guidelines to arrive at comprehensive solutions to address societal needs and exhibit communication and teamwork skills.

Scheme and Syllabus With effect from Academic Year 2021-22

Third Semester B.E. – Scheme

Sl. No.	Course Code		Course Name	Teaching Dept.	Total Credits	L:T:P:S	Marks
1	BSC	20CVM31	Fourier Series, Transforms & Numerical Techniques	BS	4	3-2-0-0	100
2	PCC	20CVT32	Strength of Materials	CE	3	3-2-0-0	100
3	PCC	20CVT33	Fluids Mechanics and Machinery	CE	3	3-2-0-0	100
4	PCC	20CVT34	Construction Materials, Stores and Inventory Control	CE	3	3-0-0-0	100
5	PCC	20CVT35	Engineering Surveying	CE	3	2-2-0-0	100
6	PCC	20CVT36	Engineering Geology	CE	3	3-0-0-0	100
7	PCC	20CVL37	Building Material Testing Laboratory	CE	2	1-0-2-0	100
8	HSMC	20CVH38	Universal Human Values	S&H	3	2-0-2-0	100
9	HSMC	20CPH39	Constitution of India and Professional Ethics	S&H	1	1-0-2-0	100
TOTAL					25	21:8:6:0	900

BSC-Basic Science	PCC – Professional Core	PEC – Professional Elective	MEP – Industrial Elective	HSMC – Humanity and Social Science

L - Lecture	T - Tutorials	P - Practical	S - Self Study

Fourth Semester B.E. – Scheme

Sl. No.	Course Code		Course Name	Teaching Dept.	Total Credits	L:T:P:S	Marks
1	BSC	20CVM41	Applied Calculus and Probability Distributions	BS	4	3-2-0-0	100
2	PCC	20CVT42	Structural Analysis-I	CE	4	3-2-0-0	100
3	PCC	20CVT43	Advanced Construction Techniques	CE	3	2-2-0-0	100
4	PCC	20CVT44	Irrigation and Hydraulic Structures	CE	3	3-0-0-0	100
5	PCC	20CVT45	Geotechnical Engineering	CE	3	3-0-0-0	100
6	PCC	20CVT46	Water Supply Engineering	CE	3	3-0-0-0	100
7	PCC	20CVL47	Surveying Practice	CE	2	1-0-2-0	100
8	PCC	20CVL48	Fluids Mechanics and Machinery Lab	CE	2	1-0-2-0	100
9	HSMC	20KSK49	Samskrutha Kannada and Balake Kannada	S&H	1	1-0-0-0	100
TOTAL					25	20:6:4:0	900

BSC-Basic Science	PCC – Professional Core	PEC – Professional Elective	MEP – Industrial Elective	HSMC – Humanity and Social Science

L - Lecture	T - Tutorials	P - Practical	S - Self Study

Fifth Semester B.E. – Scheme

Sl. No	Course Code		Course Name	Teaching Dept.	Total Credits	L-T-P:S	Marks
1	PCC	20CVT51	Design and Drawing of RCC Structures	CE	4	3-2-0-0	100
2	PCC	20CVT52	Structural Analysis-II	CE	3	2-2-0-0	100
3	PCC	20CVT53	Highway Engineering and Construction	CE	3	2-2-0-0	100
4	PEC	20CVT54	Construction Quality Management System	CE	3	3-0-0-0	100
5	PCC	20CVT55	Foundation Engineering	CE	3	2-2-0-0	100
6	PEC	20CVT56X	Professional Elective – I	CE	3	3-0-0-0	100
7	PCC	20CVL57	Environmental Engineering Lab	CE	2	1-0-2-0	100
8	HSMC	20CVH58	Construction Management and Entrepreneurship	CE	3	3-0-0-0	100
9	HSMC	20CVH59	Environmental Studies	CE	1	1-0-0-0	100
Total					**25**	**20:8:2:0**	**900**

Professional Elective – I		
Sl. No	**Course Code**	**Course**
1	20CVT 561	Alternative Building Materials And Technologies
2	20CVT 562	Air pollution controlling and monitoring
3	20CVT 563	Design of Masonry Structures

PCC – Professional Core	PEC – Professional Elective	MEP – Industrial Elective	HSMC – Humanity and Social Science

L - Lecture	T - Tutorials	P - Practical	S - Self Study

Sixth Semester B.E. – Scheme

Sl. No	Course Code		Course Name	Teaching Dept.	Total Credits	L-T-P:S	Marks
1	PCC	20CVT61	Design of Steel Structures	CE	4	3-2-0-0	100
2	PCC	20CVT62	Estimation and Quantity Surveying	CE	3	2-2-0-0	100
3	PCC	20CVT63	Construction planning & Project Management	CE	4	3-2-0-0	100
4	PEC	20CVT64X	Professional Elective –II	CE	3	3-0-0-0	100
5	PEC	20CVT65X	Professional Elective –III	CE	3	3-0-0-0	100
6	MEP	20CVT66X	Industrial Elective-I	CE	3	3-0-0-0	100
7	PCC	20CVL67	Concrete and Highway Engineering Lab	CE	2	1-0-2-0	100
8	PCC	20CVP68	Extensive Survey project	CE	2	1-0-2-0	100
9	P & T	20CVPT60	Placement Training	PT	1	1-0-0-0	100
Total					**25**	**20:6:4:0**	**900**

Professional Elective –II		
Sl. No	**Course Code**	**Course**
1	20CVT 641	Traffic Engineering and Management
2	20CVT 642	Remote sensing and GIS
3	20CVT 643	Sub Surface Exploration and Ground Improvement Techniques

Professional Elective –III		
Sl. No	**Course Code**	**Course**
1	20CVT 651	Repair and Rehabilitation of Concrete structures
2	20CVT 652	Advanced design of temporary structure
3	20CVT 653	Solid waste Management

Industrial Elective – I		
Sl. No	Courses Code	Course Name
1	20CVT 661	Construction joints and water proofing
2	20CVT 662	Construction Safety and industrial policies
3	20CVT 663	Natural Disaster Mitigation and Management

PCC – Professional Core	PEC – Professional Elective	MEP – Industrial Elective	HSMC – Humanity and Social Science

L - Lecture	T - Tutorials	P - Practical	S - Self Study

Seventh Semester B E Scheme

Sl. No	Subject Code		Subject	Teaching Dept.	L-T-P-S	Total Credits	Marks
1	PCC	20CVT71	Bridge Engineering	CE	2-2-0-0	3	100
2	PCC	20CVT72	Pre Stressed Concrete Structures	CE	2-2-0-0	3	100
3	PEC	20CVT73X	Professional Elective – IV	CE	3-0-0-0	3	100
4	MEP	20CVT74X	Industrial Electives- II	CE	3-0-0-0	3	100
5	MEP	20CVT75X	Industrial Electives- III	CE	3-0-0-0	3	100
6	PCC	20CVL76	Geotechnical Engineering Lab	CE	1-0-2-0	2	100
7	PCC	20CVL77	Software Application Lab	CE	0-0-2-0	2	100
8	PCC	20CVP78	Project Phase -I	CE	0-0-0-2	1	100
Total					**14:4:4:2**	**20**	**800**

Professional Elective - IV		
Sl. No	**Courses Code**	**Course**
1	20CVT 731	Transportation Engineering
2	20CVT 732	Advanced Concrete Technology
3	20CVT 733	Energy efficient and Green Buildings

Industrial Elective - II		
Sl. No	**Courses Code**	**Course**
1	20CVT 741	Analysis and Design of Tall Structures
2	20CVT 742	Computational Structural Mechanics
3	20CVT 743	Advanced Design of Steel Structures

Industrial Elective - III		
Sl. No	**Courses Code**	**Course**
1	20CVT751	Earthquake Engineering
2	20CVT 752	Municipal wastewater treatment
3	20CVT 753	Ground Water Hydrology

PCC – Professional Core	PEC – Professional Elective	MEP – Industrial Elective	HSMC – Humanity and Social Science

L - Lecture	T - Tutorials	P - Practical	S - Self Study

Eighth Semester B E Scheme

Sl. No	Course Code	Course Name	Total Credits	Marks
1.	20CVP81	Internship	3	100
2.	20CVP82	Project Phase (II, III & Viva Voce)	12	400
Total			**15**	**500**

PCC – Professional Core	PEC – Professional Elective	MEP – Industrial Elective	HSMC – Humanity and Social Science

L - Lecture	T - Tutorials	P - Practical	S - Self Study

Nagarjuna College of Engineering and Technology, Bengaluru

Credit distribution for 2021-22 scheme of study

Programme: BE in Civil Engineering

Sem	S1	S2	S3	S4	S5	S6	S7	S8	S9	Total
1	4	3	3	4	3	2	1			20
2	4	4	3	3	3	2	1			20
3	4	3	3	3	3	3	2	3	1	25
4	4	4	3	3	3	3	2	2	1	25
5	4	3	3	3	3	3	2	3	1	25
6	4	3	4	3	3	3	2	2	1	25
7	3	3	3	3	3	2	2	1		20
8	3	3	4	4	1					15
Total Credits										175

THIRD SEMESTER

FOURIER SERIES, TRANSFORMS AND NUMERICAL TECHNIQUES					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVM31	**3:2:0:0**	**4**	**50:50**	**3 Hours**	**BSC**

Course Objectives:

This course will enable students to:

- Have the efficiency in expressing a periodic function in terms of infinite trigonometric series.
- Obtain the knowledge of Laplace Transforms.
- Acquire the skill in solving the engineering applications problem using Laplace Transforms.
- Get the ability to solve the engineering problem using Fourier Transforms.
- Develop the proficiency in solving algebraic and transcendental equations and interpolation using numerical methods.

Syllabus

Module – I

Fourier Series: Periodic functions, Dirichlet's conditions, Euler's Formulae (without proof), Fourier series of periodic functions of period 2l and 2π, Half range Fourier series, Practical harmonic analysis-problems. **10Hrs**

Module – II

Laplace Transform: Definition, Laplace Transform of elementary functions. Properties, transform of derivatives, multiplication by t^n and division by t - Problems. Laplace transforms of periodic functions, unit step functions and unit impulse function – Problems. **10 Hrs**

Module – III

Inverse Laplace Transforms: Inverse Laplace Transforms of standard functions. (Formulae only). Inverse Laplace transform by using completing the squares, partial fractions, shifting property and differentiation - problems. Convolution theorem - problems. Applications - solution of linear differential equations with initial conditions- problems. **10 Hrs**

Module – IV

Fourier Transforms and Z - Transforms: Complex Fourier transforms, Fourier Sine and Cosine transforms and their inverse transforms –
problems.

Z - Transforms of some standard functions, Damping and shifting rules - problems. Inverse
Z –Transforms by partial fraction method. **10Hrs**

Module – V

Numerical Methods: Numerical solutions of algebraic and transcendental equations- Regular Falsi Method and Newton Raphson Method (Formulae only) –Problems. Finite Differences-Forward and Backward differences, Newton's Forward and Newton's Backward interpolation formulae. Lagrange's Interpolation formula (without proof)–Problems. Numerical Differentiation using Newton's Forward and Backward interpolation formulae. –Problems. **10Hrs**

Course Outcomes:

On completion of this course, the students are able to:
- Demonstrate Fourier series to study the behavior of periodic functions and their applications in engineering problem.
- Find the Laplace transform of different types of functions.
- Use the Laplace transform and inverse Laplace Transform in solving various types engineering application problems.
- Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in engineering applications.

• Determine the roots of Algebraic and Transcendental equations and Interpolation arising in engineering applications, using numerical methods.

Text Books:
- Dr. B.S. Grewal: "Higher Engineering Mathematics", (Chapters 10, 21, 22, 28, 29, 30), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN:9788174 091955.
- N.P. Bali and Dr. Manish Goyal: "A Text Book of Engineering Mathematics",
  (Chapters 10, 18, 20, 22, 24), Laxmi Publications (P) Ltd., New Delhi, 9thEdition, 2014,
  ISBN: 9788131808320.

Reference Books:
- Erwin Kreyszig: "Advanced Engineering Mathematics", Wiley Pvt. Ltd. India, New   Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.

- B.V. Ramana: "Higher Engineering Mathematics", Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.

E-Resources:
- http://bookboon.com/en/essential-engineering-mathematics-ebook
- https://www.free-ebooks.net/ebook/essential-engineering-mathematics
- https://archive.org/details/AdvancedEngineeringMathematics10thEdition

STRENGTH OF MATERIALS					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT32	**3-2-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The objective of this course is to enable the students to understand the behavior of structural members under different loading in terms of flexure, shear, torsion and compound stresses.

Syllabus

Module – I

Simple Stress and Strain: Introduction, Properties of Materials, Stress, Strain, Hooke's law, Poisson's Ratio, Stress – Strain diagram for structural steel and non-ferrous materials, Principle of superposition, Deformation of uniform bars.

Elastic constants: Relationship among elastic constant, Volumetric strain, Stresses in varied sections, Composite Bars & Temperature Stress problems. **10Hrs**

Module – II

Bending Moment and Shear Force: Introduction, Shearing force, Bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams. Fixed beam and overhanging beams considering point loads, UDL, UVL and Moment. **10 Hrs**

Module – III

Deflection of beams: Definitions of slope, deflection, Elastic curve, derivation of differential equation for deflection, Sign convention, Slope and deflection for standard loading cases using Macaulay's method for beams subjected to point loads, UDL and moment.

Compound stresses: Introduction, Stress components on inclined planes, General two dimensional stress system, Principal planes and stresses, Mohr's circle of stresses. **10 Hrs**

Module – IV

Torsion of circular shafts: Pure torsion, torsion equation of circular shafts, torsional rigidity and polar modulus, Power transmitted by shaft for solid and hollow circular shafts.

Elastic stability of columns: Short and long columns, Euler's theory on long columns, Effective length slenderness ratio, radius of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula. **10 Hrs**

Module – V

Bending stress in beams: Introduction to Bending stress in beams, Assumptions in pure bending and derivation of Bending equation, Modulus of rupture, section modulus, Flexural rigidity.

Shear Stress in Beams: Expression for shear stress in beam, Shear stress diagram for symmetrical and unsymmetrical section. **10Hrs**

Course Outcomes:

Students will be able to

- Apply the knowledge of strength of various structural element subjected to external forces.
- Examine the behavior of different structural elements subjected to various types of loads.
- Evaluate the strength of structural elements under the action of compound stresses, torsion and buckling.
- Understand the effect of pure bending concepts.

Text Books:

- S. S. Bhavikatti, "Strength of Materials", S. Chand (G/L) & Company Ltd, 4th edition, 2013, ISBN: 978-9325971578.
- Dr. R. K. Bansal, "A Textbook of Strength of Materials", Laxmi Publisher, 5th Edition, 2012, ISBN: 978-8131808146.
- S. Ramamrutham and R. Narayanan, "Strength of Materials", Dhanpat Rai Publishing Company, 14th Edition, 2011, ISBN:978-8187433545.

Reference Books:

- Dr. B. C. Punmia, Dr. A. K. Jain, "Mechanics of Materials", Fire wall media, 2002, ISBN: 9788170082156.
- Ferdinand P. Bere, Johnston (jr) and E. Russel "Mechanics of Materials", Mcgrawhill Publisher, 7th Edition, 2016. ISBN:978-9339217624.
- Stephen Timoshenko, " Strength of Materials", 3rd Edition, CBS Publisher, 2002, ISBN:978-8123910307

E-Resources:

- http://www.vtuupdates.com>vtunotes
- http://www.vidhayarthiplus.com
- http://www.iitg.ernet.in>qip>cd_cell>chapters

FLUID MECHANICS AND MACHINERY

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT33	3-2-0-0	3	50:50	3 hours	PCC

Course Objectives:

This course will introduce the students to the basic principles of fluid mechanics and enable them to apply these principles to fluid flow problems associated with pipe flows, open channel flows. Further, this course enables the students to understand the working principles of pumps and turbines.

Syllabus

Module – I

Fluids & Properties: Introduction to fluids, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Viscosity, Cohesion, Adhesion, Surface tension & Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems), Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet (Numerical problems).

Fluid Pressure and Its Measurements: Definition of pressure, Pressure at a point, Pascal's law, Variation of Pressure with depth. Measurement of pressure using simple, differential manometers (No problems).   **10Hrs**

Module – II

Hydrostatic Forces on Surfaces: Introduction, Definitions Total pressure and Centre of pressure, equations for hydrostatic force and depth of centre of pressure for Vertical and inclined submerged plane surfaces (Numerical Problems).

Kinematics and Dynamics of Fluid Flow: Introductions, types of fluid flow, streamline path line. Laws of Mass, Energy and Momentum, Continuity equation (Three Dimensional), Euler's equation, Bernoulli's equation using Euler's equation of motion with assumptions and limitations (Numerical Problems).   **10 Hrs**

Module – III

Flow through pipes:

Head losses - Major loss & Minor loss, Darcy - Weisbach Equation, Hydraulic Gradient line, Total Energy Line, Series and Parallel Network of pipes, Numerical Problems.

Orifice and mouth piece: Hydraulic coefficients, Concept of Orifice and Mouthpiece (No Numerical Problems).

Notches and Weirs: Definition of Notch and Weir, Flow through V-notch, Rectangular weir, Cippoletti weir, Corrections for Velocity of Approach, End Contractions, Numerical Problems.   **10 Hrs**

Module – IV

Open Channels Flow: Velocity using Chezy's and Manning's equations, Hydraulic Efficient Channels: Rectangular and Trapezoidal channel, Numerical Problems. Specific Energy, Critical Depth, Froude's Number, Specific Energy Diagram, Subcritical and Supercritical flows, Alternative Depths, Hydraulic Jump, Numerical Problems.   **10 Hrs**

Module – V

Impact of Jet on Vanes: Impact of jet on vanes, Force exerted by the jet on a straight & curved vane (Stationary & Moving). Velocity triangles, Numerical Problems.

Pumps: Centrifugal and reciprocating pumps working principle and applications.

Turbines – Classification – Components and working principle of Pelton wheel turbine and Francis turbines. Draft Tube: Types, Efficiency of Draft tube.   **10Hrs**

Course Outcomes: After completing the course, the students will be able to

- CO1: Applying the knowledge of fundamental principles of mass, energy and momentum for solving fluid flow problems.
- CO2: Analyze the fluid flow problems using Continuity and Bernoulli's equation.
- CO3: Apply impulse momentum principle to compute impact of jet on fixed and moving plates
- CO4: Select and applying appropriate methods for flow measurements
- CO5: Analyze the working of different components of pumps and turbines.

Text Books:
- R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi
- P.N. Modi& S.M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House
- Madan Mohan Das, "Fluid Mechanics and Turbo Machines", PHI Learning Pvt. Ltd. 2011

Reference Books:
- K Subramanya, "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Publishing Co. Ltd.
- K Subramanya, "Fluid Mechanics and Hydraulic Machines-problems and solutions", Tata McGraw Hill Publishing Co. Ltd.
- Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", 5 Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)

E-Resources:
- nptel.ac.in/courses/105/103/105103095/
- nptel.ac.in/courses/105/105/105105203/
- nptel.ac.in/courses/105/101/105101082/

CONSTRUCTION MATERIALS, STORES AND INVENTORY CONTROL					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT34	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The students will be able to:

- Classify the types of building materials and Inventory Control.
- Describe the importance of cement and aggregates.
- Acquire the knowledge on steel used in construction industry.
- Familiarize with alternative building materials.
- Comprehend the concept of stores and inventory control.

Syllabus

Module – I

Building Materials: Stone as building material; Requirement of good building stones, dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks as per IS 3495: 1992. Other masonry units, Sizes, requirement of good blocks. Types of masonry. Insulation materials, classification, properties, applications.   **10 Hrs**

Module – II

Cement, Fine aggregate and Coarse aggregate: Cement – Manufacturing of cement, Types of cements and their uses, Field test and acceptance. Tests on aggregates (IS 2386: 1963 and IS 383 : 2016) Fine aggregate –Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate –Importance of size, shape and texture. Grading, specific gravity, flakiness and elongation index, crushing test, impact test and abrasion tests.   **10 Hrs**

Module – III

Concrete: Ingredients, Manufacturing Process – admixtures – batching plants – mixing – transporting – placing – compaction of concrete – curing and finishing. Nominal mix and design as per IS10262:2019. Site mix concrete – Ready mix concrete. Advantages and disadvantages.

Steel: Introduction, Types of Reinforcement – structural steel – metallic – non-metallic – sizes – configuration, test methods as per IS 1786: 1985, corrosion and its protection.   **10 Hrs**

Module – IV

Timber and other materials: Timber, market forms, industrial timber, plywood, veneer, expanded polystyrene, laminates, aluminum and other metallic. Paints – varnishes – distempers, bitumen and sealants.

Modern materials: Glass, ceramics, sealants for joints, refractories, composite materials – types – applications – advantages and disadvantages, fibre textiles.   **10 Hrs**

Module – V

Stores and Inventory Management: Stores Management - Purpose of stores, Types of stores, Location and Layout, Cost aspects and Productivity, problems and developments.

Inventory Management – Introduction, Raw materials, Work-In-Progress (WIP), Finished goods, Norms of inventory, Queueing theory, Peculiarities in India context, Relevant costs.   **10 Hrs**

Course Outcomes:

Students will be able to

- Recognize the material quality for construction projects.
- Apply the knowledge for the selection of alternative building materials.
- Application of different types of cement and steel used for construction.
- Relate the importance of stores and inventory management.

Text Books:

- Rangawala, Building Construction, Charotar Publishing House Pvt. Ltd., India, 33rd Edition, 2019.
- P. C. Rangawala, "Engineering Materials (Material Science)", Charotar Publishing House, India,

33rd Edition, 2015, ISBN: 978-93-85039-04-1.
- M. S Shetty, "Concrete Technology Theory and Practice", S. Chand & Co Ltd., New Delhi, 2007.
- P. Gopalakrishnan and M. Sundaresan, Materials Management and Integrated Approach, PHI Learning Pvt. Ltd., New Delhi, 34th Edition, ISBN: 978-81-203-0027-9, 2012.

Reference Books:
- S. K. Duggal: "Building materials", New Age International Pub lishers, India, 4th Revised Edition, ISBN 10: 81224337900.
- Rangwala, "Engineering Materials", Charotar Publishing House Pvt. Ltd., India, 43rd Edition, 2019.
- M. L Gambhir, "Concrete Technology", 4th edition, McGraw-Hill, 2009.
- IS 3495 (Parts 1 to 4) : 1992, Methods of Tests of Burnt Clay Building Bricks.
- IS 2386: 1963, Methods of Test for Aggregates For Concrete.
- IS 383 : 2016, Coarse and Fine Aggregate for Concrete Specification.
- IS 1786: 1985, Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement.

E-Resources:
- https://nptel.ac.in/courses/105/102/105102088/
- https://nptel.ac.in/courses/105/106/105106053/
- https://www.rejinpaul.com/2015/03/ce6401-construction-materials-syllabus-notes-question-papers-civil-4th-sem.html

ENGINEERING SURVEYING					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
19CVT35	**2-2-0-0**	3	**50:50**	**3 hours**	**PCC**

Course Objectives:

This course enables the students to gain knowledge about the conventional, latest methods and instruments used for measuring distances, angles and elevation of objects. Students will be able to perform levelling to compute areas and volumes of the existing ground profile.

Syllabus

Module – I

Introduction to Surveying:

Introduction to Surveying, Definition of surveying, Classification of surveying, Units of measurement, Basic principles of surveying, Precision and Accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout.

Linear measurements:

Chain and tapes, Ranging of lines, Direct and indirect methods of ranging, Measurement using tapes, Chain and tape corrections, Numerical Problems. Introduction to minor instruments. **10 Hrs**

Module – II

Measurement of Directions and Angles:

Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems

Traverse – open and closed traverse, WCB and Reduced bearing, computation of included angles given the bearings of legs of a closed traverse.

Levelling:

Principles and basic Definitions, Types of adjustments and objectives, Temporary adjustments of a dumpy level, booking of levels, Rise and Fall method and Height of Instrument method, Differential levelling, longitudinal & cross section levelling, refraction & curvature correction, reciprocal levelling. **10 Hrs**

Module – III

Theodolite surveying:

Theodolites and types, Uses of Theodolite, temporary and permanent adjustment, Measurement of Horizontal and Vertical angle.

Tacheometry :

Basic principle, Types of tachometric survey, Tacheometric equation for horizontal line of sight in fixed hair method.

Contouring: Characteristics of contour, methods of contouring including usage of softwares. **10 Hrs**

Module – IV

Curves:

Simple Curves - Necessity, types, Definitions, designation of curve, elements of simple curve - settings of simple circular curve by linear method, setting out of simple curves by Rankines deflection angle method. Introduction to compound curve and reverse curve – Introduction to vertical curves.

Areas and Volumes:

Calculation of area from cross staff surveying, Calculation of area of a closed traverse by coordinates method. Planimeter – principle of working and use of planimeter to measure areas, Computations of volumes by trapezoidal and prismoidal rule. **10 Hrs**

Module – V

Total station:

Basic Principle – Classifications - Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system, Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and

Microwave system. Care and maintenance of Total Station instruments. Modern positioning systems – Traversing and Trilateration. **10 Hrs**

Course Outcomes:

Students will be able to:

- Understand the basic concepts of surveying.
- Utilize different surveying instruments to solve problems by appropriate methods.
- Develop skill to carry out tachometry, geodetic surveying in the field.
- Explain latest technologies and modern instruments used in survey.
- Estimate the area of a given plot and quantities of earthwork involved in cuttings and fillings.

Text Books:

- Dr B C Punmia, "Surveying Volume I, Lakshmi Publications Pvt Ltd,6th Edition, 2005,ISBN 978-81-700-8853-0.
- Dr B C Punmia, "Surveying Volume II", Lakshmi Publications Pvt Ltd, 6th Edition, 2005,ISBN 978-81-700-8853-0.
- Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan,1988, ISBN-10 : 8185825009.

Reference Books:

- C Venkatramaiah," Text Book of Surveying, Universities Press (India) Pvt. Ltd, 5th edition, 1996.
- S.K. Roy, "Fundamentals of Surveying", Prentice-Hall of India Pvt. Limited, 2004, 2nd Edition, ISBN: 81-20-312-60-0.
- R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi, ISBN 10: 0198085427.

E-Resources:

- http://lib.uniten.edu.my/libsite/index.php?option=com_joomd&view=item&layout=detail&typeid=2&id=202&Itemid=790
- http://ascelibrary.org/journal/jsued2
- www.survivorlibrary.com/.../engineers_surveying_instruments_1892.pdf

ENGINEERING GEOLOGY					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT36	**3:0:0:0**	**3**	**CIE:50 SEE:50**	**3 hours**	**FC**

Course Objectives:

To make students to learn, The principles of Engineering Geology, Earth resource and their properties, Earth processes and natural hazards, Earths structures and their impact on engineering construction and Water resource management and conservation.

Syllabus

Module – I

INTRODUCTION: Geology and its role in the field of Civil Engineering. Earth: Its internal structure and composition.

MINERALOGY: Description and identification of Rock forming minerals and Ores, based on physical and special properties, Quartz and its varieties; Feldspar group; Mica group; carbonate group; Hornblende, Olivine, Asbestos, Talc, Gypsum, Garnet, Corundum. Magnetite, Hematite, Limonite, Pyrite, Chalcopyrite, Pyrolusite, Psilomalane, Chromite, Galena, Bauxite. **8 Hours**

Module – II

GEOMORPHOLOGY: Epigene and Hypgene geological agents; rock weathering and its types; Soil formation, types, erosion and remedial measures; Geological action of rivers with different drainage patterns; Geological action of wind. Coastal zones, coastal landforms, continental shelf, continental rise, continental slope, abyssal plain, mid-oceanic ridges, trenches, tsunamis. Landslides; causes effects and remedial measures. **8 Hours**

Module – III

PETROLOGY: Rocks as fundamental units and building materials of the earth crust and their engineering applications: As building stones, road metals and stones for decoration, pavement, cladding, roofing, flooring, concreting and foundation engineering.

Igneous rocks: Origin, classification (chemical and textural), mode of occurrence; Identification and description of Granite, Syenite, Diorite, Gabbro, Dunite; Pegmatite, Porphiries, Dolerite; Rhyolite, Basalt and Pumice.

Sedimentary rocks: Origin, classification, primary structures and description of Sandstones, Conglomerate, Breccia, Shale, Lime stones and Laterite.

Metamorphic rocks: Kinds of metamorphism, description of Gneiss, Quartzite, Marble, Slate, Phyllite and Schists. **8 Hours**

Module – IV

ROCK DEFORMATION AND ENGINEERING GEOLOGY: Deformational effects on different rocks; Out crop, Dip, strike and escarpment, Dip And Strike Problems Clinometer-compass- Joints, faults, folds and unconformities their effects on civil engineering structures. Earthquakes- Seismic waves, seismograph, causes, effects, seismic zones, shield areas and seismic resisting structures. Study of Topo-

Sheet.

Geophysical investigations for civil engineering projects: Study of toposheets and geological maps, importance of lithological and structural features studies for the construction of Dams, Reservoirs, Tunnels, Bridges and Highways. **8 Hours**

Module – V

HYDROGEOLOGY: Hydrological cycle; distribution of ground water in the earth crust; properties of water bearing geological formation: Aquifers and their types; selection of sites for well locations and spacing of wells; geological, hydrological and geophysical investigations for ground water exploration; artificial recharge of groundwater methods and rainwater harvesting. Sea water intrusion and remedial measures. Bore Hole Problems. **8 Hours**

Course Outcomes:
Students will be able to

1. Access the knowledge of earth and its internal structure.

2. Explain Earth process and its effect on engineering construction.

3. Recognize good building materials and their properties.

4. Understand the dynamics of Earth Structure.

5. Explain about aquifers, its properties and conservation of water.

Text Books:
1. **Text book of Geology** by P.K. Mukherjee, World Press Pvt. Ltd. Kolkatta. ISBN-13 9788187567547

2. **Foundations of Engineering Geology**, by Tony Waltham (3rdEd.) Universities Press. ISBN 9780415469609

3. **Principles of Engineering Geology and Geotechnics** by Dimitri P. Krynine and William R. Judd. ISBN 13: 9788123906034

4. **Structural Geology (3rd Ed.)** by M. P. Billings, Published by Prentice Hall of India Pvt. Ltd. New Delhi

5. **Text of Engineering and General Geology** by Parbin Singh, Published by S. K. Kataria and Sons, New Delhi. ISBN: 8188458511, 9788188458516.

6. **A Text book of Engineering Geology** by Chenna Kesavulu, MacMillan India Ltd.

7. **A Text Book of Mineralogy** by Dana, E.S & Ford, W.E. (1985), WELLY, Delhi

Reference Books:
1. **Rock Mechanics for Engineers** by Dr. B. P. Verma, Khanna Publishers, New Delhi.

2. **Physical Geology** by Arthur Holmes, Thomson Nelson and Sons, London.

3. **Ground water assessment**, development and management by K. R. Karanth, Tata McGraw Hills

4. **Rutley's Elements of Mineralogy** by Read, H.H. (1984), 26th ed., CBS, N. Delhi R2. Billings, Marland P (1987) Structural Geology, 3rd ed., PHI, Delhi

E-Resources:

1. https://books.google.co.in/books/about/Textbook_of_Engineering_Geology. html?id=W-aXSbdjB1cC

2. https:// books. google. co. i n/ books/ about/ Engineering Geology. html?id=ViNDDAAAQBAJ&redir_esc=y

3. https:// books. google. co. i n/ books/ about/ Engineering Geology. html?id=Izm6IUVDBcUC&redir_esc=y

4. https://nptel.ac.in/courses/105105106/

BUILDING MATERIAL TESTING LABORATORY

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
19CVL37	1-0-2-0	2	50:50	3 hours	PCC

Course Objectives:

The students will be able to:
- Test as per Bureau of Indian Standards specifications.
- Analyze and inference the test results.

Syllabus

1. Tension test on Mild steel bars: verification of stress and strain behavior,
2. Test on Rebar – Density and Bend test.
3. Compression test on Cast iron.
4. Test on bricks, tiles and building blocks: strength, water absorption and efflorescence.
5. Torsion test on Mild Steel circular sections.
6. Test on Wood – Flexural strength and compression test.
7. Shear Test on Mild steel.
8. Impact test on Mild Steel (Charpy and Izod).
9. Hardness tests on ferrous and non-ferrous metals–Brinell's, Rockwell and Vicker's.

Course Outcomes:

Students will be able to
- Understand the procedural aspects of testing the building materials as per BIS.
- Contemplate the physical properties of building materials as per BIS.
- Determine the mechanical properties of construction materials as per BIS and interpret the test results.

Text Books:
- M. S Shetty, "Concrete Technology Theory and Practice", S. Chand & Co Ltd., New Delhi, 2007.
- Dr.B.C Punmia:"Mechanics of Materials Volume-I",(Chapters1-3,7),Lakshmi Publi- cations, 1ˢEdition, 2014, ISBN:978-81-318-0646-3.
- M L Gambhir and NehaJamwal, "Building and construction materials-Testing and quality control", McGraw Hill education (India)Pvt. Ltd.,2014.

Reference Books:
- Davis, Troxell and Hawk, "Testing of Engineering Materials", International, Student Edition – McGraw Hill Book Co. New Delhi.
- Holes K A, "Experimental Strength of Materials", English Universities Press Ltd, London.
- Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd. New Delhi.
- Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors1996. IS 3495 (Parts 1 to 4) : 1992, Methods of Tests of Burnt Clay Building Bricks.
- IS 1786: 1985, Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement.

E-Resources:
- https://sm-nitk.vlabs.ac.in/
- https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf
- https://www.iare.ac.in/sites/default/files/lab1/IARE_Strength_of_Materials_Laboratory.pdf

UNIVERSAL HUMAN VALUES : UNDERSTANDING HARMONY					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVH38	**2-0-2-0**	**3**	**50:50**	**3**	**HSMC**

Course Objectives:

The objective of the course is four fold:

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

Syllabus

Module – I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
 4. Right understanding, Relationship and Physical Facility- the basic requirements for ful filment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module – II

Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module – III

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

 13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module – IV

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Course Outcomes:

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as "H-102 Universal Human Values 2: Understanding Harmony" is designed which may be covered in their III or IV semester.

During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

Text Books:
- Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

- Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews

- Economy of Permanence - J C Kumarappa
- Bharat Mein Angreji Raj - PanditSunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- India Wins Freedom - Maulana Abdul Kalam Azad
- Vivekananda - Romain Rolland (English)
- Gandhi - Romain Rolland (English)

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND HUMAN RIGHTS					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CPH38	1:0:2:0	1	CIE:50 SEE:50	2 Hours	HSS

Course Objectives:

This course will enable the students to
- The basic information about Indian constitution.
- The fundamental rights and duties of a citizen.
- Special privileges of socially and economically weaker sections of the society.
- Individual role and ethical responsibility towards society.
- Understand the categories in Indian Government

Syllabus

Module–I

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution, Fundamental Rights & Its limitations. **03 Hours**

Module– II

Directive Principles of State Policy & Relevance of Directive Principles of State Policy, Fundamental Duties. Union Executives – President, Prime Minister, Parliament, Supreme Court of India. **03Hours**

Module–III

State Executives–Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments. **02Hours**

Module– IV

Special Provision for SC & ST, Special Provision for Women, Children & Backward Classes, Emergency Provisions. Human Rights-Working of National Human Rights Commission in India, Powers and functions Of Municipalities, Panchayats and Co-Operative Societies. **03Hours**

Module–V

Scope & Aims of Engineering Ethics, Responsibility of Engineers, Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering. **02Hours**

Course Outcomes:

On completion of this course the students are able to
- Familiarize with fundamental rights and duties.
- Recognize the Electoral Process.
- Get exposed to legislature and judiciary.
- Realize special provisions given for women, children and weaker section of society.
- Exhibit Engineering ethics and responsibilities of Engineers .

Text Books:

1. Durga Das Basu,"Introduction to the Constitution of India", Lexis Nexis Publications; 22ndEdition, 2015, ISBN-13:978-9351434467.
2. Charles E. Haries, Michael S Pritchard and Michael J.Robins,"Engineering Ethics", Thomson Wadsworth,2nd Edition,2003,ISBN-13:978-9812436764.

Reference Books:

1.M.V. Pylee,"An Introduction to Constitution of India",Vikas Publishing,2002,1stEdition,ISBN-13:978-8125918325.

2. M.Govindarajan, S.Natarajan,V.S.Senthilkumar,"Engineering Ethics",PHILearning Private Limited, New Delhi,2ndEdition, 2013, ISBN-13:978-8120348165.

3. Brij Kishore Sharma,"Introduction to the Constitution of India", PHI Learning Private Limited, New Delhi.

FOURTH SEMESTER

APPLIED CALCULUS AND PROBABILITY DISTRIBUTIONS					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVM41	**3:2:0:0**	**4**	**50:50**	**3 Hours**	**BSC**

Course Objectives:

This course will enable students to:

- Acquire the knowledge of calculus of complex functions.
- Develop the proficiency in solving Numerical integral and Initial value problems.
- Obtain the knowledge of probability distributions.
- Learn concept of the Joint distributions and Markov's chains.
- Known the importance of statistical inference in engineering.

Syllabus
Module – I

Complex Variables:

Complex variables: Functions of a complex variable, derivative of complex functions. Analytic functions, (No problems by using limits). Cauchy's-Riemann equations in Cartesian and polar forms, Harmonic functions – problems (No problems by using limits). Construction of analytic functions by using Milne-Thomson method -problems.

Complex integration: Line integrals -problems. Cauchy Theorem (no problems on verification of the theorem) and Cauchy's integral formula -problems. **10 Hrs**

Module – II

Numerical Methods: Numerical Integration-Trapezoidal rule, Simpson's 1/3rd and 3/8th rule. Numerical solutions of ordinary differential equations of first order and first degree- Picard's method, Taylor's Series method, Modified Euler's Method, Runge-Kutta Method of 4th order and Milne's Predictor Corrector Method (without proof) –Problems **10 Hrs**

Module – III

Random Variables and Probability Distribution: Discrete and continuous Random Variables, Probability density function and distributions. Binomial, Poisson, Exponential and Normal distributions. **10 Hrs**

Module – IV

Joint Probability and Markov's Chain: Joint Probability distribution of two discrete random variables. Expectations, correlation and covariation.

Probability vectors, stochastic matrices, fixed point matrices, regular stochastic matrices, Markov's Chains, higher transition probabilities, stationery distribution of regular Markov's Chains. **10 Hrs**

Module – V

Sampling and inference: Sampling Distribution, Testing of hypothesis, level of significance, confidence limits, test of significance of large samples, sampling of variables, central limit theorem, confidence limits for unknown means, Students t-distribution and Chi-square test. **10 Hrs**

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

- Use the concepts of analytic functions and complex integration in engineering application problems.
- Solve the Numerical integral and Initial value problems arising in engineering applications, using numerical methods.
- Apply probability distributions in analyzing the probability models arising in engineering field.
- Apply Joint probability distributions and Markov's chains in analyzing the probability models arising in engineering field.
- Use the concept of sampling analysis in analyzing the statistical models arising in engineering field.

Text Books:
- Dr. B.S. Grewal: "Higher Engineering Mathematics", (Chapters 20,26,27,30,32), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN: 9788174091955.
- N.P. Bali and Dr. Manish Goyal: "A Text Book of Engineering Mathematics",(Chapters: 19,21), Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2014, ISBN: 9788131808320.
- Seymour Lipschutz and Marc Lars Lipson: "Probability", (Chapters: 5 and 8), McGraw Hill Education (India) Private Limited, Chennai, Special Indian Edition, 2010, ISBN: 978-0-07-014622-8.

Reference Books:
- Erwin Kreyszig: "Advanced Engineering Mathematics", Wiley Pvt. Ltd., India, New Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.

- B.V. Ramana: "Higher Engineering Mathematics", Tata McGraw – Hill Publishing   Company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.

E-Resources:
- http://bookboon.com/en/essential-engineering-mathematics-ebook
- https://www.free-ebooks.net/ebook/essential-engineering-mathematics
- https://archive.org/details/AdvancedEngineeringMathematics10thEdition
- http://www.zums.ac.ir/ebooks/mathematics/essential-engineering-mathematic.

STRUCTURAL ANALYSIS-I					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT42	**3-2-0-0**	**4**	**50:50**	**3 hours**	**PCC**

Course Objectives:

To enable the students to gain knowledge on the fundamentals of structural analysis by applying the knowledge gained through Engineering Mechanics and Strength of Materials. It enables to get the prerequisite for advanced structural analysis and design.

Syllabus

Module – I

Introduction:

Forms of structures, Conditions of equilibrium, Degree of freedom, one, two and three dimensional structural systems, Determinate and indeterminate structures, Degree of Indeterminacy.

Analysis of trusses: Method of joints and Method of sections.   **10 Hrs**

Module – II

Arches and Cables:

Three hinged parabolic and circular arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment.

Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.   **10 Hrs**

Module – III

Deflection of beams:

Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts.

Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections   **10 Hrs**

Module – IV

Analysis of beams:

Fixed beams, Clapeyron's theorem of three moments for continuous beams with different end conditions.

Slope deflection method: Continuous beams and rigid frames (with and without sway) – Symmetry and anti-symmetry – Simplification for hinged end – Support displacements   **10 Hrs**

Module – V

Strain Energy Principle:

Strain energy and complimentary strain energy. Strain energy due to axial load, bending moment and shear force. Theorem of minimum potential energy, principle of virtual work.

Castigliano's theorems and their applications in the analysis of determinate beams and trusses. Maxwell – Betti's theorem of reciprocal deflection.   **10 Hrs**

Course Outcomes:

Students will be able to

- Identify forms of structures and the associated in determinacies, analyze the trusses by using method of joints and method of sections.
- Apply the force equilibrium conditions and compatibility conditions to analyze simple structures like arches, cables, beams
- Evaluate structural response for various loads.
- To differentiate the suitable structures for various purposes.
- Apply energy principles to analyse determinate structures.

Text Books:

- Theory of Structures Vol-1 by Pandit and Gupta, Tata McGraw Hill, New Delhi, 1 st Edition
- S S Bhavikatti: "Structural Analysis-Vol.I", Vikas Publishing House, 4thEdition, 2009, ISBN:9788125927907.

- S Ramamrutham and R Narayan: "Theory of Structures", DhanpatRai Publishing Company Private Limited, New Delhi, 9thEdition, 2014, ISBN:978-9384378103.

Reference Books:
- V. N Vazirani: "Analysis Of Structures Vol. 1: Analysis, Design And Details Of Structures", International Student Edition, Mcgraw Hill Book Co., New York, 2008, ISBN:978-8174091406.
- ReddyC.S:"BasicStructuralAnalysis", TataMcGrawHill,New Delhi, 3rdEdition, 2010, ISBN:9780070702769.
- Structural Analysis by R C Hibler, 5th edition, Pearson Education

E-Resources:
- https://www.edx.org/learn/structural-engineering
- https://www.coursera.org/courses?query=structural%20engineering
- https://www.classcentral.com/course/swayam-structural-analysis-i-14313

ADVANCED CONSTRUCTION TECHNIQUES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT43	**2-2-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The objective of this course is to enable the students to understand various construction techniques, construction practices and construction methods. To gain the knowledge on construction of sub structure and super structure. Selection of various construction equipments and their uses.

Syllabus

Module – I

Construction Techniques: Different types of structures - Load Bearing Structure - Framed Structure – Components parts of Load bearing and framed structures - Load transfer mechanism.

Construction Methods – Introduction to Precast construction techniques. Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Building automation -Case studies of residential, office buildings and other buildings in each zones. **10 Hrs**

Module – II

Construction Practices: Details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork –Foundation – Plinth – Superstructure. Building Foundations - Types of foundations. Masonry – Types of Masonry - Bond in masonry. Centering, shuttering and scaffoldings and its types. Special types of form work – Slip form. Flooring – Types of Flooring. Roofing and different types of Roof finishes. **10 Hrs**

Module – III

Sub Structure Construction: Techniques of Sub Structures –Jacking Techniques – Pipe and Box Jacking. Various Piling Techniques. Tunneling -Process and Sequence of Tunneling techniques, tunneling in soft soil and rocks. Under water construction Techniques – cofferdam and its types – diaphragm walls and sheet piles - well and caisson and its types. **10 Hrs**

Module – IV

Super Structure Construction: Bridges – Component and parts, Types of Bridge Deck Systems. Bridge launching techniques – Span by Span method –Balance Cantilever Method – Progressive Placement Method – Incremental Launching method. Concept of Pre Stressing – Pre Tensioning and Post Tensioning, Merits and Demerits. Articulated structures - Erection of articulated structures**. 10 Hrs**

Module – V

Construction Equipment: Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – types of cranes - Equipment for dredging, trenching, tunneling. **10 Hrs**

Course Outcomes:

After a successful completion of the course, the student will be able to:
- Acquire knowledge on different construction techniques and methods.
- Identify and analyze various techniques and practice for Sub Structure and super structure.
- Select suitable equipments for construction and adopt suitable construction techniques.
- Supervise the construction of different construction methods and techniques based on suitability

Text Books:
- Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.
- Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", DhanpatRai and Sons, 1997.

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

Reference Books:
- Jha J and Sinha S.K., "Construction and Foundation engineering", Khanna Publish- ers, 1999.
- Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2002.
- Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.
- Mahesh Varma, "Construction Equipment and its Planning and Application", Met- ropolitan Book Company, New Delhi, 1983.

IRRIGATION AND HYDRAULIC STRUCTURES

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT44	3-0-0-0	3	50:50	3 hours	PCC

Course Objectives:

The main objective of the course is to enable the students to learn the basics of Irrigation and Hydraulic structures which will help them in computation of water requirement of different crops and to design a canal system for irrigation.

Syllabus

Module – I

Introduction: Definition. Benefits and ill effects of irrigation. Sources of water for irrigation. Systems of irrigation: Surface and ground water, flow irrigation, Lift irrigation, Bhandhara irrigation. Methods of irrigation in India – Potential and development

Irrigation and water requirements of crops: Definition of duty, Delta and Base period, Relationship between Duty, Delta and Base period, Factors affecting duty of water. Irrigation efficiency, Frequency of irrigation.

10Hrs

Module – II

Canals: Definition. Types of canals, Alignment of canals. Longitudinal section of canal, Balancing depth, Losses in canal, Typical C/S of Irrigation channel in cutting, in filling, in partial cutting & filling, Lined canals: types of lining, selection of types of lining, Maintaince of Irrigation channel. Cross drainage works: types- selection of suitable type of CD works **10 Hrs**

Module – III

Reservoirs: Definitions. Investigation for reservoir planning. Storage zones. Determination of storage capacity and yield of a reservoir using mass curve. Diversion Works: Definition. Layout. Types of weirs, Tank sluices and canal drops. Reservoir sediment control, Single purpose and multipurpose reservoir.

10 Hrs

Module – IV

Dams: Introduction, Types of dams, Selection of Dam, Factors Affecting Selection of Dam, Failures of dams. Gravity dams: Definition. Forces acting on a Gravity dam. Modes of failures. Elementary and practical profile. Low and high gravity dams. Problems on Gravity dam. Functions of Drainage galleries.

10 Hrs

Module – V

Earthen dams: Introduction. Types of earthen dams. Failure of earthen dams. Criteria for safe design of earthen dam. Phreatic line. Slope protection and seepage control measures, Spillways: Definition. Types of Spillways. Energy dissipaters: Types and introduction to IS Stilling basins (No problems). **10Hrs**

Course Outcomes:

Students will be able to

  CO1: Explain the necessity, scope of irrigation and able to compute the crop water requirement.

  CO2: Describe theories of Canal design and apply the concept to lined and unlined canals and detail out the cross sections.

  CO3: Prepare planning, design and operational requirements of storage reservoir, gravity dams and analyze for its stability.

  CO4: Applying the design concept of the hydraulic structures on permeable foundation.

Text Books:

- Santosh Kumar Garg, "Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures", Khanna Publishers, 24th Revised Edition (2011)
- B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, PandeBrijBasiLal, "Irrigation and Water Power Engineering", Laxmi Publications, Sixteenth Edition (2016)
- K R Arora, Irrigation Water Power and Water Resource Engineering, Publisher: Standard Publishers Distributors, edition 2004.

Reference Books:
- P.N. Modi, "Irrigation & Water Resources Engineering", Standard Book House. 9th Edition(2014)
- Pande B.B, Arun Kumar Jain, Ashok Kumar Jain, "Textbook of Irrigation Engineering and Hydraulic Structures", Laxmi Publications , 16th Edition (2014)
- B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, PandeBrijBasiLal, "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 16th Edition, 2016

E-Resources:
- https://nptel.ac.in/courses/105/105/105105110/
- https://nptel.ac.in/courses/105/106/105106114/

GEOTECHNICAL ENGINEERING					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT45	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The students will be able to understand the basic concepts of soil mechanics to identify and classify the different soil types and Comprehend basic engineering and mechanical properties of different types of soil. In addition, they will study about geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering and assess the improvement in mechanical behaviour by densification of soil deposits using compaction. Also, they will get to know about laboratory tests to determine strength characteristics of soils and consolidation settlement.

Syllabus

Module – I

Introduction: Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.

Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis (sieve analysis).

Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970). **10 Hrs**

Module – II

Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering.

Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, Proctor's needle, Compacting equipment's and their suitability. **10 Hrs**

Module – III

Flow through Soils: Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena. Seepage Analysis: Laplace equation, assumptions and limitations.

Flow nets: characteristics and applications. Flow nets for sheet piles and below the dam section. Effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena. **10 Hrs**

Module – IV

Shear Strength of Soil: Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotropy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. **10 Hrs**

Module – V

Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumptions and limitations. Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Normally consolidated, under consolidated and over consolidated soils. Determination of consolidation characteristics of soils-compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation. **10 Hrs**

Course Outcomes:

Students will be able to

- Acquire an understanding of the procedures to determine index properties of soil, classify the soil based on its index properties.
- Determine compaction characteristics of soil and apply that knowledge to asses field compaction.
- Determine permeability of soils and acquire conceptual knowledge about stresses due to seepage and effective stress.
- Estimate shear strength parameters of different types of soils by laboratory tests and comprehend Mohr-Coulomb failure theory.
- Estimate consolidation settlement of soil deposits and also time required for the same.

Text Books:

- Punmia B.C. (2005), "Soil Mechanics and Foundation Engg.", 16th Edition Laxmi Publications Co., New Delhi.
- Gopal Ranjan and Rao A.S.R. (2000), " Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.
- Venkatramiah C., Geotechnical Engineering, New Age International (P) Ltd , Publishers, New Delhi, 2006.
- Dr. K.R.Arora, "Soil Mechanics & Foundation Engineering", Standard Publishers & Distributors, New Delhi.
- Lambe and Whitman (1979), "Soil Mechanics" John Wiley & Sons, New York Terzaghi. K., and Peck. R.B. (1967) "Soil mechanics in Engineering practice", 2nd Edition, John Wiley and Sons, New York.

Reference Books:

- Head K.H., (1986), "Manual of Soil Laboratory Testing", Vol. I, II, III, Princeton Press, London.
- Bowles J.E. (1988), "Engineering Properties of Soil and Their Measurements", McGraw Hill Book Co. New York.
- Ramamurthy T.N. & Sitharam T.G.(2010), "Geotechnical Engineering", S.Chand & Company, New Delhi.
- Alam Singh and Chowdhary G.R. (1994), "Soil Engineering in Theory and Practice"' CBS Publishers and Distributors Ltd., New Delhi
- Braja M. Das (2002), Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India

E-Resources:

- http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/soil_mech/index.htm
- http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html
- http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf

WATER SUPPLY ENGINEERING					
Course Code	**L:T:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT 46	**3:0:0:0**	**3**	**CIE:50 SEE:50**	**4 hours**	**FC**

Course Objectives:

The students will able students to

Learn the types of water demand, sources, collection, quality, and conservation of water and gain knowledge in designing the water treatment and distribution of systems.

Syllabus

Module – I

Demand of Water: Need for protected water supply, types of water demands-domestic demand, industrial, institutional and commercial, public uses, fire demand. Factors affecting per capita demand, variations in demand of water, Peak Factor.

Design period: factors governing the design periods, population forecasting, different methods with merits and demerits, Numerical Problems.   **10Hours**

Module – II

Sources and Collection of Water: Surface and Subsurface Sources – With regard to quality and Quantity. Intake structures - types of intakes –Factors to be considered in selection of intake structures.

Water quality Characteristics: Sampling Objectives, Methods, Preservation techniques. Physical, chemical, microbiological. Drinking water standards BIS and WHO guidelines.   **10 Hours**

Module – III

Purification of Water: Objectives, Treatment Flow chart – Significance of each unit. Screening, Types of screen, Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers. Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Flocculation. Optimum dosage of coagulant – Jar test apparatus.

Filtration: Mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system.   **10 Hours**

Module – IV

Disinfection of Water: Theory of disinfection, methods of disinfection with merits and demerits, Chlorination, forms of application of chlorine, types of chlorination. Numerical problems.

Water Softening: Methods for removing temporary and permanent hardness, comparison of Lime soda and Zeolite process, Fluoridation and De-fluoridation, Demineralization, Miscellaneous Treatment. RO and Nano filtration: Basic principles, Flux, Salt passage, rejection and concentration polarization. Fluoridation and De-fluoridation.   **10 Hours**

Module – V

Conveyance of Water: Pumps: Types of pumps with working principles. Numerical Problems. Pipes: Design of the economical diameter for the rising main; Numerical Problems. Pipe appurtenances, Valves, Fire hydrants Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material.

Distribution System: Requirement of goof distribution system, Methods- Gravity, Pumping, Combined gravity and pumping system, different types of distribution networks, Methods of distribution, distribution reservoirs.   **10 Hours**

Course Outcomes:
- Achieve knowledge on different types of water demand.
- Analyze future population by different forecasting methods.
- Design water treatment and distribution systems.
- Asses the water quality with respect to public health and safety.

TEXT BOOKS :
1. Garg S.K.: "Environmental Engineering", Vols. I and II, 12th Edition, Khanna Publishers, New Delhi, 2001, ISBN: 81-7409-120-3.
2. B.C.Punmia: "Water Supply Engineering", Arihant Publications, ISBN: 81-7008-092-4.
3. Metcalf and Eddy Inc.: "Waste water Treatment, Disposal and Reuse", Tata McGraw Hill Publications, ISBN: 9780070495395.

Reference Books:
- B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010. 2.
- Howard S. Peavy, Donald R. Rowe, George T, Environmental Engineering - McGraw Hill International Edition. New York, 2000 3.
- CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

E-Resources:
- https://ecommons.cornell.edu.
- https://doi.org/10.1016/j.enbsoft.

SURVEYING PRACTICE					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVL47	**1-0-2-0**	2	**50:50**	**3hours**	**PCC**

Course Objectives:

The students will be able to:

Impart the practical knowledge of different surveying instruments. Also to effectively identify the different field procedures for a professional surveyor. Conduct a profile leveling to calculate the volume of earthwork for different Civil Engineering works, and also expose techniques and instruments used for setting out curves in the field.

Syllabus

List of Experiments

Sl. No	Name of the Experiment
1.	Measurements of distances using tape along with horizontal planes and slopes, direct ranging. Setting out perpendiculars. Use of cross staff, optical square.
2.	Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
3.	Determination of distance between two inaccessible points using compass
4.	Todeterminedifferenceinelevationbetweentwopointsusingsimpleanddifferentiallevelingtechniqueusing both HI and Rise and Fall methods.
5.	To determine the difference in elevation between two points using Reciprocal leveling and to determine the collimation error.
6.	Toconductprofilelevelingforwatersupply/sewagelineandtodrawthelongitudinalsectiontodeterminethedepthofcutanddepthoffillingforagivenformationlevel.
7.	Measurementofhorizontalangleswithmethodofrepetitionusingtheodolite.
8.	Measurement of vertical angles using the odolite.
9.	Tosetoutsimplecurvesusinglinearmethods–perpendicularoffsetsfromlong Chord.
10.	To set out simple curves using Rankine's deflection angles method.
11.	Traverse survey using total Station.

Course Outcomes:

Students will be able to

- Identify the different techniques to be adopted for surveying in field.

- Set the curves using linear and instrument method.

- To analyze the quantity of earthwork for the given profile based on the formation line.

Text Books:

- DrBCPunmia,"SurveyingVolumeI",LakshmiPublicationsPvtLtd,6thEdition,2005,ISBN978-81-700-8853-0

- DrBCPunmia,"SurveyingVolumeII",LakshmiPublicationsPvtLtd,6thEdition,2005,ISBN978-81-700-8853-0.

- Kanetkar T P and S V Kulkarni, Surveying and Leveling Part I,PuneVidyarthiGrihaPrakashan,1988,

ISBN-10: 8185825009

Reference Books:

- CVenkatramaiah,"TextBookofSurveying",UniversitiesPress(India)Pvt.Ltd,5thedition,1996.
- S.K.Roy,"FundamentalsofSurveying",(Chapter1,3&19),Prentice-

  HallOfIndiaPvt.Limited,2004,2ndEdition, ISBN:81-20-312-60-0.

- RSubramanian,SurveyingandLeveling,Secondedition,OxfordUniversityPress,NewDelhi,

  ISBN 10:0198085427

E-Resources:

- http://lib.uniten.edu.my/libsite/index.php?option=com_joomd&view=item&layout=detail&typeid=2&id=202&Itemid=790
- http://ascelibrary.org/journal/jsued2
- www.survivorlibrary.com/.../engineers_surveying_instruments_1892.pdf

FLUID MECHANICS AND MACHINERY LABORATORY					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVL48	**1-0-2-0**	**2**	**50:50**	**3 hours**	**PCC**

Course Objectives:

This course will enable students to impart the practical knowledge of different fluid and fluid machinery instruments. Also to Find hydraulic coefficients of flow measuring devices, Characterize the performance of hydraulics machines. Measure discharge and head losses in pipes and understand the fluid flow pattern.

Syllabus

Cycle 1
1. Calibration of V- Notch
2. Calibration of Rectangular Notch
3. Calibration of Broad Crested Weir and Ogee Weir

Cycle 2
4. To determine hydraulic coefficient of Orifice/mouth piece
5. Calibration of Venturi meter
6. To determine loss coefficient for flow through pipes
7. To determine darcy's friction factor for flow through pipes

Cycle 3
8. To determine Impact of jet on curved, flat and inclined vanes
9. To determine performance characteristics for varying speed with constant head for a given Centrifugal pump
10. To determine performance characteristics for varying speed with constant head for a given Pelton wheel turbine
11. To determine performance characteristics for varying speed with constant head for a given Kaplan Turbine

Course Outcomes:

During the course of study students will develop understanding of:
- Properties of fluid and the use of various instruments for fluid flow measurement.
- Working of hydraulic machines under various conditions of working and their characteristics.
- To measure the discharge using various measuring devices
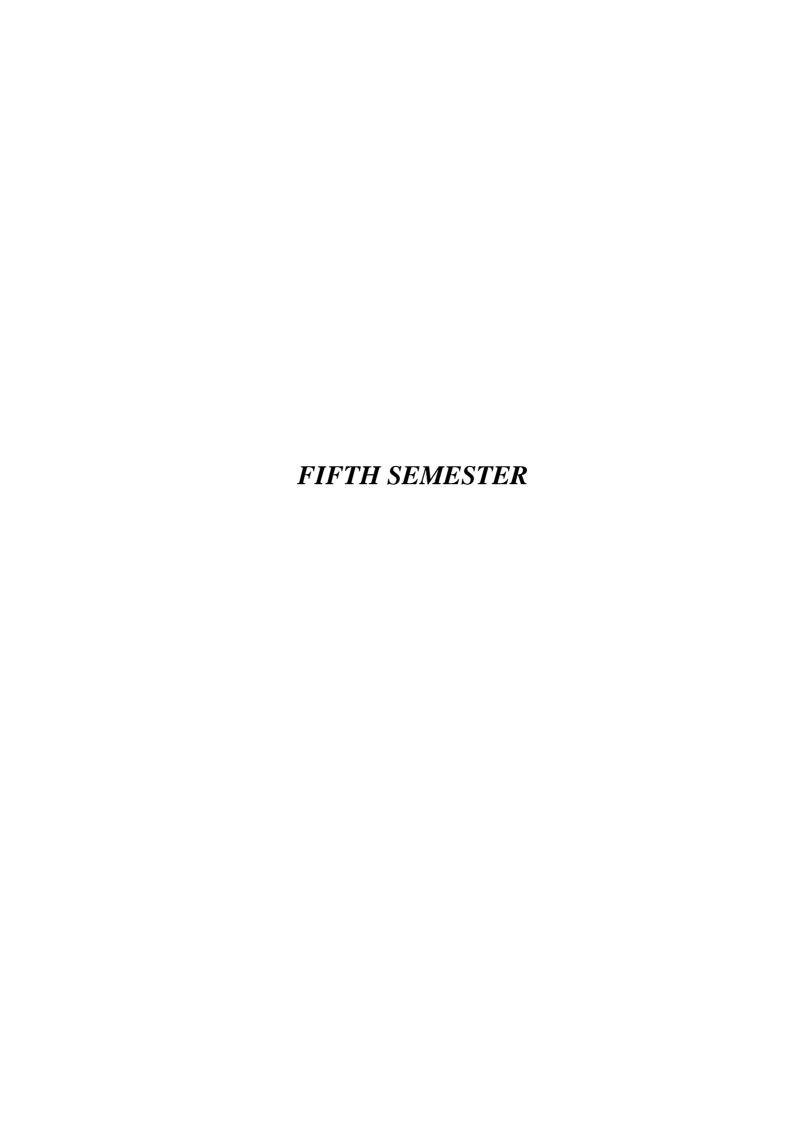- To measure loss coefficient for flow through pipes.

Text Books:
- P.N. Modi & S.M. Seth, "Hydraulics and Fluid Mechanics including ", Standard Book House
- Madan Mohan Das, "Fluid Mechanics and Turbo Machines", PHI Learning Pvt. Ltd. 2011
- R.K.Bansal, " A text book of fluid mechanics and hydraulic machines",

Reference Books:
- Sarbjit Singh , Experiments in Fluid Mechanics - PHI Pvt. Ltd.- New Delhi.
- Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press.
- Hydraulics and Fluid Mechanics' – Dr. P.N. Modi& D r S.M. Seth, Standard Book HouseNew Delhi. 2009 Edition.

E-Resources:
- **http://nptel.ac.in/courses/105107059/**

FIFTH SEMESTER

DESIGN AND DRAWING OF RCC STRUCTURES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT51	**3:2:0:0**	**4**	**50:50**	**3 hours**	**PCC**

Course Objectives:

To provide fundamental knowledge of concrete and steel reinforcement used for reinforced concrete design, Knowledge of design methodologies for different load conditions. The students will explore procedural knowledge in designing various structural RC elements by Imparting the usage of codes for strength, serviceability and durability.

Syllabus

Module – I

Introduction to Basic Design Concept:

Introduction, Objectives of Design of Reinforced Concrete Structures, Methods of Design, Design Loads, codal provisions for concrete and reinforcements.

Philosophies of Design: Principles of Working stress method (no numerical examples)and limit state method, Stress block parameters for limit state of collapse for flexure, flexural strength of singly, doubly reinforced and flanged sections, related numerical problems. Concepts of bond strength, development length, anchorage and shear resistance**.**   **10 Hrs**

Module – II

Design of Beams:
Design philosophy, Practical requirements, Size of beam, cover to reinforcement, and spacing of bars. Design procedures for critical sections for bending moment, shear and torsion. Anchorages of bars and check for development length. Reinforcement requirements and Slenderness limits for beams to ensure lateral stability.
Problems on simply supported, Cantilever and continuous beams (analysis using coefficients in IS 456), flanged sections. Serviceability.   **10 Hrs**

Module – III

Design of Slabs:
General consideration of design of slabs, Rectangular slabs spanning one direction, Rectangular slabs spanning in two directions for various boundary conditions. Design of cantilever slab, one way two way simply supported and continuous slabs.
Serviceability limit states: General aspects of serviceability, Deflection limit as in IS: code, Calculation of deflection (Theoretical method) cracking in structural concrete members, Calculation of deflections and crack width.   **10 Hrs**

Module – IV

Design of Columns:
General aspects, cover, development length, Effective length of column, Loads on columns, Slenderness ratio for columns, Minimum eccentricity, additional moments due to eccentricity. Design of short columns under axial compression, Design of short columns under compression with uniaxial bending.
Design of short and long columns under compression with biaxial bending. Using SP–16 charts. (Rectangular and circular sections only)   **10 Hrs**

Module – V

Design of Footings:
Introduction, load for footings. Design basis for limit state method, Design of isolated rectangular footing for axial load, axial load and uniaxial moment.
Design of Stair cases: General features, Types of stair case, loads on stair cases, effective span as per IS code provisions, Distribution of loading on stairs, Design of Open Well & Dog Legged Stair case
                                                                                                                                                        10 Hrs

Course Outcomes:

Students will be able to
- Apply basic fundamental principles, procedures, Indian code design specifications, Strain compatibility equilibrium concepts to determine the strength of RC members.
- Design RC structural components as per IS Codal Specifications.
- Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
- Design structural elements for serviceability.
- Prepare Reinforcement drawings of structural elements
-

Text Books:
- Pillai and Menon, Reinforced Concrete Design-, McGraw Hill Education, 3rd edition (2017)
- N Krishnaraju, Design of Reinforced Concrete Structures: IS:456-2000, CBS Publishers & Distributors, 4th Edition (2016)
- S.S.Bhavikatti:"Design of RCC Structural Elements Vol - I", New Age International Publications, New Delhi, ISBN:978-8122416930.

Reference Books:
- Neelam Sharma, "R.C.C. Design & Drawing", S.K. Kataria& Sons, Reprint edition (2013)
- P.C. Varghese, "Limit State Design of Reinforced Concrete", PHI Learning Private Limited, 2nd Edition (2008)
- V. L. Karve& Late S. R. Shaha, "Limit State Theory & Design of Reinforced Concrete (I.S. 456 - 2000)", Structures Publications (2014)
- S.N.Shinha: "Reinforced concrete Design" TMH Education Private Limited, ISBN: 978-9351342472

E-Resources:
- http://nptel.ac.in/courses/105105105/14
- https://youtu.be/pIdaC_I6H_M
- https://youtu.be/zVKf6hZfrhA
- https://youtu.be/DjT5G6Klf1M
- https://youtu.be/0fTvE8aSsiE

STRUCTURAL ANALYSIS II

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT52	**2-2-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The course will enable the students tom analyze statically indeterminate structures from the knowledge of fundamental and basic concepts of structural analysis.

Syllabus

Module – I

Moment Distribution Method: Introduction, Definition of terms- Distribution factor, Carry over factor, Development of method and Analysis of beams and orthogonal rigid jointed plane frames with kinematic redundancy less than/equal to three. **10 Hours**

Module – II

Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway. Analysis of rigid jointed non-sway plane frames. **10 Hours**

Module – III

Matrix Method of Analysis (Flexibility Method): Introduction to matrix methods, types, local and global axis and co-ordinates, Derivation of flexibility matrix equation, Flexibility coefficient matrix. Analysis of continuous beams and rigid jointed plane frames with static indeterminacy up to 3 using system approach.
10 Hours

Module – IV

Matrix Method of Analysis (Stiffness Method): Introduction, Derivation of stiffness matrix equation, stiffness coefficients. Analysis of continuous beams and rigid jointed plane frames with kinematic indeterminacy up to 3 using system approach. **10 Hours**

Module-V

Rolling Load and Influence Lines: Rolling load analysis for simply supported beams for several point loads and UDL, Influence line diagram for reaction, SF and BM at a given section for the cases mentioned above.
10 Hours

Course Outcomes:

Students will be able to

- Develop relevant equations for Displacement method and applying the same for analysis on structures for different loading and boundary conditions.
- Redistribute and estimate bending moments and shear force of Continuous beams and frame structures.
- Develop conditions for force method and apply the same for analysis on structures with different load and boundary condition.
- Analyse the beams and indeterminate frames by system stiffness method.
- Analyze beams for shear force and bending moment for rolling loads and use of influence line diagrams.

Text Books:

- S S Bhavikatti: "Structural Analysis-Vol.II",(Chapters1,7,8,12), Vikas Publishing House, 4thEdition, 2009, ISBN:9788125927907.
- S Ramamrutham and R Narayan: "Theory of Structures", (Chapters 1,4,6,9), DhanpatRai Publishing Company Private Limited, New Delhi, 9thEdition, 2014, ISBN:978-9384378103.

Reference Books:

- V. N Vazirani: "Analysis Of Structures Vol. 1: Analysis, Design And Details Of Structures", (Chapters 1, 6, 9), International Student Edition, Mcgraw Hill Book Co., New York, 2008, ISBN: 978-8174091406.

- Reddy C.S:"Basic Structural Analysis", (Chapters1,6,8),Tata McGraw-Hill, New Delhi, 3rdEdition, 2010, ISBN:9780070702769.

E-Resources:
- http://elearning.vtu.ac.in/elcmys/13/enotes/eceem/gr.pdf
- http://elearning.vtu.ac.in/elcmys/e-con/stru_ana/ch5/html/0004.htm
- http://elearning.vtu.ac.in/elcmys/p2/cv42/Chapters_05/html/0004.htm
- http://elearning.vtu.ac.in/elcmys/struana.html

HIGHWAY ENGINEERING AND CONSTRUCTION					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT53	**2-2-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

This course enables the students to study importance of the transportation, features and components of highway. To provide knowledge of highway materials and methods of construction of different types of flexible and rigid pavements.

Syllabus

Module – I

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport, Jayakar committee recommendations and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.

Highway Development and Planning: Road types and classification, road patterns, planning surveys, saturation system of road planning, phasing road development in India, Present scenario of road development in India (NHDP and PMGSY) and in Karnataka (KSHIP), Road development plan - vision 2021. **10 Hrs**

Module – II

Highway Alignment and Surveys: Ideal Alignment, Factors affecting the alignment, engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects. Pavement materials: Desirable properties of Sub grade soil, HRB soil classification, determination of CBR & examples, Aggregates-Desirable properties, List-Tests on Aggregates, Bituminous Materials – Desirable properties, List-Tests on bituminous materials. **10 Hrs**

Module – III

Highway Geometric Design – I: Importance, Terrain classification, Design speed, Factors affecting geometric design, Cross sectional elements-Camber, width of pavement, Shoulders, Width of formation. Right of way, Typical cross sections. Highway Geometric Design – II: Sight Distance, Restrictions to sight distance, PIEV theory, Stopping sight distance, Overtaking sight distance, overtaking zones- Examples. Sight distance at intersections, Horizontal Alignment-Radius of Curve, Super elevation, Extra widening, Transition curve and its length, Examples, Vertical Alignment-Gradient-summit and valley curves. **10 Hrs**

Module – IV

Pavement Components and Construction: Pavement types, component parts of flexible and rigid pavements and their functions. Preparation of subgrade, Specification and construction of Granular Sub base, WBM Base, WMM base, Bituminous Macadam, Dense Bituminous Macadam Bituminous Concrete, Dry Lean Concrete sub base, PQC and Joints in Concrete roads. Equipment's in Highway Construction: Various types of equipment for excavation, grading and compaction- advantages. List- Special equipment for bituminous and cement concrete pavements. **10 Hrs**

Module – V

PAVEMENT DESIGN: Design factors, ESWL and its determination-Examples, Flexible pavement-Design of flexible pavements as per IRC; 37-2012-Examples, Rigid pavement- Westergaard's equations for load and temperature stresses- Examples- Design of slab thickness only as per IRC: 58- 2015. Introduction to white topping – design factors and equipment's in use – quality control. Condition assessment of existing pavements. Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system. **10 Hrs**

Course Outcomes:

Students will be able to

- Describe the importance of road transportation in infrastructural development of a Nation.
- Design the geometric elements for the proposed alignment.
- Utilizing the pavement materials for designing and construction.
- Appraise and evaluate the highway economics.

Text Books:
- Dr. S.K. Khanna, Dr. C.E.G Justo, A. Veraraghvan, "Highway Engineering" Revised 10th Edition, Nem Chand & Sons (2017).
- L.R. Kadiyali, "Principles And Practices Of Highway Engineering"(Including Expressways And Airport Engineering), Khanna Publishers(2005).
- Transportation Engineering, K P Subramanium, ISBN:978-8174092205 2nd edition, 2011, Scitech Publications, Chennai.
- Introduction to Transportation Engineering, James H Banks, ISBN-13: 978-0070702462 2nd edition, 2004, Mc. Graw. Hill Pub. New Delhi.
- Construction Equipment and its Management- S.C. Sharma, (Chapters 1,2,3,4,6,7) SBN:9788174092281 8174092285 xvi+893 Yr. of Pub.2013 Paper Back English Khanna Publishers, Delhi.

Reference Books:
- IRC Codes, Indian Road Congress Publications
- "Specifications for Roads and Bridges"-MoRT&H Specifications, Indian Road Congress Publications(2013)
- C. Jotin Khisty, B. Kent lal, "Transportation Engineering, PHI Learning Pvt. Ltd", 3rd Edition(2002)
- E.J. Yoder, M.W. Witczak, "Road materials & Pavement Design", Wiley India Pvt Ltd; 2nd edition (2011)
- James H Banks, "Introduction to Transportation Engineering", McGraw. Hill Publicatons (2010)

E-Resources:
- https://www.fhwa.dot.gov/environment/publications/flexibility/ch01.cfm
- https://www.railelectrica.com/traction-mechanics/train-grade-curve-and- accelerationresistance-2/
- http://nptel.ac.in/courses/105104098/TransportationII/lecture6/7slide.htm/
- http://www.aboutcivil.org/highway-drainage-design-guidelines-structures.html
- http://nptel.ac.in/courses/105104098/45 • https://www.youtube.com/watch?v=qbO7ZMfCDWI

CONSTRUCTION QUALITY MANAGEMENT SYSTEM

Course Code	L:T:P:S	Credits	Exam marks	Course Type
20 CVT 54	**3-0-0-0**	**3**	**50:50**	**PEC**

Course Objectives:

The students will be able to learn the importance of quality assurance and control and get knowledge about the ISO standards for construction and QC/QA plan. Further the students will be able to explain the various Quality assessing tools as applied to construction industry.

Syllabus

Module – I

Introduction: Construction Quality, Eight dimensions of quality, Quality Gurus - definition of quality as given by Deming, Juran and Crosby. Deming's chain reaction, Juran's quality trilogy - Quality planning, Quality control and Quality improvement, Crosby's 14 points of quality improvement, Deming's 14 points of quality management. Quality aspects in every phase in the life cycle of Construction project, Quality control, Quality Assurance, difference between Quality control, Quality Assurance (QA/QC). Plan-Do-Check-Act Cycle. **10 Hrs**

Module – II

Quality Systems: Study of ISO 9000 - Quality System Standards, Purpose of ISO Standards - project setting construction QC/QA plan - contracts description - objectives of this construction quality assurance plan (CQAP) - organization

Project QC/QA organization - responsibilities and authorities of organizations- environmental protection agency - structure of QC/QA organization - responsibilities and authorities of key personnel - contractor's quality control personnel - QC systems manager **10 Hrs**

Module – III

Performance monitoring requirements - quality of life performance standards - pollution prevention - reporting

Inspection and verification activities - general construction inspection and verification requirements - control, verification and acceptance testing plan – inspections - preparatory inspection - initial inspection - follow-up inspection - completion inspection - QC testing - QA testing - construction acceptance criteria - construction audits - compliance with handling, storage, packaging, - preservation, and delivery requirements

- material identification and traceability . **10 Hrs**

Module – IV

Construction deficiencies - deficiency identification - contractor qc deficiency identification and control - non-conformance report - contractor QC deficiency correction - preventive actions

Documentation - daily record keeping - daily construction report - inspection and testing report forms - record drawings - control of quality records

Environmental requirement approvals (environmental protection agency) - required submittals – CQAP - work completion report - EPA approval

Field changes - CQAP changes - QC changes

Final reporting: As-built drawings and specification – QA/QC report **10 Hrs**

Module – V

Project Base Learning

   Quality plan for a small residential building including documentation using templates. **10 Hrs**

Course Outcomes:

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

1. Gain the knowledge of different aspects of quality
2. Implement QA/QC plan as per the ISO standards.
3. Understand the responsibilities of the QA/QC personnel.
4. Identify construction deficiencies, documentation, field changes and reporting for site.
5. Able to prepare the non-conformance report for the site activities.
6. Evaluate the QA/QC plan for life project.

Text Books:

- N. Logothetis, "Management for Total Quality",8ᵗʰ Edition, Prentice Hall New Delhi, 2003.
- D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book House, Bangalore. 2000
- Robert (QMP) "Bench Marking", "The search for industry Best Practices that led to superior performance" American Society of Quality 1995.

References:

- Break Joseph and Susan Joseph "Total Quality Management", Excel Books , New Delhi, 1995.
- Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2002.
- Ishikawa, K. (2006). Introduction to quality control. Productivity Press, Chennai.
- Mathur, P. (2003). Implementing ISO 9001:2000. Vikas Publishing House, New Delhi.
- Mitra, A. (2001). Fundamentals of quality control and improvement. Pearson Education Asia, New Delhi.
- Mohanty R., Lakhe R. (2002). Total quality management. Jaico Publication House, Mumbai

E-Resouces:

- https://nptel.ac.in/courses/110/104/110104080/
- **https://nptel.ac.in/courses/105/104/105104161/**
- **https://nptel.ac.in/courses/110/101/110101010/**

FOUNDATION ENGINEERING					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT55	**2-2-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The students will be able to learn foundation engineering terminology and introductory concepts of Geotechnical investigations required for civil engineering projects. Also they will study about the estimation of internal stresses developed in the soil mass and assess stability of slopes and earth pressure on rigid retaining structures. In addition, they will learn about different types of foundations and its bearing capacity determination along with settlement calculations.

Syllabus

Module – I

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration – Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT. **10 Hrs**

Module – II

Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart.

Foundation Settlement: Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1). **10 Hrs**

Module – III

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Cullman's graphical construction.

Stability of Slopes: Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-Ø (Method of slices) soils, Taylor's stability number. **10 Hrs**

Module – IV

Bearing Capacity of Shallow Foundation: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test. **10 Hrs**

Module – V

Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation). **10 Hrs**

Course Outcomes:

Students will be able to

- Plan and execute geotechnical site investigation program for different civil engineering projects.
- Understand the stress distribution and resulting settlement beneath the loaded footings.
- Estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures.
- Determine bearing capacity of soil and also settlement beneath the loaded footings on sand and clayey soils.
- Capable of estimating load carrying capacity of single and group of piles.

Text Books:

- Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
- K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, New Delhi.

- P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.
- Punmia B C, Soil Mechanics and Foundation Engineering-(2017), 16thEdition, Laxmi Publications co., New Delhi.
- Bowles J E , Foundation analysis and design, McGraw- Hill Publications, New York.

Reference Books:
- Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
- Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
- Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.
- Braja M. Das (2002), Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India.

E-Resources:
- www.sciencedirect.com/science/book/9780124080768
- https://www.bauer.de>bma>info_80_e
- thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/
- https:// www.nptel.ac.in/courses/105104034

ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT561	**3-0-0-0**	**3**	**50:50**	**3 hours**	**IEC**

Course Objectives:

This course enables the students to learn the concept of sustainable buildings using alternative building materials and technologies. understand environmental issues due to building materials and the energy consumption in manufacturing building materials, also study the various masonry blocks, masonry mortar and structural behaviour of masonry under compression

<div align="center">Syllabus</div>

<div align="center">Module – I</div>

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture, Green building ratings – IGBC and LEED manuals – mandatory requirements.   **10 Hrs**

<div align="center">Module – II</div>

Alternative Building Materials: Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks: mud blocks, steam cured blocks, Fal-G Blocks stone masonry block.

Recycling of Construction demolition waste (CDW) and CDW management.   **10Hrs**

<div align="center">Module – III</div>

Alternative Building Materials: Lime, Pozzolona cements, Raw materials, Manufacturing process, Properties and uses, Fibres- metals and synthetics, Properties and Applications. Fiber reinforced plastics, Matrix materials, Fiber organic and synthetics, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications, Field quality control test methods.   **10 Hrs**

<div align="center">Module – IV</div>

Alternative Building Technologies: Alternative for wall construction, Types, Construction method, Masonry mortars, Types, Preparation, Properties, Ferro cement and Ferro concrete building components, Materials and specifications, Properties, Construction methods, Applications, Alternative roofing systems, Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes**.**   **10 Hrs**

<div align="center">Module – V</div>

Structural Masonry: Compressive strength of masonry elements, Factors affecting compressive strength, Strength of units, prisms / wallettes and walls, Effect of brick work bond on strength, Bond strength of masonry : Flexure and shear, Elastic properties of masonry materials and masonry, IS Code provisions, Design of masonry compression elements, Concepts in lateral load resistance.   **10 Hrs**

Course Outcomes:

Students will be able to

- Identify and apply sustainable, alternative and cost effective construction materials and practices.
- Asses the properties of materials alternative to conventional materials considering cost, energy and aestheticism.
- Select the materials catering to the requirement of project based on its location and cost criteria.
- Apprehend the concepts of construction of building components by employing alternative building technologies.
- Analyse and design of masonry compression elements as per BIS.

Text Books:

- Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, "Alternative Building Materials and Technologies"- New Age International, New Delhi Bangalore, 2007.
- M. S Shetty, "Concrete Technology Theory and Practice", S. Chand & Co Ltd., New Delhi, 2007.

- A.W.Hendry , B.P.Sinha and S.R.Davies "Structural Masonry", 3rd edition, E. & F. N. Spon, 2004.

Reference Books:
- IS 1905, BIS, New Delhi.
- SP20(S&T),New Delhi.
- IS 4326, BIS, New Delhi.
- Proceedings of workshop on Alternative Building Materials and Technologies.
- A. R Santhakumar, "Concrete Technology"- Oxford University Press, New Delhi, 2007
  .

E-Resources:
- https://nptel.ac.in/courses/105/102/105102195/
- http://www.vtuboss.in/2018/07/vtu-civil-engineering-6th-sem-cbcs.html

AIR POLLUTION AND CONTROL					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT562	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PEC**

Course Objectives:

The students will be able to

Learn about sources of air pollution, classification, effects, measurement, standards, regulations, and importance of meteorology in dispersion of air pollutants and gain knowledge in designing the air pollution control systems.

Syllabus

Module – I

Sources of air pollutants: Composition and structure of atmosphere, Natural and anthropogenic, units of measurements of air pollutants. Simple problems on unit conversion.

Classification of Air Pollutants: Primary and Secondary pollutants. Photochemical oxidants, characteristics, smoke and its measurement.

Air pollution episodes – Bhopal gas tragedy, London and Los angles smog, Sand / Dust storms.   **10 Hours**

Module – II

Effect of Air Pollution: Effects of air pollutants on human, plants, and animals, materials and structure / monuments. Indoor air pollution – hospitals, health care facilities, residential and commercial establishments, effects and control, air changes per hour (ACH), IAQ standards.

Environmental Issues (Burning): Effect of air pollutants on visibility and other atmospheric characteristics, acid rain, wet deposition, greenhouse effect, global warming, ozone depletion and heat island effect.   **10 Hours**

Module – III

Air Pollution Meteorology: Role of meteorology in air pollution and its control. Meteorological factors – solar radiation, temperature, lapse rate, wind velocity profile, humidity, Precipitation, maximum / mean mixing depths, atmospheric stability conditions, wind rose diagram.

Inversion: Types, plume behavior under different atmospheric stability conditions, Pasuil – Gifford atmospheric stability classification. Effect of topography on pollutant dispersion. Land / sea breeze effects.   **10 Hours**

Module – IV

Atmospheric Dispersion of Stack Emissions: Plume rise, effective stack height, plume rise formulations, guidelines for fixing stack height, Numerical problems on plume rise calculation.

Measurement of Air Pollutants: Criteria for station selection, measurement of various gaseous (CO, HC, NOX and SOX) pollutants, particulate matter and microbial, sampling devices, sampling train, sampling methods / techniques, stack sampling techniques.   **10 Hours**

Module – V

Air Pollution Control Equipment's: General methods, control by process changes, particulate matter control – settling chambers, inertial separators, cyclone separators, fabric filters, scrubbers, wet collectors and electrostatic precipitators. Design aspects. Control of gaseous pollutants – adsorption, absorption, combustion and condensation.

Air Pollution Control Regulations: Air pollution laws / acts, air quality emission standards, air pollution indices – determination of air pollution index by different methods   **10 Hours**

Course Outcomes:

Students will be able to

- Achieve the knowledge on different types and meteorological factors influencing the dispersion of air pollutants.
- Analyze the plume rise using air pollution model equations.
- Design the air pollution control systems.

- Asses the environmental significance of air pollutants with regard to health and safety.

Text Books:
- Rao M.N. and Rao H.V.N:"Air Pollution",(Chapters 1-6),Tata- McGraw- Hill Publishing Company Ltd., New Delhi, India, 2011,ISBN 13:978-0074518717.
- Anjaneyulu Y:"Air Pollution and control Technologies",(Chapters 2-5),Allied Publishers, Delhi, 2012, ISBN- 13: 9788177641844.
- Rao C.S: "Environmental Pollution Control Engineering", (Chapters 2-6), New age International Publishers, New Delhi, 2nd Edition, 2013, ISBN- 13: 978- 8122418354

Reference Books:

- Gilbert M Masters: "Introduction to Environmental Engineering and Science", (Chapters1-4), Pearson Education, 3rd Edition, 2007, ISBN-13:978-0131481930.
- Mahajan.S.P:"PollutionControlinProcessIndustries",(Chapters1-5),Tata Mc- Graw Hill Publishing Co., New Delhi,2010,ISBN-13:978-0074517727

E-Resources:
- http://nptel.ac.in/courses/105102089/
- http://nptel.ac.in/courses/105104099/
- 3. nptel.ac.in/courses/103107084/module1/lecture1/lecture1.pdf

DESIGN OF MASONRY STRUCTURES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT563	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PEC**

Course Objectives:

The students will be able to:

- Understand the concept of masonry construction with strength and stability aspects.
- Comprehend flexural and shear bond strengths.
- Design the load bearing masonry building as per BIS codal provisions.

Syllabus

Module – I

Masonry Construction: Introduction - brick, stone, concrete block, stabilized mud block. Tests on masonry units– strength, water absorption, efflorescence and warpage as per Bureau of Indian Standards. Mortar – materials, purpose, classification and properties, selection of mortars and recommendations on selection of mortar. **8 Hrs**

Module – II

Stability: Strength and stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks. **8 Hrs**

Module – III

Strength of Masonry in Compression: Behavior of Masonry under compression, strength and Young's modulus, influence of mortar and masonry unit, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context. Effects of slenderness and eccentricity on compressive strength. **8 Hrs**

Module – IV

Flexural and shear bond: Bond between mortar and masonry unit, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. **8 Hrs**

Module – V

Permissible Stresses, Design Considerations and Load Considerations for Masonry: Permissible stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses. Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels. Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, freestanding wall.

Design of Load Bearing Masonry Buildings: Design of load bearing masonry for building up to 3 storey using IS : 1905 and SP : 20 procedure. **8 Hrs**

Course Outcomes:

Students will be able to

- Describe the characteristics of different masonry units.
- Comprehend the factors affecting the stability of masonry.
- Understand elastic behaviour of masonry.
- Apprehend test procedures for evaluating flexural and shear strength.
- Analyze and design the load bearing masonry building.

Text Books:

- Hendry A.W , "Structural masonry", Macmillan Education Ltd., 2nd edition,ISBN-13: 978-0333733097
- Sinha B.P & Davis S.R. "Design of Masonry structures", E. & F. N. Spon, 2004.
- Jagadish K. S, Venkatarama Reddy B. V and NanjundaRao K. S, "Alternative building materials &

technologies", New age International, New Delhi & Bangalore, 2007.

Reference Books:
- Dayaratnam P, "Brick & Reinforced Brick structures", Oxford & IHB.ISBN-13: 978-8120402492, 2017.
- Sven Sahlin, "Structural Masonry", Prentice Hall,ISBN-13: 978-0138539375, 1971.
- IS 4326: Code of practice for earthquake resistant design and construction of buildings.
- IS 1905: Code Of Practice for Structural Use of Unreinforced Masonry.
- SP 20: Handbook on Masonry Design and Construction.

E-Resources:
- https://nptel.ac.in/courses/105/106/105106197/
- https://thearchiblog.files.wordpress.com/2011/02/architecture-ebook-design-of-masonry-structures.pdf
- https://www.scribd.com/document/395255000/Structural-Masonry

ENVIRONMENTAL ENGINEERING LAB					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVL 57	**1-0-2-0**	**2**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The students will be able to

Learn the different methods used for the analysis of water/ wastewater quality parameters as per IS codes, prepare water / wastewater quality assessment report and suggest suitable treatment method for water / wastewater purification.

Syllabus

1. Determination of pH, Electrical conductivity, Acidity and Alkalinity.

2. Determination of Calcium, magnesium and Total hardness.

3. Determination of Turbidity by Nephelo meter.

4. Determination of Total solids, suspended solids, Dissolved solids and settle able solids.

5. Determination of Solids in sewage:
i. Total solids, ii) Suspended solids, iii) Dissolved solids iv) Settle able solids.

6. Determination of Chlorides.

7. Determination of Dissolved Oxygen.

8. Determination of Biochemical Oxygen Demand.

9. Determination of Chemical Oxygen Demand.

10. Determination of COD.

11. Determination of percentage of available chlorine, Residual Chlorine and Chlorine

12. Determination of Optimum dosage of Alum using Jar test apparatus.

13. Determination of Phosphate, Nitrates, Iron and Manganese using spectrophotometer.

14. Determination of Sodium and Potassium using Flame Photometer.

15. Air Quality Monitoring (Ambient, Stack Monitoring, Indoor Air Pollution) Demonstration.

Course Outcomes:

Students will be able to

- Conduct experiments and analyze the physical and chemical characteristics of water and wastewater.
- Compare the experimental results with water and wastewater quality standards.
- Analyze the type and degree of treatment required for water and wastewater.
- Asses the environmental significance of water / wastewater quality parameters on public health and environment.

Text Books:

- Garg S.K.: "Environmental Engineering", Vols. I and II, 12th Edition, Khanna Publishers, New Delhi, 2001, ISBN: 81-7409-120-3.
- B.C.Punmia: "Water Supply Engineering", Arihant Publications, ISBN: 81-7008-092-4.
- Lab manual, ISO – 14001 Environmental management, Regulatory standards for drinking water and sewage disposal

Reference Books:

- Clair sawyer and perry Mc Carty and Gene Parkin, "Chemistry for Environmental Engineering and Science", McGraw – Hill Series in civil and Environmental Engineering.

- Guide manual: Water and wastewater analysis, Central pollution control board, Govt of India.
- APHA standard methods for the examination of water and wastewater – 20th edition.
- Water supply engineering S. K Garg – 30th Edition.

E-Resources:
- www.neerienvis.nic.in/pdf/
- www.fao.org/
- www.gewater.com/applications, www.waterleau.com/en

CONSTRUCTION MANAGEMENT AND ENTREPRENEURSHIP				
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Course Type**
20CVH58	**3-0-0-0**	**3**	**50:50**	**HSMC**

Course Objectives:

The students will be able to:
- Understand the fundamentals of construction and project management.
- Learn the fundamentals of Resource management
- Study the concepts of Construction economics
- Get insight financial management and construction accounting
- Inculcate the concepts of entrepreneurship

Syllabus
Module – I
Management: Characteristics of management, functions of management, importance and purpose of planning process, types of plans

Construction Project Formulation and Planning: Introduction to construction management, Projects as a business; Fundamentals; Project management- concepts; Project management triangle; Project management systems; Project planning- scope definition, work breakdown structure; Organization breakdown structure; project organization, management functions, management styles, types of project plans, , Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node. **10 Hrs**

Module – II
Resource Management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.

Construction Equipment Management: Equipment-Selection, planning and financing, classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipment.

Materials Management: Importance, objectives and uses. Functions of materials management department and stores management **10 Hrs**

Module – III
Introduction to engineering economy: Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.

Interest and time value : concept of simple and compound interest, interest formula for: single payment, equal payment and uniform series. Nominal and effective interest rates,

Comparison of alternatives: Present worth, annual equivalent , capitalized and rate of return methods , analysis. **10 Hrs**

Module – IV
Financial management– Depreciation – methods of depreciation, Numerical on depreciation Taxation Inflation , Working capital management, Sources of finance, Long term and short term Finance, Construction accounting – Basic concepts and principles, Income statement, Financial statements – Profit and Loss, balance sheets. **10 Hrs**

Module – V
Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.

Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC,SIDBI, KSFC

Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities , entry into international business , exporting , direct foreign investment , venture capital. **10 Hrs**

Course Outcomes:

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

- Recognize the nature of construction industry and the importance of management.
- Balance the resources efficiently in construction.
- Apply the concepts of economics in constructions.
- Manage finance and accounts in construction
- Gain knowledge of entrepreneurship

Text Books:
- Chitkara K K, Construction Project Management, 10th Reprint, Tata McGraw Hill, 2006. ISBN-13: 978-9339205447.
- Courtland A. Collier and William B. Ledbetter," Engineering Economics and Cost Analysis", Harper & Row.2005.ISBN-13: 9780673983947.
- Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.

References:
- Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
- S.C Sharma –"Construction Equipments and its management" – Khanna publishers
- Srinath L.S, "PERT and CPM", 3rd Edition, East West Press Pvt. Ltd. New Delhi. 2001. ISBN-13: 978-8185336206
- Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
- Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, New Delhi
- Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, " Modern Construction Management", Wiley-Blackwell.

Eresouces:
- https://nptel.ac.in/courses/110/107/110107081/

ENVIRONMENTAL STUDIES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
20CVH59	**1:0:0:0**	**1**	**CIE:50 SEE:50**	**1 Hours**	**HSMC**

Course Objectives: To recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment. The industrial revolution and development have led to the stress on environment in the form of pollution. Checking of the pollution in all fronts at local and global level encompassing the issues of carbon credit, ozone level depletion, global warming, desertification and polar ice cap melting. The main objectives of the course is to expose to students to the problems and mitigation measures concerned to the environmental components like resources, air, water and land.

Syllabus

Module 1:

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.
Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.   **3 Hours**

Module 2:

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.   **4 Hours**

Module 3:

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.   **4 Hours**

Module 4:

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/ recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.   **3 Hours**
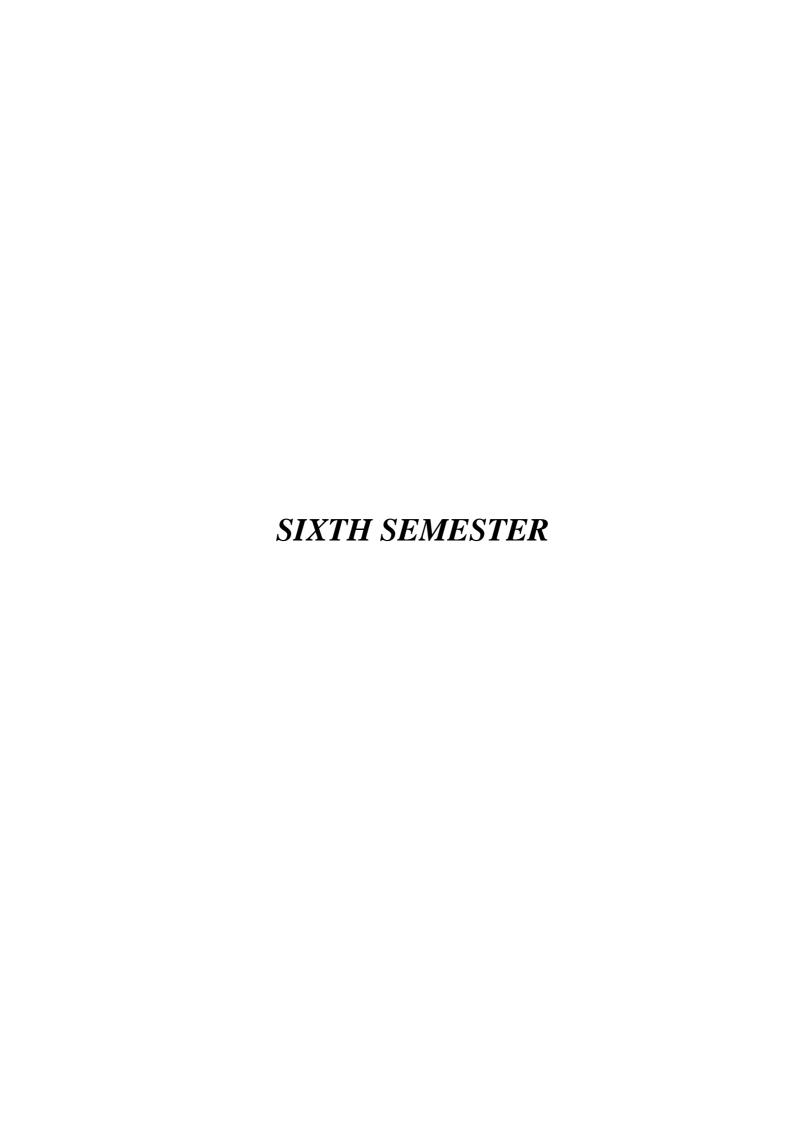
Module 5:

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.

Field work: Visit to an Environmental Engineering Laboratory or Green Building; Visit to a local area to document environment assets river / forest / grassland / hill / mountain. Visit to a local polluted site-urban/rural/industrial/agricultural/Water Treatment Plant/ Waste water treatment Plant. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hills lopes; etc (field work equal to 2 lecture works) ought to be Followed by understanding of process and its brief documentation.   **4 Hours**

Course outcomes: At the end of the course, students will be able to: ·
- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale, ·
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Sl. No	Name of the Textbook/s	Title of the Book Author/s	Name of the Publisher	Edition and Year
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012
2	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
4.	Environmental Studies	R. Geetha Balakrishna, K. G. Lakshminarayana Bhatta	SM Publications.	2016
Reference Books				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2nd Edition, 2005
2	Environmental Science – working with the Earth	G. Tyler Miller Jr.	Thomson Brooks /Cole,	11th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh & Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1st Edition

SIXTH SEMESTER

DESIGN OF STEEL STRUCTURES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT61	**3-2-0-0**	**4**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The students will be able to:

Learn the behavior of structural steel members and their connections. And apply the limit state method for design of steel members and column bases using IS codes.

Syllabus

Module – I

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method, Loading and load combination, Failure criteria of steel, IS Codes, Specifications and section classification.

Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, load factor, Shape factor, Methods of plastic analysis, Theorem of Plastic collapse and Plastic analysis of continuous beams. **10 Hrs**

Module – II

Bolted Connections: Types of Bolts, Advantages and Limitations of bolted joints, Design strength of ordinary Black Bolts and High Strength Friction Grip bolts (HSFG), Design of Simple Connections, Moment resistant connections.

Welded Connections: Advantages of Welding, Types and Properties of Welds, Weld specifications, Design of welds, Simple joints and Moment resistant connections. Design and drawing of Beam to Beam connection. **10Hrs**

Module – III

Design of Tension Members: Introduction, Types of tension members, Design of strands, Behavior of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets. **10 Hrs**

Module – IV

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Elastic buckling of slender compression members, Sections used for compression members with batten and lacings, Effective length of compression members, Design of compression members, Built up compression members. **10 Hrs**

Module – V

Flexural Members: Introduction, Beam types, Lateral stability of beams, factors affecting lateral stability, Design of laterally supported and laterally unsupported beams.

Column Bases: Design of simple slab base and gusseted base. **10Hrs**

Course Outcomes:

Students will be able to

- Acquire knowledge of engineering properties and plastic behavior of structural steel.
- Analyze and design the structural steel members.
- Design the connections for structural steel members.
- Detailing of steel members and their connections.

Text Books:
- N Subramanian: "Design of Steel structures", Oxford University Press, 11th Edition, 2013, ISBN: 9780195676815.
- K S Duggal: "Limit State Design of Steel Structures", Tata Mcgraw Hill, Edition, 2010, ISBN: 9781259083785.
- S. Ramamurtham: "Design of Steel structures", Dhanpat Rai Publishing Company, Edition, 2018, ISBN-10: 8187433361; ISBN-13: 978-8187433361.

Reference Books:
- S.S Bhavikatti: "Design of Steel Structures", IK International Pvt. Ltd.,2009, ISBN: 9789380026619.
- Dr. B C Punmia, Dr. A K Jain: "Comprehensive Design of Steel Structures", Firewall Media, 1998, ISBN: 9788170080930.
- P Dayaratnam "Design of Steel Structures", 2nd Edition, S chand Publication,2012, ISBN-13: 978-8121923200.

E-Resources:
- http://nptel.ac.in/courses/105106112/
- https://www.vidyarthiplus.com/vp/attachment.php?aid=24120

ESTIMATION AND QUANTITY SURVEYING					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT62	**2-2-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The objective of this course is to understand the estimation of various civil engineering works, specifications, analysis of rates and to create tender and contract management.

Syllabus

Module – I

Introduction: Introduction to estimating, types of estimation, different item of works, Unit of measurements, Method of taking quantities - Study of the various drawings.

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, color washing and painting / varnishing for shops, rooms, residential, building.
10Hrs

Module – II

Estimate of joineries -for paneled and glazed doors, windows, ventilators, handrails etc. Estimation of septic tank, sanitary and water supply installations – water supply pipeline – sewer line, estimation of road works- bituminous and cement concrete roads. **10Hrs**

Module – III

Specifications & Analysis of rates: Data, Schedule of rates, Analysis of rates – Specifications – sources – Detailed and general specifications, M-Book Measurement - Preparation of bills – Preparation of BOQ (Bill of Quantity)**.** Self study: Excel sheets preparation **10Hrs**

Module – IV

Valuation: Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease Arbitration and legal requirements.
10Hrs

Module – V

Contract Management: Types of contract- essentials of contract agreement- legal aspects, penal provisions on breach of contract. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Law of Contract as per Indian Contract act 1872, Joint venture.

Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Features / elements of the standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC) **10Hrs**

Course Outcomes:

Students will be able to

- Calculate the approximate cost of the projects through preliminary and detailed estimates.
- Analyze the rates of individual items for the preparation of the estimates.
- Write the specifications for various items.
- Assess contract and tender documents for various construction works.

Text Books:

- B.N. Dutta : "Estimating and costing", UBS publishers Distributors Ltd.,India,27th Edition, ISBN-13:978-8174767295.
- P. L. Basin:"Quantity Surveying",3rd Revised Edition, S. Chandand company, New Delhi, ISBN-10:8121900859.
- S.C. Rangwala: "Estimating and Specification", 16th Edition, Charotar publishing house, 2014, ISBN:978-93-80358-97-0.

Reference Books:

- G.S. Birde: "Text book of Estimating and Costing", 6th Edition, Dhanpath Rai and sons, New Delhi, ISBN:9789384378134.
- D.D. Kohli, R.C. Kohli: "A textbook on Estimating, Costing and Accounts", 2nd Edition, S. Chand, New Delhi, ISBN-10:8121903327.
- Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.

E-Resources:

- https://www.schandpublishing.com/books/...textbook-estimating-costing.
- nfra.eresourceerp.com/estimation.html
- nfra.eresourceerp.com/Project-estimation.html
- https://www.mynewsdesk.com/in/view/pressrelease/job-costing-estimation.

CONSTRUCTION PLANNING & PROJECT MANAGEMENT					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT63	**3-2-0-0**	**4**	**50:50**	**3 hours**	**PCC**

Course Objectives:

This course will enable students to understand the project management and construction planning techniques by using various methods. Also imparts knowledge on project strategies, optimizing the characteristics of project and resource management systems.

Syllabus

Module – I

Introduction: Construction Projects – Concept, Project categories, Characteristic of projects, Project life cycle phase. Development of construction plans - Choice of technology and construction method - Defining project activities - Defining work tasks - Defining precedence relationships among activities – Estimating activity duration. Estimating resource requirements for work activities.

Project management- Function, Role of project manager, Organizing for construction - Principles of organization, type of organization structure.

10 Hrs

Module – II

Construction Planning and Scheduling Techniques: Project planning Scope – Process -Objectives, Types of project plans, Resource planning process, Introduction to software's in construction scheduling (MSP, Primavera, Construction manager), Planning and Scheduling, need of Planning and Scheduling, Steps in Planning and Scheduling, Advantages of Planning and Scheduling, Time Management Function Details– Planning, Monitoring and Control, RPM (Repetitive Project Modeling) techniques, Mass haul diagrams, Work Breakdown Structure (WBS).

10Hrs

Module – III

CPM and PERT: Introduction to Critical Path Method (CPM), its applications, Network fundamentals, Numerical on Fulkerson's rule. Program Evaluation Review technique (PERT) and its uses and importance, Numerical on Time estimates.

Precedence Diagram Method (PDM) - Precedence diagrams, advantages, Difference between precedence diagram and network diagram, four types of relationships – finish to start – finish to finish – start to finish – start to start and Lag and Lead concept , network design (PDM calculation) and analysis. A-O-N diagram and A-O-A diagram, Numerical Problems. **10 Hrs**

Module – IV

LOB: Introduction to Line of Balance (LOB) Scheduling, construction and prepare of LOB, Line of balance (LOB) technique Need and methods, Numerical on LOB, linear programming chart (LPC); Links, lead/lags, types of schedule constraints and effect.

Cost & Network: Time-Cost Trade-off, Direct cost, Indirect cost, Total project cost, Cost optimization, numerical on cost optimization, Cost Control in Construction, Numerical on crashing of network. **10 Hrs**

Module – V
Resource Allocation: Introduction, Resource usage profiles, Project updating, Planning, levelling and Allocation, Numerical on Resource allocation, Monitoring and control, progress monitoring, records, reports, assessment and review; Updating and revision of project plan. Introduction to Building Information Model (BIM).   **Earned value Analysis:** Introduction to earned value analysis - Components - Budgeted cost of work scheduled (BCWS) Budgeted cost of work performed (BCWP) Actual cost of work performed (ACWP), Schedule variance (SV), Schedule performance index, Cost variance (CV) , Cost performance index, Estimate to complete (ETC), Budget at completion (BAC), Estimate at completion(EAC). **10 Hrs**

Course Outcomes:

Students will be able to

- Acquire the knowledge on construction project management.
- Identify the different types of construction planning & scheduling techniques.
- Analyze the construction network diagram and time estimates.
- Apply the time cost trade off principle and cost control in construction.

Text Books:

- Chitkara K K, **Construction Project Management**, 10ᵗʰReprint, Tata Mc Graw Hill, 2006. ISBN-13: 978-9339205447.
- Choudhury S, "**Project Management**", Mc Graw Hill Publishing Company, New Delhi, 1988
- Callaghan, M.T., Quackenbush, D.G. and Rowings, J.E. (1992) "Construction Project Scheduling", McGraw-Hill.
- Harris, R.B. (1978) "**Precedence and Arrow Network Techniques for Construction**", John Wiley and Sons.
- Chris Hendrickson and Tung Au, "**Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders**", Prentice Hall, Pittsburgh, 2000

Reference Books:

- Srinath L.S, "PERT and CPM", East West Press Pvt Ltd New Delhi.

- Poornima M. Charantimath , "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education.
- Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
- S.C Sharma –"Construction Equipment and its management" – Khanna publishers
- Srinath L.S, "PERT and CPM", 3ʳᵈ Edition, East West Press Pvt. Ltd. New Delhi. 2001, ISBN-13: 978- 8185336206.
- Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, "Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
- Harold Koontz, Heinz Weihrich, "Essentials of Management: An International, Innovation, and Leadership perspective", T.M.H. Edition, NewDelhi
- Frank Harris, Ronald Mc Caffer with Francis Edum - Fotwe, "Modern Construction Management", Wiley-Blackwell.

E-Resources:

- https://nptel.ac.in/courses/110/107/110107081/

TRAFFIC ENGINEERING AND MANAGEMENT						
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**		**Course Type**
19CVT641	3-0-0-0	3	50:50	3 hours		PEC

Course Objectives:

This course enables the students understand the importance of traffic engineering and its characteristics also the students analyse the Interpretation of the traffic study and traffic flow theory. Know the various intersections and its applications

Syllabus

Module – I

Introduction to Traffic Engineering: Definition, objectives of Traffic Engineering and scope of Traffic Engineering. Traffic Characteristics: Road user characteristics, Vehicular characteristics – static and dynamic characteristics, Power performance of vehicles, Resistance to the motion of vehicles – Reaction time of driver – Problems. **10 Hrs**

Module – II

Traffic Studies and Interpretation – Types, Objectives, Data collection, analysis and interpretation of traffic results. Spot speed, speed and delay, origin and destination, Parking studies, Accident- causes, analysis of individual accidents, measures to reduce accident. Problems. **10 Hrs**

Module – III

Traffic Flow Characteristics: Traffic flow variables, speed – flow – density relationship, PCU values, correlation and regression analysis (linear only) – Queuing theory, Poisson's distribution and Normal Distribution application to traffic engineering and relevant problems on Normal Distribution. Traffic Forecast and Simulation technique. **10 Hrs**

Module – IV

Intersection Design: Principle At grade and Grade separated junctions – Types – channelization – Features of channelizing Island – median opening – Gap in median at junction. Rotary Intersection: Elements – Advantages – Disadvantages – Design guide lines Three legged inter section – Diamond inter change – Half clover leaf – Clover leaf- Advantages- Disadvantages only. **10 Hrs**

Module – V

Traffic Regulation and Control: Driver, vehicle and road controls – Traffic regulations, Traffic markings, Traffic signs, Traffic signals – Signals co-ordination. Webster's and IRC method of signal design-Examples, Street lighting. Intelligent Transport System: Definition, Necessities, Application in the present traffic scenario. Area Traffic Management System, Traffic System Management (TSM), Travel Demand Management (TDM). **10 Hrs**

Course Outcomes:

Students will be able to
- Get the knowledge of objective and scope of traffic engineering and traffic characteristics.
- Analyse the traffic study and traffic flow theory data.
- Understand the human factors and vehicular factors in traffic engineering design.
- Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
- Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.

Text Books:
- L.R. Kadiyali: "Traffic Engineering and Transport Planning", Khanna Publishers, (Chapters, 1-6,8-11,13-17), ISBN-10: 817409220X,ISBN-13: 978-8174092205.
- Khanna, Justo: "Highway Engineering", Nemchand and Bros, Roorkee, (Chapter 5), ISBN: 978-81-85240-80-0.
- Nicholas J. Garber, Traffic & Highway Engineering, Cengage Learning India Private Limited.

Reference Books:

- Salter RJ and Hounsell NB: "Highway, Traffic Analysis and Design"- Macmillan Press Ltd., London, (Chapters 1-4), ISBN: 9780333609033.
- Matson T M, Smith W S, Hurd F W: "Traffic Engineering, McGraw Hill Book Co, NY, USA, ISBN 10: 0071761136 ISBN 13: 9780071761130.
- Drew D R," Traffic Flow Theory and Control", McGraw Hill Book Co, NY, USA, ISBN: 978-3-642-02604-1.
- Wohl, Martin: "Traffic System Analysis of Engineers and Planners", Mcgraw Hill Book Co., New York, USA, ISBN-10: 0070712743, ISBN-13: 9780070712744.
- Pignataro: " Traffic Engineering", John wiley and sons, ISBN: 978-1-118-76230-1 IRC: SP:41-1994, IRC SP:31-1992, IRC 43-1994, Indian Roads Congress.
- MORTH: "Type Designs for Intersections on National Highways", Indian Roads. Congress.
- MORTH: "Manual for Road Safety in Road Design", Indian Roads Congress.

E-Resources:

- https://en.wikipedia.org/wiki/Traffic_engineering(transportation)
- http://www.faadooengineers.com/threads/7094-Traffic-Engineering-Ebooks-
- notes-pdf-ppt-download • http://nptel.ac.in/downloads/105101008/
- http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=4114883

REMOTE SENSING AND GIS

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT642	3-0-0-0	3	50:50	3 hours	PCC

Course Objectives:

The students will be learning:

- About the principles of remote sensing and spectral signatures.
  About satellites, types of remote sensing, enhancement and information extraction and digital image processing
- About GIS mapping and analysis Techniques.
- Application of RS and GIS is various domains including Watershed management, Irrigation management, Drought and Flood monitoring, Environment and ecology.

Syllabus

Module – I

Principles of Remote Sensing: Introduction to remote sensing & system. Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Active & Passive Microwave Remote Sensing: Basics–physics of RADAR waves, spectral characteristics of RADAR waves, microwave radiometers, passive microwave scanners and sensors.

10 Hrs

Module – II

Platforms, Sensors and Data Products: Introduction - Ground aircraft, space aircraft platforms- photographic sensors, scanners, radiometers, and Mission planning. Data types and format, Scale and Legend., platforms- Indian satellite IRS and Land sat specifications, Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal) Basic elements in Image interpretation. **10 Hrs**

Module – III

Geographic Information System: Introduction, history of GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation-processes and capabilities, different types of GIS, GIS data- spatial and non-spatial, data models with advantages and disadvantages. Drone survey and its application **10 Hrs**

Module – IV

Hyper-spectral Remote Sensing: spectral concepts, Imaging and data collection systems- calibration techniques, data processing techniques; preprocessing, N dimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyper- spectral sensors, applications. High-resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications. GNSS, IRNSS, GPS and its application. **10 Hrs**

Module – V

Applications of RS and GIS in Civil Engineering: Water resource management, Ground water studies, Agriculture, Earthquake hazardous studies, Urban Development Planning, Flood monitoring, Draught monitoring, Transportation engineering, Watershed management, Irrigation management, Site selection for Dams, Bridges and Reservoirs. **10 Hrs**

Course Outcomes:

Students will be able to

- Demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves.
- Apply the concepts of satellite and sensor parameters and characteristics of different platforms.
- Prepare spatial Maps in GIS and able to Interpret GIS Maps.
- Design the Hyper spectral remote sensing systems.
  Solve complex Civil engineering Problems using RS and GIS techniques.

Text Books:
- LillesandT.MandR.W.Kiefer:"Remotesensingandimageinterpretation",(Chapters 1-8), 4thEdition, John Wiley and Sons, 2000, ISBN: 9780470052457.
- Jensen J.R: "Introductory digital image processing, a remote sensing perspective",(Chapters1-4),2ndEditionPrenticeHall,1996,ISBN:9780132058407.
- RichardsJ.A.,andX.Jia:"Remotesensingdigitalimageanalysis:anintroduction", (Chapters 1-3), 3rdEdition, Springer, 2006, ISBN: 9783540297116.
- MikhailE.,J.Bethel,andJ.C.McGlone:"Introductiontomodernphotogramme- try",(Chapters5-9),Wiley,2001,ISBN:9780471309246.

Reference Books:

- Ravi P Gupta: "Remote sensing Geology", (Chapters 1-8), Springer Verilag, New York, ISBN: 9783662052839
- Mather P.M.: "Computer processing of remotely-sensed images, an introduction",
- ISBN: 9781119956419.

E-Resources:

- http://www.set.ait.ac.th/page.php?fol=rsgisandpage=rsgis
- http://geology.wlu.edu/harbor/geol260/lecture_notes/notes.html
- http://www.rejinpaul.com/2014/10/vtu-civil-notes-vtu-civil-enigneering-1st- 2nd-3rd-4th-5th-6th-7th-8th-semester-lecture-notes-download-load.html
- http://www.rejinpaul.com/2013/12/civil-2nd-4th-6th-8th-semester-notes-an- na-university-civil-notes.html

SUB SURFACE EXPLORATION AND GROUND IMPROVEMENT TECHNIQUES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT643	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PEC**

Course Objectives:

The students will be able to access ground condition through multidisciplinary sources and Implement various exploration methods to determine soil properties which helps in design of foundations. In addition, they will learn to select and apply appropriate techniques for ground improvement and suggest/propose suitable chemical stabilizers for ground improvement, through engineering practice and environmental context.

Syllabus

Module – I

Subsurface Exploration: Introduction, Importance of exploration, Methods of exploration: Boring, sounding tests. Soil samples-undisturbed, disturbed and representative samples, Soil samples and sampling, Number and disposition of trial pits and boring, Depth of exploration, Field tests: SPT, SCPT, DCPT, plate load test, Geo-physical methods, Borehole logs, Site investigation report.   **10 Hrs**

Module – II

Ground Improvement: Introduction, Need and objectives for ground improvement, Classification of improvement techniques, suitability and feasibility. Engineering properties of weak and compressible deposits.

Hydraulic Modifications: Objectives, Techniques, Dewatering methods. Drains, different types of drains. Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

10 Hrs

Module – III

Mechanical Modification: Introduction, Principles of densification, Compaction- Shallow and deep compaction, compaction quality control. Effect of compaction on engineering properties - compressibility, permeability, and liquefaction potential.

Dynamic Modifications: Introduction, Need and objectives, Dynamic Consolidation, Compaction by blasting, vibratory probe, Vibroflotation.   **10 Hrs**

Module – IV

Chemical Modification: Introduction, Methods of Chemical stabilization, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization, Stabilization using Fly ash.

Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Bitumen, tar or asphalt in stabilization.   **10 Hrs**

Module – V

Grouting: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

Geo synthetics: Introduction, Geo synthetic types, properties of Geo synthetics – materials and fiber properties, Hydraulic properties, Durability; Applications of Geosynthetics – Reinforcement, Separation, Filtration and Fluid Transmission.   **10 Hrs**

Course Outcomes:

Students will be able to,

- Apply the knowledge of exploration methods to interpret field and laboratory data.
- Identify dewatering techniques based on field conditions
- Conduct investigations on problems and suitable techniques in stabilization
- Suggest/propose suitable chemical stabilizers based on site condition
- Choose suitable type of geo synthetics for ground improvement and filtration process.

Text Books:

- Peter. G. Nicholson,"Soil improvement and ground modification methods", Butterworth-Heinemann Ltd, 1ˢᵗ Edition-22 Aug 2014 ,ISBN: 978-0-12-408076-8
- 2. Dr. P.Purushotham Raju ,"Ground Improvement techniques", Laxmi Publications,2000, ISBN: 978-8131808573
- 3. Manfred R. Hausmann," Engineering principles of ground modification", McGraw-Hill Publishing Co.1990, ISBN: 978-0071007405
- 4. Nihar Ranjan Patra,"Ground Improvement techniques",S.Chand (G/L) & Company Ltd,2012,ISBN:978-9325960015.

Reference Books:

- Jie Han,"Principles and Pratice of Ground Improvement",John Wiley & Sons,edition-28 july 2015, ISBN: 978-1118259917
- Ingles. O.G and Metcalf J.B.,'Soil stabilisation –Principles and Practice",Butterworths. London 1972, ISBN: 978-0409482157
- M.C.Alfaro,"Improvement Techniques of Soft Ground in Subsiding & Lowland",CRC Press,1994,ISBN: 978-9054101536
- J.M.Galvin,"Groung Engineering ", Springer,2016 ,ISBN: 978-3319250038

E-Resources:

- www.sciencedirect.com/science/book/9780124080768
- https://www.bauer.de>bma>info_80_e
- thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/
- https:// www.nptel.ac.in/courses/105104034

REPAIR AND REHABILITATION OF STRUCTURES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT651	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PEC**

Course Objectives:

The students will be able to:

- The objectives of this course is to make students to investigate the cause of deterioration of concrete structures,
- Strategies different repair and rehabilitation of structures.
- Evaluate the performance of the materials for repair and rehabilitation.

Syllabus

Module – I

General: Introduction 3R, Cause of deterioration of concrete structures includes Fire attack, frost attack, abrasion, erosion etc., Condition survey of affected structure, Diagnostic methods, interpretation & assessment out of preliminary investigations, experimental investigations using NDT & PDT/load testing, Types of reinforcement, assessing the quality of steel , corrosion parameter mapping, core drilling and other instrumental methods Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Introduction to Forensic science & Law. **10 Hours**

Module – II

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion and carbonation mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, and introduction to service life estimation. **10 Hours**

Module – III

Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete, Epoxy injection, shoring and underpinning. **10 Hours**

Module – IV

Maintenance and Repair Strategies: Definitions: Maintenance-Methods of maintenance, necessitation of maintenance, Process of maintenance. Facets of Maintenance, importance and Maintenance Preventive measures on various aspects. Repair of cracks- Crack measurements, Factors affecting cracks, Methods of crack repair. Structural repairs of prestress concrete systems, Inspection. Repair strategies. **10 Hours**

Module – V

Case Studies of Rehabilitated Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques and types for dilapidated structures, external strengthening of girders. Points to remember during repair work. **10 Hours**

Course Outcomes:

Students will be able to

- Achieve Knowledge of design and development of problem solving skills.
- Analyse the cause of deterioration of concrete structures.
- Design and develop analytical skills.
- Summarize the principles of repair and rehabilitation of structures
- Utilize the concept of Serviceability and Durability.

Text Books:
- Dr B Vidivelli "Rehabilitation of Concrete Structures". 1st edition. Standard Publisher Distributors., 2009.
- Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures". Krieger Publishing Co. 1980.
- Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical. 1991.

Reference Books:

- R.T. Allen, S.C. Edwards and D N Shaw, "Repair of Concrete Structures"-Blakie and Sons, CRC Press, 1992.
- Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and service"- R&D Center (SDCPL)., 1987.

E-Resources:
- http://linlspringer.com
- http://crcnetbase.com

ADVANCED DESIGN OF TEMPORARY STRUCTURE

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT 652	3:0:0:0	3	50:50	3 Hours	PEC

Course Objectives:

This course enables the students to know the importance of different types of false-work and form work. Recognize the inter-relationship and interdependence of various areas in construction. Understand the operations, technology & structure, management, economics safety aspects. in the area of temporary structure.

Syllabus

Module – I

Introduction: Temporary Structure & Recent Developments/Formwork Materials -Types of temporary structure, Uniform Traffic Control and Devices- temporary road and bridge installations for construction projects-soil erosion and sediment control plan - codes & standards pertaining to scaffolding, stairways and ladders, Modular formwork systems used in construction - Lifting plant and materials   **10 Hrs**

Module – II

False work design: Procedures, materials and components, forces applied to false work, analysis of false work structure, foundations to false work - design using scaffold tube and fittings, standard solutions and other considerations affecting certain design solutions.   **10 Hrs**

Module – III

Design considerations: Live loads and Wind pressure -Concrete pressure on form work- concrete density - Height of discharge-Temperature-RateofPlacing-Consistencyofconcrete-Vibration-Hydrostatic pressure and pressure distribution –Design Examples -Adjustment for non-standard conditions- Basic simplification - Beam forms-Slabforms-Columnforms-Wallforms–Allowablestresses-Checkfordeflection,bendingand lateral stability - Codal provisions Examples on form designs.   **10 Hrs**

Module – IV

Design Techniques: Building erection of formwork, - formwork for concrete structures, including the basics of formwork layout - temporary guying, and bracing of steel structures – Using the forms involving the temporary installation of retaining walls, sheet piling, and cofferdams -subsurface excavation work. Construction

dewatering,Earthretainingstructures/shoring/sheetingSoilcompactionandstabilization,Accessroads, hauling and decking Shoring & Re-shoring & Test-Problems - Slip forms and jump forms   **10 Hrs**

Module – V

Formwork cost: Economics/planning, Form estimating - Safe work method statements procedures (MSP) - Emergency procedures for slip forms or jump forms – Safety procedure document for adjacent buildings or structures.   **10 Hrs**

Course Outcomes:

Students will be able to

- Know the knowledge of different types of false-work and formwork used in construction.
- Use different loading conditions on the temporary structure for the design.
- Manage alternative solutions to formwork design and materials.
- Give solution through inter-relationship and interdependence of various areas in construction.
- Execute the operations through technology & structure, management, economics and safety aspects in the area of temporary structure.

Text Books:

- Formwork for concrete structures, Kumar NeerajJha, McGraw Hill Education,2017.
- Formwork For Concrete Structures, Robert L. Peurifoy and Garold D. Oberlender, McGraw –Hill.
- Slipform Techniques, Tudor Dinescu and ConstantinRadulescu, Abacus Press, Turn Bridge Wells,Kent

Reference Books:

- Formwork for Concrete, Austin, C.K., Cleaver - Hume Press Ltd., London,1996.
- Formwork for Concrete, Special Publication No.4, American Concrete Institute, Hurd, M. K., Detroit,
- Concrete Formwork Systems -Awad. Hanna - University of Wisconsin –Copyright Marcel DekkelInc.
- A guide to Good Practice – Formwork –Concrete Society –U.K 2nd Edition1995.
- IllingworthJ.R(1987)TemporaryWorks:TheirRoleinConstruction,London:ThomasTelford Labour Department (1995) Code of Practice for Scaffolding Safety
- Chudley, R (1999) Advanced Construction Technology, 3rd ed. revised by Roger Grano, Longman.
- Illingworth, J.R. (2000) Construction Methods and Planning, 2nd ed., E & FNSpon

E-Resources:
- http:d2l.kennesaw.edu

SOLID WASTE MANAGEMENT					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT653	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PEC**

Course Objectives:

The students will be able to

Learn about functional elements of solid waste management including the waste minimization concepts and gain knowledge on biomedical waste management and designing of solid waste management systems.

Syllabus

Module – I

Engineering Principle: Sources of solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Waste generation rates, frequency, storage, refuse collection. Numerical Problems on waste generation rate.

Collection and Transport: Collection of solid waste- services and systems – economics, equipment's. Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.   **10 Hours**

Module – II

4R – Reduce, Recovery, Recycle and Reuse: Source of segregation, waste minimization, recovery potential and recycling practices, recycle of non – biodegradable materials, reuse cycles.

Processing Techniques: Purpose of processing, Chemical volume reduction (incineration) – Process description, 3T's, principal components in the design of municipal incinerators, Air pollution control, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).   **10 Hours**

Module – III

Composting: Aerobic and anaerobic method – process description, process microbiology, design consideration, Mechanical composting, Vermi composting, Numerical Problems.

Sanitary land filling: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems.   **10 Hours**

Module – IV

Biomedical Waste: Health care systems, sources, generation, categories, collection, handling, treatment and disposal of Biomedical waste. Bio medical waste (Management and Handling) rules – 2018.

E-Waste: Sources, generation, categories, collection, handling, treatment and disposal of E - waste. Construction and demolition waste Sources, generation, categories, collection, handling, treatment and disposal of Construction and demolition waste.   **10 Hours**

Module – V

Incineration: 3Ts factor affecting incineration, types of incinerations, Pyrolysis: types and design criteria Energy recovery technique from solid waste management.

Recent Trends: Community based waste management, waste as a resource concept, public private partnership (PPP) in municipal solid waste and Bio medical waste management.   **10 Hours**

Course Outcomes:

Students will be able to

- Achieve knowledge on engineering principles of solid waste management.
- Identify proper solid waste collection and transport systems.
- Apply the management concepts and 4R approach for waste minimization.

- Design advance treatment systems for solid waste management.
- Evaluate the environmental implications of solid waste disposal.

Text Books:
- Howard S.Peavy et.al: "Environmental Engineering", Mc-Graw- Hill Book Company, New York, 2012, ISBN:978-0071002318.
- Tchobanoglous G., Theisen H., and Vigil S. (1993), "Integrated Solid Waste Management", Mc- Graw-Hill Inc., New York, 2013, ISBN:9780070632370.

Reference Books:
- K Sasikumar K Sanoopgopi (2009), "Solid Waste management", PHI Learning Pvt. Limited, New Delhi, 1[3th]Edition, ISBN: 9788120338692.
- S.K Garg: "Environmental Engineering (Vol II)",Khanna Publishers, New Delhi, 2009, ISBN: 9788174092304.

E-Resources:
- https://ecommons.cornell.edu
- https://doi.org/10.1016/j.enbsoft

CONSTRUCTION JOINTS AND WATER PROOFING					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT661	**3-0-0-0**	3	**50:50**	**3 hours**	**MEP**

Course Objectives:

The objective the course is to enable the student to study the importance of different construction joints used for construction of various structures and design it for durability and maintenance. The students will also able to investigate, design and apply waterproofing principles.

Syllabus

Module – I

Construction Joints: Introduction - Types of joint – Concrete Contraction Joints - Expansion Joints - necessity for joint sealant – failure of sealant - common problems – Defect identification and remedial measures -method of joint sealant application – pre surface preparation – Post preparation - Types of Sealants Used for Joints in Buildings – Properties and Uses - Design and workmanship – Durability and maintenance. **10 Hrs**

Module – II

Waterproofing Principles - Below-Grade Waterproofing - Above-Grade Waterproofing - Residential Waterproofing - Admixtures - Remedial Waterproofing - Mold - The Building Envelope - Life Cycles - Envelope Testing - Leak Investigation and Detection - Safety - Guide Specifications - Resources
10 Hrs

Module – III

Materials: Introduction - waterproofing materials identification - selection process - Difference between waterproofing and damp proofing - waterproofing system applications - below-grade systems - above-grade waterproofing – water proofing membranes.

Design - design above-grade and below-grade waterproofing systems - performance - various calculations - detailing - geotechnical conditions - various drainage systems **10 Hrs**

Module – IV

Industry Standards - safety hazards associated with waterproofing systems - Product Safety and Safe Use – examples - standards and codes

Testing and Investigation - various test and investigative methods for existing waterproofing – testing methods related to new or replacement waterproofing installations **10 Hrs**

Module – V

Asphalt - Petroleum Asphalt - Components and Structure - Technical Properties - Technical Standards - selection of the petroleum asphalt - Mineral Filler Modification - Polymer Modification - Other Kinds of Modification - Waterproof Asphalt Paint - Architectural Waterproof Asphalt Jointing Ointment - New Waterproof Membrane - New Waterproof Paint - New Building Sealing Material **10 Hrs**

Course Outcomes:

Students will be able to:

- Acquire knowledge of different applications of construction joints and sealants.
- Impart the knowledge in water proofing principles and design a water proofing system.
- Apply the codal provisions for safety of waterproofing systems.
- Examine various existing waterproofing methods and replace waterproofing installations.
- Use a suitable building sealant material for different kind of modifications in a structure.

Text Books:

- Michael T Kubal, Construction water proofing hand book, Tata Mc Graw Hill publications
- CPWD Specifications (VOL. 2) 2009, published by, Director General of works, CPWD, Nirman Bhawan, New Delhi
- P.C.Varghese, Building Materials, Prentice-Hall India, 2005

Reference Books:
- IS 6509: Code of practice for installation of joints in concrete pavements.
- IS 13143: Joints in concrete lining of canals - sealing compound.
- M. N. Bussell, R. Cather, Thomas Telford, 1995 - Technology & Engineering.
- Farhana M. et al "Expansion joint treatment: material & techniques" conference on "Trends and Challenges of Civil Engineering in Today's Transforming World" 129th March, 2014.
- Available from: https://www.researchgate.net/publication/270894738
- Biswajit Roy Aminul Islam Laskar, Construction joints in substandard beam–column
- connections subjected to cyclic loading, Magazine of Concrete Research, ISSN 0024-9831 | EISSN 1751-763X Volume 72 Issue 8, April, 2020, pp. 379-391
- Study guide For the Registered waterproofing consultant, by International Institute of Building Enclosure Consultants,1500 Sunday Drive, Suite 204, Raleigh, NC 27607

E-Resources:
- https://www.researchgate.net/publication/270894738

CONSTRUCTION SAFETY AND INDUSTRIAL POLICIES				
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**
20CVT662	**3-0-0-0**	**3**	**50:50**	**3 hours**

Course Objectives:

The students will be able to understand the concept of safety management and its role in construction projects. Also, the student will be familiarizing with the design for safety in construction and get insight the occupational health and safety and legal Provisions.

Syllabus

Module – I

Introduction: Construction Safety-meaning and scope, Safety in construction- Technological aspects, organizational aspects and behavioral aspects, Safety in Project management, Education and training conditions on safety in Civil Engineering projects, Safety with respect to the use of common construction equipments, Introduction to environment and environmental impacts associated with projects and common construction equipments. **10 Hrs**

Module – II

Safety in construction: Causes, classification, cost and measurement of an accident, accident report. Safety information systems, safety programme for construction, Personnel Protective Equipment, Human Factors in Construction Safety – Costs of Construction Injuries – Occupational and Safety Hazard Assessment –. Safety Culture – Safe Workers, Contractual obligations Safety in Construction Contracts – Substance Abuse – Safety Record Keeping, Safety legislation and Standards, Legal Implications of accident **10 Hrs**

Module – III

Safety in critical operations; Storage of materials. Safety for Material handling at site; Excavation and earthwork, drilling and blasting, piping and foundations, concreting, erection, demolition, hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation, Safety for specialized structures- tunnels, dams, power plants, and oil and gas or coal transportation. **10 Hrs**

Module – IV

Designing for safety and Owners' and Designers' Outlook :– Safety and First Line Supervisors – Safety and Middle Managers, Top Management Practices, Company Activities and Safety – Safety Personnel – Sub- contractual Obligation – Project Coordination and Safety Procedures, Study of safety policies, Safety in office and while working on a high rise construction activity. **10 Hrs**

Module – V

Occupational Safety and Health Administration: Definition and Context of OHS, Objectives and Principles of OHS, Workplace and Health Occupational Health, Hygiene and Ergonomics. Introduction to OHSAS - 18001

Socio-Economic aspects of Occupational Health and Safety: Women's occupational and health safety, Child labor issues in occupational health and safety, Health issues in the unorganized sector.

Legal Provisions on Occupational Health and Safety: Overview of existing OHS Legislations in India, The Factories Act, The Mines Act, The Workmen's Compensation Act, The Employee's State Insurance Act **10 Hrs**

Course Outcomes:

On completion of this course, students will be able to:
1. Acquire working knowledge of various safety, health and environment policies and systems.
2. Gain the knowledge of different aspects of safety management on site.
3. Know the safety precaution in critical construction activities.
4. Design for safety and Owners' and Designers' Outlook.
5. Develop the ability to know the occupational health and safety and legal Provisions on Occupational Health and Safety.

6. Apply the social and economical aspects in finding solution for common safety issues.

Text Books:
- David Gold Smith, "Safety Management in construction and Industry",McGraw Hill Publishers.
- K N Vaid, "Construction Safety Management", NICMAR, Bombay. The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, Universal Law Publishing Co. Pvt. Ltd.
- NICMAR. (1998). *Safety management in the construction industry - A manual for project managers*. NICMAR, Mumbai.

References:
- Woodside, G., Kourek, D. (1997). *Environmental safety and health engineering*. John Wiley & Sons, New Jersey
- Grimaldi, J., Simonds, R. (2003). *Safety management*. AITBS, Delhi.
- Colling, D. (1990). *Industrial safety management and technology*. Prentice-Hall, New Jersey.
- Davies V., Thomasin, K. (1996). *Construction safety handbook*. Thomas Telford, London.
- Deb, S. (2003). *Environmental management*. Jaico Publication House, Mumbai.
- Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.

E-Resouces:
- https://nptel.ac.in/courses/110/104/110104080/
- **https://nptel.ac.in/courses/105/102/105102206/**
- **https://onlinecourses.nptel.ac.in/noc21_ce16/preview**

NATURAL DISASTER MITIGATION AND MANAGEMENT					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT663	**3-0-0-0**	**3**	**50:50**	**3 hours**	**IEC**

Course Objectives:

The students will be able to:

- Understand about types of Natural Disasters and Disaster Management Cycle.
- Develop skills in various stages of preparedness, mitigation and Management of Natural Hazards.
- Obtain Complete Knowledge on the Water and Weather related Disaster Management.
- Apply knowledge of Space Technologies and Early warning systems in Disaster Management.
- Demonstrate the knowledge of Various Organization and Stakeholders Working on Disaster Management.

Syllabus

Module – I

Natural Disasters – Overview: Introduction- Natural Disasters around the world-Natural Disaster Risk Assessment- Earth and its characteristics Human Dimensions of Global environment Change - Disaster mitigation, preparedness, response and recovery comprehensive emergency management Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food, Nutrition and Shelter -Role of UN Red cross and NGOs.

10 Hrs

Module – II

Climate system aspects and Processes: Oceanic, Atmospheric and Hydrologic cycles Severe Weather and Tornadoes , Cyclones, Floods and Droughts - Global Patterns - Mitigation and Preparation – Drought – Famine- nature and dimensions – Drought Assessment and Monitoring.

10 Hrs

Module – III

Natural Hazards: Introduction and Review - Natural Disasters - Principles, Elements, and Systems-Geological – Geo morphological aspects, Earthquake- Geology, Seismology, Characteristics and dimensions – Landslides - Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc.-Tsunami - Nature and characteristics.

10 Hrs

Module – IV

Natural Disaster Communication: Mapping - Modeling, risk analysis and loss estimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination, mobile communication system – Modern systems.

10 Hrs

Module – V

Administrative mechanisms: Structure of rescue system, Community and Social organizations – Education and Training – Establishment of capacity building among various stake holders – Government - Educational institutions – Use of Multi-media knowledge products for self-education.

10 Hrs

Course Outcomes:

Students will be able to

- Develop organizational and Administrative strategies for managing Natural Hazards.
- Adopt methodologies for disaster risk assessment w.r.t Water and Climate related disasters.
- Apply tools like GPS, GIS, Remote sensing, information technologies, etc. for managing the disasters.
- Specify key roles of capacity building to face disaster among government bodies, institutions, NGO's, etc.

Text Books:
- Kovach, Robert L.: "Earth's Fury: An Introduction to Natural Hazards and Disasters", Englewood Cliffs, N.J., Prentice Hall, 1995.
- B.Narayan: "Disaster Management", S.B.Nangia, A P H publishing corporation, Delhi-2014
- Siddhartha Gautam, K Leelakrishna Rao: "Natural disaster Management", 3rd Edition, 2012, ISBN: 9381604320.

Reference Books:

- Arul Jothi, D L Balaji: "Safety and Disaster Management Education In Schools", 1st Edition, Anmol Publications, 2009, ISBN: 9380252609.
- R B Singh "Natural Hazards and Disaster Management: Vulnerability and Mitigation"

Rawat Publication 2006, ISBN : 8131600335, 9788131600337.

E-Resources:
- https://www.ndma.gov.in/en/
- https://www.ksndmc.org/Default.as
- www.nrdms.gov.in/natural_disaster.asp

CONCRETE AND HIGHWAY ENGINEERING LAB

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVL67	1-0-2-0	2	50:50	3 hours	PCC

Course Objectives:

The students will be able to:

To learn the procedure of testing concrete ingredients and properties of concrete as per IS recommendations. Also to know the procedure of testing bituminous materials as per code recommendations and to relate material characteristics to various application of construction.

Syllabus

List of Experiments

Tests on Cement

1. Test on Specific Gravity and Fineness of Cement.
2. Test on Normal consistency and Initial and Final setting time of Cement.
3. Test on Soundness of Cement
4. Test on Compressive Strength of Cement.

Tests on Aggregates

5. Sieve Analysis of Fine Aggregate
6. Aggregate Crushing Value Test
7. Los Angeles Abrasion Test
8. Aggregate Impact Test
9. Shape tests (Flaky, Elongation)

Tests on Concrete

10. Mix Design of Concrete-Fresh Concrete: Slump, Compaction Factor, Vee-Bee test, Flow Table Test.
11. Properties of Hardened Concrete-Compressive Strength and Split Tensile Strength.

Tests on Bituminous Materials

12. Specific Gravity Test
13. Penetration Test
14. Ductility Test
15. Softening point Test
16. Flash and Fire Point Test
17. Viscosity Test

Demonstration

- Non-Destructive Test on Hardened Concrete using Rebound Hammer.
- Non- Destructive Test on Hardened Concrete using Ultrasonic Pulse Velocity.
- Permeability and Water Absorption Test on Concrete.
- Marshall Stability test.

Course Outcomes: Students will be able to

- Able to interpret the experimental results of concrete and highway materials based on laboratory tests.
- Determine the quality and suitability of cement.
- Design appropriate concrete mix Using Professional codes.
- Determine strength and quality of concrete
- Measure the physical properties and stability of bituminous materials and mixes by conducting tests.

Text Books:

- M.S Shetty, "Concrete Technology ", S. Chand & Co. Ltd, New Delhi.
- Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.
- S.K Khanna, C.E.G.Justo, and A.Veeraragavan, "Highway Material and Pavement Testing.
- M. L. Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi

Reference Books:
- Neville AM, "Properties of Concrete", ELBS Publications, London.
- Relevant BIS codes, Relevant IS Codes and IRC Codes.
- IS: 2386 – Methods of tests for aggregate for concrete.
- IS: 383:2016 – Specifications for fine & coarse aggregate from natural sources for concrete
- IS: 516 – Methods of test for strength of hardened concrete.

E-Resources:
- http://elearning.vtu.ac.in
- www.sginstitute.in/downloads/civil.../manual_ConcreteTech

EXTENSIVE SURVEY PROJECT

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVP68	1-0-2-0	2	50:50	3 hours	PCC

Course Objectives:

The students will be able to:

- Understand the practical applications of Surveying.
- Use Total station in different projects.
- Develop communication skills, team work and use modern tool usage in the field of civil engineering.

Syllabus

An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks (14 days).

The student shall submit a project report consisting of designs and drawings.

General instructions: Reconnaissance of the sites and fly leveling to establish bench marks.

1. **New Tank Projects:** The work shall consist of

    a. Alignment of center line of the proposed bund, Longitudinal and cross sections of the centerline.

    b. Capacity surveys.

    c. Details at surplus weir and sluice points.

    d. Canal alignment.

2. **Restoration of an Existing Tank:** The work shall consist of:

    a. Alignment of centre line of the existing bund, Longitudinal and Cross sections along the centre line.

    b. Capacity surveys, Details at sluice and surplus weir.

3. **Water Supply and Sanitary Project:** Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.

4. **Highway Project:** Preliminary and detailed investigations to alignment new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road. (Drawing should be preferably done using AutoCAD).

5. **TOWN/HOUSING / LAYOUT PLANNING:** The work shall consist of;

a) Reconnaissance survey for selection of site and conceptualization of project.

b) Detailed survey required for project execution like contour surveys

c) Preparation of layout plans as per regulations.

d) Centerline marking-transfer of centre lines from plan to ground

e) Design of all elements and preparation of drawing with report as per regulations.

Course Outcomes:

Students will be able to

- Understand of the principles and operation of the Global Positioning System for locating

salient features by Total Station.

- Measure differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork for civil engineering projects.
- Apply the need for licensed surveyors to establish positioning information for property and structures.
- Prepare layout plans as per the specifications of the local bodies.
- Develop communication skills and team work in any project.

Text Books:

- Dr. B C Punmia: "Surveying Volume I", Lakshmi Publications Pvt. Ltd, 6th Edition, 2005, ISBN:978-81-700-8853-0.
- Dr. B C Punmia:"Surveying VolumeII",(Chapters1-4, 6, 7, and 15), Lakshmi Publications Pvt Ltd, 6th Edition, 2005, ISBN:978-81-700-8853-0..
- A. M. Chandra ,'Plane Surveying'– New age international (P) Ltd,(2015)ISBN-10: 8122438806

Reference Books:

- Chandra, A.M.: "Higher Surveying", New Age International Publishers, 2002, ISBN: 9788122438123.
- Punmia P. C.: "Surveying", Volume 3, 15th Edition, Laxmi publications, 2004, ISBN:81-7008-825-9.
- Lab manual provided by Dept. of Civil Engg., NCET.
- A Text-Book of Plane Surveying, William Galt Raymond (Author), Charles Winthrop Crockett, Nabu Press, (2010), ISBN-10: 1146996349.

PLACEMENT TRAINING					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVPT60	**1:0:0:0**	**1**	**CIE:50 SEE:50**	**3 Hours**	**P & T**

Course Objectives:

This course will enable students to:

- Understand concept of Highway Engineering and Soil Mechanics.
- Acquire knowledge on concepts of Concrete Technology.
- Learn techniques of Construction Management and Environmental Engineering.
- Demonstrate the knowledge of Structural Engineering.
- Apply the concepts of Surveying and Fluid Mechanics.

SYLLABUS

Module – I
Transportation Engineering: Stopping sight distance, Super elevation, Highway alignment and surveys. Classification of roads Different road development programs. Railways, Airport and Traffic Engineering. Highway materials and design of highway pavements.   **Geotechnical Engineering:** In-situ test, particle size analysis, consistency limits, Compaction, permeability, consolidation, strength of soil, foundation types, bearing capacity.   **10 Hours**

Module – II
Concrete Technology: Cement - Compounds of cement, different types, setting time and strength. Cement mortar - Ingredients, proportions, water demand and mortars for plastering and masonry.   Concrete - Importance of W/C ratio, strength, ingredients including admixtures, workability, testing for strength, elasticity, non-destructive testing and mix design methods.   **10 Hours**

Module – III
Construction Management: Introduction to construction management - Planning scheduling, controlling and monitoring. PERT and CPM, types of project, types of organization and introduction to project management software.   **Environmental Engineering:** Permissible standards and calculation of PH, BOD & COD. Waste Water Treatment –definitions of various stages involved in water treatment. Solid Waste Management. Air quality Monitoring.   **10 Hours**

Module – IV
Structural Engineering: Concepts of shear force and Bending Moment Stresses, Analysis of Statically Determinate and Indeterminate Structures. Working Stress and Limit State Design of RCC and Steel Structure. Estimation and Quantity Surveying.   **10 Hours**

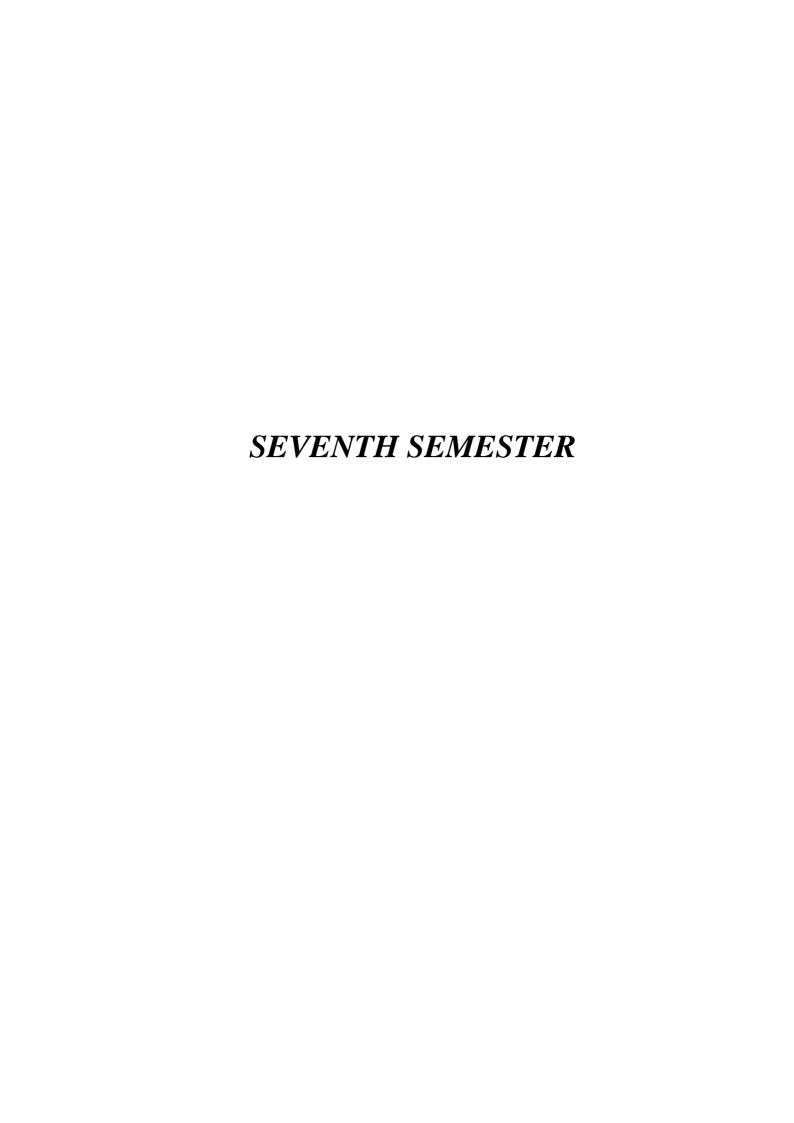| **Module – V** |
|---|
| **Surveying:** Basics of surveying. Linear and Angular measurements. Tachometry. Modern surveying.
 Hydrology and Irrigation: Components of Hydrologic cycle. Rain gauges. Duty and Delta problems. Basics of Canal Design.
 Fluid Mechanics and Hydraulics: Basic properties of fluid, Hydrostatic pressure, Measurement of Pressure. Turbines. Bernoulli's equation.
<div align="right">**10 Hours**</div> |

Course Outcomes :

On completion of this course, students should be able to:
- Understand the importance of soil Mechanics and Highway Engineering.
- Analyze the importance of operations in Concreting.
- Enhance the concepts of Construction Management and Environmental Engineering.
- Identify Techniques in Structural Design.

Text Books:
- Dr. S K Khanna, "Highway Engineering" – Nem Chand & Bro. Roorkee. ISBN 978-81-85240
- Dr. R. K. Bhansal, "Fluid Mechanics" – Laxmi Publications (P) Ltd.
- Dr. B.C. Punmia, "Surveying" - Laxmi Publications (P) Ltd.
- Dr. B.C. Punmia, "Soil Mechanics and Foundations" - Laxmi Publications (P) Ltd.

SEVENTH SEMESTER

BRIDGE ENGINEERING					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT71	**2-2-0-0**	**3**	**50:50**	**3 hours**	**PCC**

Course Objectives:

The students will be able to:

Identify components and classify bridges by selecting suitable site through survey and data collection. And learn IRC codal requirements applicable to design of bridges, culverts and substructures.

Syllabus

Module – I

Introduction: Introduction to bridges, classification, selection of bridge site, preliminary and detailed survey work, computation of discharge, linear waterway, economic span, afflux, scour depth, Hydrograph and its flood discharge, Numerical examples. **10 Hrs**

Module – II

Specifications of Road Bridges: Indian Road Congress Bridge code, carriage way, clearance, Forces on bridge, Review of IRC loadings, Applications of loads on bridge such as dead load, live load, impact effect, etc. Load Distribution Theory, Bridge slabs, Effective width, Introduction to design methods as per I.R.C. **10 Hrs**

Module – III

RC Slab Culvert: R C Slab culvert, dead load BM & SF, BM & SF For IRC Class AA Tracked Vehicle, BM & SF For IRC Class AA Wheeled Vehicle, BM & SF For IRC Class A Loading, Structural Design and drawing of Slab Culvert. **10 Hrs**

Module – IV

Design of T beam bridges: Proportioning of Components, Analysis of Slab Using IRC Class AA Tracked Vehicle, Structural Design of Slab.

Analysis of Cross Girder for Dead Load & IRC Class AA Tracked Vehicle, Structural Design of Cross Girder.

Analysis of Main Girder using Courbon's Method, Calculation of Dead load BM and SF, Calculation of Live load BM & SF using IRC Class AA Tracked vehicle, Structural design and drawing of Main Girder. **10 Hrs**

Module – V

Substructure: Definition of pier and abutment, Design and drawing of pier and abutments, Scour at abutments and pier.

Types of foundations, pile, well and pneumatic caissons.

Importance of bridge bearings, sketches of different types of bearings. **10 Hrs**

Course Outcomes:

Students will be able to

- Acquire knowledge of basic components and working principles of bridges and culverts.
- Analyze bridges and culverts for different IRC loadings.
- Outline the design principles of substructures and bearings.
- Detailing of bridges, culverts and substructures as per IS standards.

Text Books:

- Essentials of Bridge Engineering by Dr. D Johnson Victor, Oxford & IBH Publishing Co New Delhi
- Design of Bridges by Dr. N Krishna Raju, Oxford & IBH Publishing Co., New Delhi
- Design of Bridges by Jagadish and Dr M A Jayaram

Reference Books:

- Principles and Practice of Bridge Engineering by S P Bindra, Dhanpat Rai & Sons New Delhi
- IRC 6 – 2017 Standard Specifications And Code Of Practice For Road Bridges Section II Loads and Stresses, The Indian Road Congress New Delhi

- IRC 112 -2019 Standard Specifications And Code Of Practice For Road Bridges Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
- IS 456 - 2000 Indian Standard Plain and Reinforced Concrete Code of Practice (Fourth Revision) BIS New Delhi
- IS 1343 - 2019 Indian Standard Prestressed Concrete Code of Practice BIS New Delhi.

E-Resources:
- https://nptel.ac.in/courses/105/105/105105165/

PRE-STRESSED CONCRETE STRUCTURES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT72	**2-2-0-0**	3	**50:50**	**3 hours**	**PCC**

Course Objectives:

This course enables the students to study the pre-stressed methods and design involved in modern construction. It also helps the students to analyse the behaviour of pre-stressed concrete structures under different loading conditions.

Syllabus

Module – I

Introduction: Definition and scope of pre stressed concrete, its applications, Types of pre-stressing system, High strength concrete and steel, Stress-Strain characteristics and properties.

Basic Principles of Pre-stressing: Fundamentals, Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning devices, tensioning methods and end anchorages. Ram pressure, extension and proof stress calculation during stressing operation.

Analysis of Sections for Flexure: Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles. **10 Hrs**

Module – II

Losses of Pre-Stressing: Various losses encountered in pre-tensioning and post-tensioning methods, determination of jacking force.

Deflections: Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer of loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep and deflection, load verses deflection curve, methods of reducing deflection. **10 Hrs**

Module – III

Design of beam: Flexure -IS Code recommendations –Ultimate flexural strength of sections Shear, shear resistance of sections, shear reinforcement. Limit state of serviceability control of deflections and cracking. Design of pre-tensioned and post-tensioned sections. Design of post tensioned slabs (PT Slab). **10 Hrs**

Module – IV

Design of End Block: Transmission of pre-stress in pre-tensioned member, transmission length, anchorage stress in post-tensioned members. Bearing stress and bursting tensile force, stresses in end block, IS code method, design of anchorage zone reinforcement – Check for transfer bond length in pre- tensioned beams.

10 Hrs

Module – V

Cantilever Beams and Continuous Beams: Analysis and design of cantilever beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

10 Hrs

Course Outcomes:

Students will be able to

- Identify different pre-stressing techniques and apply principles of pre-stressing to field problem.
- Evaluate the nature of stresses in the flexural member and calculate different losses in PSC members.
- Compute the deflection of PSC members.
- Design the pre-tensioned and post-tensioned beams.
- Analyze composite and continues beam.

Text Books:

- Krishna Raju N.: "Pre-stressed Concrete", 5thEdition, Tata McGraw Hill,New Delhi, 2007.ISBN:978-9387886209.
- Dayaratnam P.: "Pre-stressed Concrete Structures", 7th edition, Oxford and IBHPublications, New Delhi, 1996. ISBN: 978-9386479778.

- Lin T.Y., Ned. Burns H.: "Design of Pre-stressed Concrete Structures", 3rd edition, John Wiley and Sons, New York, 1982. ISBN: 978-9812531179.

Reference Books:
- Mallick S.K., Gupta A.P: "Pre-stressed Concrete", Oxford and IBH, New Delhi, 1983. ISBN: 978-9324527831.
- Natarajan V.: "Fundamentals of Pre-Stressed Concrete", 1976, B.I Publications, Bombay. ISBN: 978-9367312602.
- Libby J.R.: "Modern Pre-stressed Concrete", CBS Publishers, New Delhi, 1986. ISBN: 978-9376239543.
- IS: 1343-1980, Code of Practice For Prestressed Concrete, Bureau of Indian Standards, New Delhi, 1981.

E-Resources:
- http://www.vtuupdates.com>vtunotes
- http://www.vidhayarthiplus.com
- http://www.iitg.ernet.in>qip>cd_cell>chapters

TRANSPORTATION ENGINEERING					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT731	**3:0:0:0**	**3**	**50:50**	**3 hours**	**PEC**

Course Objectives:
Impart the basic knowledge about the components of Railways, design of railway geometrics, understand the concepts of an airport and design of runway and taxiways, concepts of harbor and tunnel engineering.

Syllabus

Module – I

Introduction of Railways and its Components: Advantages of railways as transportation mode, Typical cross sections, suitability of different gauges, Coning of wheels.

Permanent way: components of the permanent way, Rails, Sleepers, Ballast and Fixtures - functions, types and requirements. Calculation of quantity of materials required for laying a track-Examples.   **10 Hrs**

Module – II

Traction and Tractive Resistance: Traction and Tractive resistance, Gradients, super elevation, cant deficiency, Negative super elevation, Points and crossings, Salient features of Metro transport.

Geometric Design of Railways: Necessity, Safe speed on curves, Cant-cant deficiency- negative cant- safe speed based on various criteria, (both for normal and high speed tracks) Transition curve, Gradient and types, grade compensation, Examples on above.   **10 Hrs**

Module – III

Airport Planning: Airport components and diagram, Aircraft characteristics, Site selection and ICAO stipulations.

Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Elements of Taxiway Design, Runway and Taxiway Markings and lighting, Instrumental Landing System.   **10 Hrs**

Module – IV

Tunnel Engineering: Advantages and disadvantages, Different shapes of tunnels, Surveying- Transferring centre line, and gradient from surface to inside the tunnel working face.

Tunnel Methods: Tunneling in rocks-Drift method, Heading and benching method, Tunneling methods in soils-Needle beam, Liner plate, Tunnel lining, Tunnel ventilation, Pilot tunneling.   **10 Hrs**

Module – V

Harbours: Types, components, Natural phenomenon affecting the design of harbours. Wind, wave and tides. Currents, Breakwaters - types, wharf and quays, Jetties and berths. Offshore Platforms.

Docks: Dry dock and wet docks, Slipways, Navigational aids, warehouse and transit- shed.

10 Hrs

Course Outcomes: After successful completion of the course, students will be able to,
- Identify the importance of Railway Engineering in transportation sector.
- Design the components of railway geometric and airway system.
- Understand the different types of tunnels and its methods of construction.

- Acquire knowledge about the concepts of Harbors and Docks.
- Understand the impact of transportation engineering solutions.

Text Books:
- Saxena Subhash C and Satyapal Arora: "Railway Engineering", 7th Edition, Dhanpat Rai Publications, New Delhi, ISBN: 9788189928834.
- S.K Khanna, M.G Arora, S.S Jain - Airport Planning and Design, 6th Edition, Nem Chand Bros - Roorkee, ISBN: 81-85240-68-10.
- R. Srinivasan: "Harbour, Dock and Tunnel Engineering", Charaotar Publishing House, 28th Edition, 2016, ISBN: 9789385039195.

Reference Books:
- M.M. Agarwal, "Railway Engineering", Prabha & Co. 2007.
- Hasmukh P. Oza, Gautam H. Oza "Dock and Harbour Engineering", (Chapters 8- 12,17,21), 7th Edition, Charotar Publishing house Pvt. Ltd., Gujarat, India, ISBN: 9789380358789.

E-Resources:
- http:nptel.ac.in/courses/105107123/
- https://www.railelectrica.com/traction-mechanics/train-grade-curve-and- acceleration-resistance-2/
- http://www.faa.gov/airports/engineering/
- https://sites.google.com/a/venusict.org/dha/material

ADVANCED CONCRETE TECHNOLOGY

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT732	3-0-0-0	3	50:50	3 hours	PEC

Course Objectives:

This course deals with modern concrete ingredients, making techniques and applications of special concrete. And also imparts knowledge on various testing methods on concrete as per IS Codes.

Syllabus

Module – I

Concrete Ingredients: Cement – Chemical composition, hydration of cement, types of cement, manufacture of OPC with flow charts, Bogue's compound and transition zone in cement paste.

Tests on cement – field test, fineness, normal consistency, setting time, soundness and compressive strength. Quality of mixing water.

Fine aggregate – grading of aggregates, sieve analysis, specific gravity, bulking, moisture content and deleterious materials.

Coarse aggregate – importance of size, shape and texture, grading of aggregates, sieve analysis, specific gravity, flakiness and elongation index, crushing, impact and abrasion tests. Structure of aggregate phase, structure of hydrated cement paste, structure - property relationship in hydrated cement paste.

10 Hrs

Module – II

Admixtures and Rheology of Fresh Concrete: Chemical admixtures – plasticizers, accelerator, retarders and air entraining agents. Mineral admixtures – fly ash, blast furnace slag, metakaolin, Silica fume and rice husk ash. Workability – definition, factors affecting workability, measurement of workability by slump, compaction factor, vee-bee and flow tests. Segregation and bleeding. Process of manufacture of concrete – batching, mixing, transporting, placing, compaction and curing of concrete.

10 Hrs

Module – III

Hardened Concrete: Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, effect of aggregate properties, compressive strength, tensile strength, bond strength, modulus of rupture, modulus of elasticity, Poisson ratio and the relationship between these parameters. Shrinkage and creep. Durability of concrete – permeability, chemical attack, sulphate attack, alkali aggregate reaction, corrosion and carbonation of concrete. Destructive and Nondestructive testing of concrete – Introduction, testing methods, advantages and applications.

10 Hrs

Module – IV

Special Concrete: Light Weight Concrete, High Density Concrete, Fiber Reinforced Concrete, Super plastized concrete, Ferro cement, High strength concrete, Ultra-High strength concrete, High Performance concrete, Self-compacting Concrete, Polymer Impregnated Concrete – (Polymer concrete, Polymer cement concrete, Geo polymer concrete), Reactive powder concrete, Bacterial concrete, Roller Compacted concrete, Pervious concrete and Nano-concrete, High Volume Fly Ash Concrete, Ternary blend concrete, Coloured Concrete, Pervious Concrete, Temperature Controlled Concrete, Sulphur Impregnated concrete.

10Hrs

Module – V

Concrete Mix Design: Concept of mix design, variables in proportioning, exposure conditions, procedure of mix design as per IS 10262-2019, Difference between Indian (IS), American (ACI), British (BS) methods, Problems as per provisions in IS10262-2019.

10 Hrs

Course Outcomes:

Students will be able to

- Acquire the knowledge on modern concrete ingredients and making techniques.
- Identify the types of admixtures and their influence on engineering properties.
- Understand the impact of environmental sustainability and durability of concrete.
- Design and develop various grade of concrete as per Indian standards.
- Select different types of destructive and non-destructive tests to find strength of concrete.

Text Books:

- M. S Shetty, "Concrete Technology Theory and Practice", S. Chand & Co Ltd., New Delhi, 2007.
- M. L Gambhir, "Concrete Technology", 4th edition, McGraw-Hill, 2009.
- Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014.
- A. R Santha kumar, "Concrete Technology"- Oxford University Press, New Delhi, 2007.

Reference Books:

- Job Thomas, "Concrete Technology", CENGAGE Learning, 2015.
- N.V. Nayak, A.K. Jain Hand book on "Advanced Concrete Technology", ISBN: 978-81-8487- 186-9.
- Neville A. M, "Properties of concrete", 4th edition, Pearson Education, Inc. and Dorling Kindersley Publishing Inc., 1995.
- IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
- IS 10262:2019, Indian Standards, Concrete Mix Proportioning – Guidelines. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

E-Resources:

- https://nptel.ac.in/courses/105/102/105102012/
- https://nptel.ac.in/courses/105/106/105106176/
- https://nptel.ac.in/courses/105/102/105102012/

ENERGY EFFICIENT AND GREEN BUILDINGS					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT733	**3-0-0-0**	**3**	**50:50**	**3 hours**	**PEC**

Course Objectives:

The students will be able to:

To study the energy efficient building which balances all the aspects of thermal comfort, ventilation heating and cooling? Further the students will have an exposure to certification process and criteria required for green designs.

Syllabus

Module – I

Introduction to thermal comfort: Climatic factors, Classification of tropical climates, site climate, micro climate of human settlements, Ventilation, types of ventilation and requirements for health, mechanisms. Estimation of natural ventilation, airflow patterns in building. Human Comfort for the noise level, human comfort for the ventilation in the buildings. Indoor air quality, Techniques for improving indoor air quality

10Hrs

Module – II

Passive solar heating and cooling: Introduction to thermal comfort in the buildings, Heat control and ventilation for solar heating and cooling, Thermal comfort factors, thermal indices, thermal quantities, heat exchange in buildings, periodic heat flow, mechanical and structural means of thermal control. Principles of day lighting in buildings

10 Hrs

Module – III

Green buildings: Green building definition, needs of green building. green building concepts, Material selection of Green buildings, Energy efficient and Technologies in green buildings, types of rating systems and certification (GRIHA and LEED rating for green buildings), Globally and in India, Case studies of different green buildings in practice **10 Hrs**

Module – IV

Solar buildings: Introduction to solar buildings, latest development in solar cell system, Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Passive solar design Technique. Case studies of Solar Passive Cooled and Heated Buildings**. 10 Hrs**

Module – V

Green Composites: Concepts of Green Composites. Zero discharge concepts. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage Urban Environment and Green Buildings. Green Cover and Built Environment. **10 Hrs**

Course Outcomes:

Students will be able to

- Appraise the effect of heating and ventilation on indoor air quality and thermal comfort.
- To identify the various areas of implementing strategies for green design in project to enhance built environment
- Apply for development and certification of green design.
- Impart the knowledge of energy efficient techniques in green buildings.

Text Books:

- O H Koenigsberger, "Manual of Tropical Housing and Building- Climatic   Design", Orient Longman, Chani 1975
- Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2002McGraw-Hill.
- Osman Attmann: "Green Architecture Advanced Technologies and Materials", (Chapters 2,4,6-9) McGraw Hill, 2010, ISBN: 9780071625012.

Reference Books:

- SP:41- Functional Requirements for Buildings, BIS, New Delhi
- Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi,2007.
- Jerry Yudelson: "Green building Through Integrated Design", (Chapters 5-7) Mc- Graw Hill, 2009, ISBN: 9780071546010.
- Walker, B, W. Steffen: "Global change and terrestrial ecosystems", International geosphere-biosphere programme book series, Cambridge University Press, 1996, ISBN-13: 9780521578103.

E-Resources:
- www.greenresourcecouncil.org/green-resources/reference-links energy.gov/eere/buildings
- www.michigan.gov/documents/CIS_EO_Inside_ChurchManual.. energy.gov/energysaver/led- lighting

ANALYSIS AND DESIGN OF TALL STRUCTURES					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT741	**3:0:0:0**	**3**	**50:50**	**3 hours**	**MEP**

Course Objectives:

The objectives of this course is to enable the students to gain the knowledge on the principles of stability of tall buildings. To expose the students for the design of tall buildings for earthquake and wind resistance which in turn they can able to analyse and evaluate the performance of tall structures for strength and stability.

Syllabus

Module – I

Design Criteria:

Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes.

Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads. Working stress design, Limit state design, Plastic design**.**   **10Hrs**

Module – II

Lateral loads and analysis:

Static and dynamic approach, Analytical and wind tunnel experimentation method. Equivalent lateral force, modal analysis, combinations of loading,

Design of different types of bracings. Numerical problems on calculating lateral load on tall structures

10 Hrs

Module – III

Behavior of Various Structural Systems:

Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems – Rigid frames, braced frames.

Infilled frames, shear walls, coupled shear walls, wallframes, tubular structures, cores, outrigger – braced and hybrid mega systems.   **10 Hrs**

Module – IV

Analysis and design

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction.

Analysis for member forces, drift and twist - Computerized three dimensional analysis – Assumptions in 3D analysis – Simplified 2D analysis.   **10 Hrs**

Module – V

Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis

Transnational, Torsional instability, out of plumb effects, Differential movement, creep and shrinkage effects, temperature effects and fire.   **10 Hrs**

Course Outcomes:

Students will be able to:

- Achieve Knowledge of design, different types of loads and their influence on tall buildings and development of problem-solving skills.
- Understand the design concepts of lateral loads and their influence on tall buildings.
- Summarize the behavior of various structural systems.
- Design and develop analytical skills.
- Describe the concepts of load displacement relationship as per modern day needs.

Text Books:
- Taranath B.S, "Structural Analysis and Design of Tall Buildings"- 2nd Edition, McGraw Hill.
- Wilf gang Schuller, "High rise building structures"- John Wiley, 1977.
- Bryan Stafford Smith and Alexcoull, "Tall building structures Analysis and Design"-2nd Edition, John Wiley.

Reference Books:
- T.Y Lin & D.Stotes Burry, "Structural concepts and system for Architects and Engineers"-3rd Edition, John Wiley.
- Lynn S.Beedle, "Advances in Tall Buildings"-3rd Edition, CBS Publishers and Distributors.
- Dr. Y.P. Gupta – Editor, "Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities"- 1st Edition, New Age International Limit.

E-Resources:
- http://publications.lib.chalmers.se/records/fulltext/3785.pdf.
- http://www.scribd.com/doc/149804560/Analysis-and-Design-of-Tall-Buildings-Bungale-S-Taranath#scribd.

COMPUTATIONAL STRUCTURAL MECHANICS					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT742	**3-0-0-0**	**3**	**50:50**	**3 hours**	**MEP**

Course Objectives:

The objective of this course is to understand the principles of Structural Analysis, numerical methods, and analyze the structural members using flexibility and stiffness matrix method.

Syllabus

Module – I

Introduction: Static and Kinematic indeterminacy, numerical problems on static and kinematic indeterminacy. Concepts of stiffness and flexibility. Energy concepts. Principle of minimum potential energy and minimum complementary energy. Flexibility and Stiffness matrices for truss, beam and Portal Frame. **10 Hrs.**

Module – II

Analysis using Flexibility method: Flexibility matrix for continuous beams, plane trusses and rigid plane frames. Analysis of continuous beams, plane trusses and rigid plane frames by flexibility method (having not more than 3 coordinates – 3x3 flexibility matrix. **10 Hrs**

Module – III

Analysis using Stiffness Method: Stiffness matrix for continuous beams, plane trusses and rigid plane frames. Analysis of continuous beams, plane trusses and rigid plane frames by stiffness method (having not more than 3 coordinates – 3x3 stiffness matrix) **10 Hrs**.

Module – IV

Effects of temperature change and lack of fit: Flexibility method of analysis-continuous beams, plane trusses and rigid plane frames by the flexibility method which are subjected to the effect of temperature change, continuous beams, plane trusses and rigid plane frames by the flexibility method which are subjected to the effect of lack of fit (having not more than 3 coordinates – 3x3 flexibility matrix). **10 Hrs.**

Module – V

Numerical methods: Solution techniques including numerical problems for simultaneous equation developed in slope deflection method and other methods of structural analysis for beam and frames. Numerical problems on Gauss elimination and Numerical problems on Cholesky method. **10 Hrs.**

Course Outcomes:

Students will be able to

- Apply the knowledge of basics of indeterminacy.
- Analyze the different structural elements using flexibility matrix method and stiffness matrix method.
- Determine the stresses developed in structural members due to temperature change and lack of fit.
- Understand the different solution techniques.

Text Books:

- S.Rajasekaran, "Computational Structural Mechanics", PHI, New Delhi, 2001.
- A. K.Jain "Advanced Structural Analysis with Computer Application" Nemchand and Brothers, Roorkee, India, 2005.
- F.W.Beaufait et al., "Computer methods of Structural Analysis", Prentice Hall, 1970.

Reference Books:
- W.Weaver and J.H.Gere, "Matrix Analysis of Framed Structures", Van Nastran, 1980.
- H.KardeStuncer, "Elementary Matrix Analysis of Structures", McGraw Hill 1974.
- M.F.Rubinstein "Matrix Computer Methods of Structural Analysis "Prentice – Hall., 2010.

E-Resources:
- http://linlspringer.com
- https://vtu.ac.in/pdf/cbcs/pg/2018/msesyll.pdf
- http://crcnetbase.com.

ADVANCED DESIGN OF STEEL STRUCTURES

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT743	3-0-0-0	3	50:50	3 hours	MEP

Course Objectives:

The students will be able to:

Learn about steel structures used for various applications as per specifications. And understand the behavior and working principles of steel structures and design as per IS standards.

Syllabus

Module – I

Steel Bridges : Introduction: Historical development of bridge, Classification of steel bridges, Movable bridges, Comparison of movable and fixed bridges, Selection of type of bridges, Execution methods of bridges, Economical span length, Clearance, Width of roadway and footway, Dimension of rolling stock **10 Hrs**

Module – II

Plate Girder: Analysis and Design of Plate girders using IS 800-2007, curtailment of flange plates, stiffeners. Introduction to hybrid girders, analysis and design of gantry girder, Problems with welded and bolted connections. **10 Hrs**

Module – III

Industrial Structure: Design of Industrial building, roofing, cladding and wall material, structural components and framing, Types of roof trusses, components, wind load estimation for different type of structures for various zones. Approximate analysis of industrial bents / PEB, design of purlins and wall girts using Channel and Angle sections; cold formed steel purlin. **10 Hrs**

Module – IV

Transmission Towers: Introduction, Loads on towers, Shape sag and Tension in uniformly loaded conductors, Design of Preliminary Geometry Tower, Analysis and Design of Tower, Design of Tower foundation. **10 Hrs**

Module – V

Light gauge members: Light gauge sections, Design considerations, allowable stresses, buckling, Design of Compression members, Tension members, Laterally supported beams and connections. **10 Hrs**

Course Outcomes:

Students will be able to

- Acquire knowledge of the use of steel structures for Infrastructure developments.
- Summarize the basic components of steel structures used as in bridges, girders, Industrial structures, etc.
- Apply appropriate method of analysis for design of steel structures as per IS standards.
- Detailing of steel members as per IS codes.

Text Books:

- Design of Steel Structures II, Prof. S.R. Satish Kumar & Prof.A.R. Santha Kumar, IIT Madras Civil Engineering Course Material,
- Design of Steel Structures by N. Subramanian, Oxford University Press
- Dr. Ramchandra, " Design of steel structures – II", published by Standard book house, Rajsons Publications Pvt Ltd., 1705, NaiSarak, Delhi-110006, PB No.1074.

Reference Books:

- S Ramamrutham, "Design of steel structures ", published by Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
- Design of Steel Structures by Arya and Ajmani, Nem Chand & Brothers.
- Indian Code of Practice IS 800 2007
- Indian Code of Practice IS 875 Part-I to IV
- Indian Code of Practice IS 1893-2002

E-Resources:

- https://nptel.ac.in/courses/105/106/105106113/
- https://www.vidyarthiplus.com/vp/attachment.php?aid=24120

EARTHQUAKE ENGINEERING

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
20CVT751	**3-0-0-0**	**3**	**50:50**	**3 hours**	**MEP**

Course Objectives:

The students will be able to learn fundamentals of engineering seismology which is required to understand the cause of an earthquake and the movement of seismic waves, through which repones spectrum will be developed which is used in design of earthquake resistant structures. The design concepts will be carried out for Reinforced Concrete Structures and Masonry Structures following IS Codes. In addition to design, students will get an insight to types of seismic analysis for seismic response control.

Syllabus

Module – I

Engineering Seismology: Terminologies (Focus, Focal depth, Epicentre, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake).   **10 Hrs**

Module – II

Response Spectrum: Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.   **10 Hrs**

Module – III

Seismic Performance of Buildings and Over View of IS-1893: Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modelling; Code based seismic design methods

10 Hrs

Module – IV

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

10 Hrs

Module – V

Earthquake Resistant Analysis and Design of RC Buildings: Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings.

Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

10 Hrs

Course Outcomes:

Students will be able to:
- Acquire basic knowledge of engineering seismology.
- Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
- Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
- Analyse multi-storied structures modelled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
- Comprehend planning and design requirements of earthquake resistant features of RCC structures thorough exposure to different IS-codes of practices.

Text Books:
- Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
- S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
- Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
- T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

Reference Books:
- David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
- C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
- IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
- IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
- IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
- IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
- IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

MUNICIPAL WASTEWATER TREATMENT					
Course Code	**L:T:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT 752	**3:0:0:0**	**3**	**CIE:50 SEE:50**	**4 hours**	**MEP**

Course Objectives:

The students will be able to

Learn the sources, collection, characteristics, treatment and disposal of wastewater and gain knowledge on rural sanitation.

Syllabus

Module – I

Sewerage Systems: Need for sanitation, methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors affecting dry and wet weather flow on design of sewerage system, estimation of storm water flow, time of concentration flow, numerical.

Sewer appurtenances: Manholes, catch basins, oil and grease traps. P, Q and S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers basic principles of house drainage.

10 Hours

Module – II

Design of Sewers: Hydraulic formula to determine velocity and discharge. Self-cleansing and non-scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.

Wastewater characteristics: sampling, significance and techniques, physical, chemical and biological characteristics, flow diagram for municipal waste water Treatment unit operations and process. Estimation of BOD. Reaction kinetics (zero order, 1st order and 2nd order). **10 Hours**

Module – III

Disposal of Effluents: Dilution, self-purification phenomenon, oxygen sag curve, zones of purification, sewage farming, sewage sickness, numerical problems on disposal of effluents. Streeter-Phelps equation.

Primary Treatment of Municipal Wastewater: Screens: types, disposal. Grit chamber, oil and grease removal. Primary and secondary settling tanks and design. **10 Hours**

Module – IV

Biological Treatment Process: Suspended growth system - conventional activated sludge process and its modifications. Attached growth system – trickling filter, bio-towers and rotating biological contactors.

Sludge Disposal: Principle of stabilization ponds, oxidation ditch, Sludge digesters (aerobic and anaerobic), Equalization, thickeners and drying beds. **10 Hours**

Module – V

Advanced Wastewater Treatment: Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Advance oxidation processes (AOPs), Electro coagulation.

Rural sanitation: Low cost treatment process: Working principal and design of septic tanks for small community in rural and urban areas, two-pit latrines, eco-toilet and soak pits **10 Hours**

Course Outcomes:
- Knowledge on sewer appurtenances and materials for sewer network.
- Analyze the self-purification of river / streams.
- Design of sewer network and wastewater treatment systems.

- Asses the wastewater quality and its environmental significance.

TEXT BOOKS :
1. Nelson L Nemerow: "Liquid Waste of industry, Theories, Practices and Treatment", Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
2. Rao M N, Dutta A.K: "Waste water treatment", 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.

Reference Books:
- Nelson L Nemerow: "Liquid Waste of industry, Theories, Practices and Treatment", Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
- Rao M N, Dutta A.K: "Waste water treatment", 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.
- Mahajan S P.: "Pollution control in Process Industries", Tata McGraw Hill Company, New Delhi, 1985, ISBN: 9780074517727, 0074517724.
- Eckenfelder: "Industrial Water pollution Control", McGraw Hill Company, New Delhi American Chemical Society, Washington D.C., USA, 2000, ISBN: 9789339220433.

E-Resources:
- www.neerienvis.nic.in/pdf/
- www.fao.org/

www.gewater.com/applications, www.waterleau.com/en

GROUND WATER HYDROLOGY					
Course Code	**L:T:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVT 753	**3:0:0:0**	**4**	**CIE:50 SEE:50**	**4 hours**	**MEP**

Course Objectives:

The students will be able

Learn about ground water availability, aquifer properties, well hydraulics, and ground water exploration and gain knowledge on ground water recharge.

Syllabus

Module – I

Importance of Ground Water: Ground water utilization and historical background, groundwater in hydrological cycle, groundwater budget and ground water level fluctuations.

Occurrence and Movement of Groundwater: Origin and age of ground water, rock properties affecting the ground water, ground water column, zone of aeration, zone of saturation, aquifer and their characteristics / classifications, ground water basins and springs.   **10 Hours**

Module – II

Fundamentals of Ground Water Flow: Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, anisotropic layered soils, steady one dimensional flow.   **10 Hours**

Module – III

Well Hydraulics: Steady, unsteady, uniform, radial flow to a well in a confined, unconfined, leaky aquifer, partially penetrating, horizontal wells, testing for a yield, hydraulics of recharge well. Concepts and methods of artificial ground water recharge, ground water budget, wastewater recharge for reuse
.   **10 Hours**

Module – IV

Surface or Sub Surface Investigation of Ground Water: Geological / geographical exploration, remote sensing, electric resistivity, seismic refraction based methods for surface investigation of ground water, test drilling and ground water level measurement, sub surface ground water investigation.

10 Hours

Module – V

Saline Water Intrusion in Aquifers: Ghyben – Herzberg relation between fresh and saline waters, shape and structure of the fresh and saline water interface, saline water intrusion control.

Pollution and Quality Analysis of Groundwater: Sources of ground water pollution, advection and dispersion, criteria and measures of ground water quality, ground water salinity, ground water remediation.   **10 Hours**

Course Outcomes:

- Acquire knowledge on fundamental concepts of occurrence and movement of groundwater.
- Analyse the yield and performance of a recharge well.
- Estimate the ground water runoff and budget.
- Asses the ground water pollution and suggest suitable control techniques.

TEXT BOOKS :

- H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.
- K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.
- Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.

Reference Books:
1. Garg Satya Prakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.
2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.
3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.

E-Resources:
- https://ecommons.cornell.edu.
- https://doi.org/10.1016/j.enbsoft.

GEOTECHNICAL ENGINEERING LABORATORY					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
20CVL76	**1-0-2-0**	**2**	**50:50**	**3 hours**	**PCC**

Course objective:

The students will be able to:
- Determine the index properties to classify the soil.
- Evaluation of the compaction characteristics of soils
- Analyze the flow water through soil
- Estimate shear strength parameters and consolidation characteristics of soil

Syllabus

LIST OF EXPERIMENTS

Conducted in Laboratory:
1. Determination of the water content of soil by oven drying method
2. Determination of the specific gravity of soil by pycnometer and density bottle method
3. Determination of the particle size distribution of coarse grained soil sample by dry sieve analysis.
4. Determination of the particle size distribution of fine grained soil sample by hydrometer method
5. Determination of the in situ density of soil by core cutter and sand replacement methods
6. Determination of liquid limit plastic limit and shrinkage limit of soil specimen
7. Determination of the compaction characteristics of soil by Standard Proctor test and Modified Proctor test
8. Determination of the permeability of soil specimen by constant head and variable head methods
9. Determination of the shear parameters of a sandy soil by direct shear test
10. Determination of the unconfined compressive strength of cohesive soil
11. Determination of the shear strength parameters of soil from unconsolidated undrained (UU) triaxial test
12. Determination of the shear strength of very soft soil specimen by laboratory vane shear test

Demonstration:
1. Field Identification of soil, gravel type, sand type, silt type and clay types soils.
2. Demonstration of the consolidation characteristics of soil sample.
3. Demonstration of .CBR of a soil specimen
4. Demonstration of relative density of cohesionless soil
5. Demonstration of miscellaneous equipment's such as Augers, Samplers, Rapid Moisture meter, Proctor's needle.

Course Outcomes

Students will able to

CO1: Classify the soil based on index properties of soil

CO2: Examine the compaction characteristics of soil to control compaction in the field

CO3:Evaluate the coefficient of permeability of soil

CO4: Determine the shear strength parameter and consolidation characteristics of soil and Use the results for solution of engineering problem

Text Books:
- Soil Mechanics and Foundation Engg.- Punmia B.C.(2005), 16th Edition Laxmi Publications Co., New Delhi.

- Dr. K.R.Arora, "Soil Mechanics & Foundation Engineering", Standard Publishers & Distributors, New Delhi.Ltd., Second Edition, 1984.
- Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol.I, II, III, Princeton Press, London.

Reference Books:

- Soil Testing for Engineers- Lambe T.W., Wiley Eastern Ltd., New Delhi.
- Engineering Properties of Soil and Their Measurements- Bowles J.E. (1988), - McGraw Hill

Book Co. New York.
- BIS Codes of Practice: IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part– 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) –1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) –1966, IS 2720 (Part-60) 1965

E-Resources:
- https://nptel.ac.in/courses/105/101/105101160/
- https://www.slideshare.net/RambabuPalaka/gt-lab-manual
- https://nptel.ac.in/courses/105/101/105101201/

SOFTWARE APPLICATION LABORATORY					
Course Code	**L-T-P-S (Hrs/week)**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
20CVL77	**0:0:2:0**	**2**	**50:50**	**3 hours**	**PCC**

Course Objectives:

To make students to learn civil engineering software in a professional set up, prepare project planning and schedule the building project and knowledge of the preparing the Excel sheets for structural design.

Syllabus

Cycle 1

Use of civil Engineering software's:

1. Analysis of plane trusses, continuous beams
2. 2D Portal Frames with different kinds of loading and support conditions
3. 3D analysis of multistoried frame structures

Cycle 2

Project Management- Exercise on Project planning and scheduling of a building project using any project management software:

1. Preparing Calendar for project.
2. Create Task and its relationship.
3. Planning and Scheduling the resources.
4. Creating work break down structure.
5. Preparing the resource sheet.
6. Assign and levelling the resource

Cycle 3

Use of Excel In Civil Engineering Problems

1. SFD and BMD for Cantilever and simply supported beam subjected to Point load, uniformly distributed and uniformly varying load acting throughout the span.
2. Design of singly reinforced and doubly reinforced rectangular beams
3. Design of one way and two-way slab.

Course Outcomes:

Students will be able to

- Understand the basic principles of structural analysis and design.
- Analyze the different structures and their behaviors.
- Acquire knowledge about the concepts of project management.
- Analyze the SFD and BMD for various kind of beam using Excel.

Text Books:

- Dr. M.N. Shesha Prakash, Dr. G.S. Suresh: "Computer Aided Design Laboratory", Lakshmi Publications.
- M.A. Jayaram, D.S. Rajendra Prasad: "CAD Laboratory", Sapna Publications Learning.
- Ramesh Bangia: "Excel", Khanna Book Publishing Co. (P) Ltd., Microsoft, 2002, ISBN-10: 8187522577, ISBN-13: 978-8187522577.
- Krishnamoorthy, C.S., Rajeev, S.: "Computer Aided Design and Analytical Tools", Narosa, 1993, 2nd Edition, ISBN: 978-81-7319-495-5.
- Peurifoy. R L: "Construction Planning, Equipment and Methods", McGraw Hill,8thEdition,

ISBN-10: 0073401129.

Reference Books:

- Vazirani V.N., Ratwani N.M.: "Strength of Materials", Vol. II, Khanna Publishers, 1996.
- Ashok, Kumar Jain: "Reinforced Concrete Limit State Design", Nem Chand Brothers, 1990.
- Harry G Harris and Gajanan M Sabnis: "Structural Modeling and Experimental Techniques", 2nd Edition, ISBN: 0849324696

E-Resources:

- https://www.researchgate.net/publication/273453659_CAD_in_Civil_Engineering_A_La
- www.sit.ac.in/department/mca/publication/jayaram.pdf.
- support.office.com/en-us/article/Set-the-general.
- www.wrike.com/blog/project-manager-calendar.
- www.tacticalprojectmanagement.com/ms-project-export.