Bansilal Ramnath Agarwal Charitable Trust's

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)


## Syllabus for

# S.Y.B. Tech.

# Civil Engineering (Pattern 2018)

# Department of Civil Engineering

**Vision:**

Excellence in Civil Engineering Education

**Mission:**

**M1:** Make competent Civil Engineers with high level of professional, moral and ethical values

**M2:** Impart highest standards in theoretical as well as practical knowledge and skill set

**M3:** Establish Center of Excellence in major areas of Civil Engineering to respond to the current and future needs of the industry, higher studies as well as research

## PROGRAM EDUCATIONAL OBJECTIVES

**PEO 1:** Graduates will have successful career in the field of Civil Engineering

**PEO 2:** Graduates will respond to growing demands of society through professional and ethical practices

**PEO 3:** Graduates will pursue lifelong learning including higher studies in the field of Civil Engineering

## PROGRAM OUTCOMES(POs)

**Engineering Graduates will be able to:**

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
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 engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex 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.
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 projects and in multi disciplinary environments.
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 OUTCOMES (PSO):

**PSO1:** Engineering graduates will be able to plan and execute various activities on construction projects.

**PSO2**: Engineering graduates will be able to analyze and design a system, component or process to meet desired needs, using fundamental knowledge of mathematics, science and engineering.

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# Vishwakarma Institute of InformationTechnology, Pune-48

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## Department of Civil Engineering

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### S. Y. B. TECH (CIVIL ENGINEERING), SEMESTER III (PATTERN 2018)

| Course Code | Course Title | Course Type | Teaching Scheme | | | Examination Scheme | | | | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CIE | ISE | SCE | ESE | PR/OR/TW | | |
| ES21181CV | Engineering Mathematics III | TH | 3 | 1 | - | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| ES21182CV | Biology for Engineers | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| CVUA21183 | Mechanics of Structures- I | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| CVUA21184 | Introduction to Fluid Mechanics | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| ES21185CV | Societal and Global Impact of Civilization | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| CVUA21186 | Lab Practice-I* | CE-PR/OR | - | - | 6 | 50 | - | - | - | 50 | 100 | 3 |
| CVUA21187 | Material, Testing and Evaluation | CE | 2 | - | 2 | - | - | 50 | - | 50 | 100 | 3 |
| AU | Mandatory course | AU | - | - | - | - | - | - | - | - | - | - |
| | Total | - | 17 | 1 | 8 | 150 | 150 | 150 | 150 | 125 | 725 | 22 |

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1hr. = 1 Credit, AU: No Credits

*Course have oral examination
Lab Practice-I will be based on courses Biology for Engineers, Mechanics of Structures- I and Introduction to Fluid Mechanics.

BOS Chairman | Dean Academics | Director

Bansilal Ramnath Agarwal Charitable Trust's

# Vishwakarma Institute of InformationTechnology, Pune-48

(An Autonomous Institute Affiliated to Savitribai PhulePune University)

## Department of Civil Engineering

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### S. Y. B. TECH (CIVIL ENGINEERING) SEMESTER IV (PATTERN 2018)

| Course Code | Course Title | Course Type | Teaching Scheme | | | Examination Scheme | | | | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CIE | ISE | SCE | ESE | PR/OR/TW | | |
| CVUA22181 | Architectural Planning and Computer Aided Civil Engineering Drawing | TH | 3 | 1 | - | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| CVUA22182 | Geotechnical Engineering | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| CVUA22183 | Mechanics of Structures - II | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| CVUA22184 | Surveying | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| CVUA22185 | Hydraulic Engineering | TH | 3 | - | - | 20 | 30 | 20 | 30 | - | 100 | 3 |
| CVUA22186 | Lab Practice – II * | CE-PR/OR | - | - | 6 | 50 | - | | - | 50 | 100 | 3 |
| CVUA22187 | Construction Engineering and Management | CE | 2 | - | 2 | - | - | 50 | - | 50 | 100 | 3 |
| CVUA22188 | Instrumentation and Sensor Technologies for Civil engineering applications | CE | 2 | - | - | 50 | - | 50 | - | - | 100 | 2 |
| AU | Mandatory course | AU | - | - | - | - | - | - | - | - | - | - |
| | Total | - | 19 | 1 | 8 | 200 | 150 | 200 | 150 | 125 | 825 | 24 |

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1hr. = 1 Credit, AU: No Credits

*Course have oral examination

Lab Practice-II will be based on courses Geotechnical Engineering, Surveying and Hydraulic Engineering

BOS Chairman | Dean Academics | Director

# Semester –I

Bansilal Ramnath Agarwal Charitable Trust's
**Vishwakarma Institute of Information Technology, Pune-48**
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

**Department of Civil Engineering**

# Engineering Mathematics III (ES21201CV)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week<br>Tutorial (T): 1 hr.<br>Practical (P): hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Pre-requisites:**
Readers/students are expected to know the following concepts:
- Basics of Derivatives, Integration, Trigonometry, Vector algebra &Partial differentiation.

**Course objectives:**
- To introduce higher order linear differential equations and modelling of mass spring systems, free and forced damped and undamped systems.
- To introduce Fourier transform and Applications, Numerical methods.
- To know Statistical technique to analyse the data.
- To introduce vector differentiation.
- To introduce vector Integration.
- To introduce partial differential equations

**Course Outcomes: At the end of course, students will be able to**
1. Understanding of Linear Differential equations, modelling of mass spring systems, free and forced damped and undamped systems
2. Understanding of Design and analysis of continuous and discrete system, where knowledge of FourierTransform is used. And understanding of Numerical methods,
3. Use of Statistical techniques in Engineering fields
4. Understand aspects of vector differential calculus which includes physical phenomenon viz gradient,divergence, curl etc
5. Understanding of applications of vector integral calculus vizwork done, Flow of fluids etc.
6. Develop the modeling of boundary value problems

**Topics to be covered:**

**Unit I: Linear Differential Equations**

LDE of nth order with constant coefficients, Method of Variation of Parameters, Cauchy's & Legendre's DE, Solution of Simultaneous and Symmetric Simultaneous DE, Modelling of mass spring system.

**Unit II: Numerical methods and Fourier Transform**

Numerical solution of 1) System of Linear Equations by Gauss Elimination.2) Ordinary Differential equations by Euler method, Rungekutta $4^{th}$ order method.
Fourier Transform, Fourier cosine and sine Transforms, Inverse Fourier Transform.

**Unit III: Statistics**

Moments, Skewness and Kurtosis, Correlation and Regression, Probability Distribution, Binomial, Poisson and Normal Distributions, -Sampling Distributions, t-distribution, Chi-Square distribution

**Unit IV: Vector differential Calculus**

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar Potential, Vector identities.

**Unit V: Vector Integral Calculus& Applications**

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem, Applications to problems in Fluid Mechanics

**Unit VI: Partial Differential Equations& Applications**

Applications of PDE: Modelling of Vibrating string, Wave equation, One- and two-dimensional heat flow equations.

**Text books:**

1) A Text book of Applied Mathematics by P.N. Wartikar, U. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune) (Volume II-ISBN 81-85825-07-6) ((Volume III-ISBN 81-85825- 01-7)
2) Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.) (*ISBN* 978-0-470-45836-5.)

**Reference Books:**

1) Higher Engineering Mathematics by B. S. Grewal Khanna Publication, Delhi)(ISBN-13. 978-81-7409-195-5. *ISBN*-10. 81-7409-195-5)
2) Advanced Engineering Mathematics by Wylie C.R &Barrett L. C. (McGraw-Hill, INC)(*ISBN* 0 – 07 -463841 – 6)
3) Advanced Engineering Mathematics by Peter V.O'Neiol (ISBN-13: 9781111427429 / ISBN-10: 1111427429)

**ENGINEERING MATHEMATICS-III (Tutorial)**

1Practice Problems on C.F & P.I
2Practice Problems on Method of Variation of Parameters, Cauchy's & Legendre's DE.
3Practice Problems on Fourier Transform (FT) and Numerical methods
4Practice Problems on Applications of Fourier Transforms in Heat equation.
5Practice Problems on Statistical methods.
6Practice Problems on Probability
7Practice Problems on Vector Differentiation, Gradient, Divergence and Curl, Directional Derivative,
8.Practice Problems on Solenoidal, Irrotational and Conservative Fields, Scalar Potential, Vector Identities.
9Practice Problems on Line integral, Greens Theorem, Gauss divergence Theorem. Stokes theorem
10Practice Problems on PDE

# Biology for Engineers (ES21182CV)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): - hr.<br>Practical (P): - hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Course Objectives:**

- The concept of biodiversity & application of bio-kinetics for practical under the microbiology treatment process.

**Course Outcomes: At the end of course, students will be able to**

1. Explain fundamentals of Biology for environmental system
2. Explain fundamentals of Microbiology for environmental system
3. Understand characteristics of Sewage, self-purification of streams and biological process in sewage treatment
4. Understand Preliminary and Primary units of Sewage Treatment Plant
5. Apply Aerobic biological process in the form of Suspended and Attached Growth process to treat domestic waste water
6. Apply anaerobic biological process to treat Waste Water, sludge and its disposal.

**Unit I- Basic fundamental of biology**

Ultrastructure of living cell. Structure of few important biomolecules and its functions [ATPase, Aquaporins, Motor proteins (dynein, flagella)],
Energy dynamics: Photosynthesis and energy assimilation, Respiration and electron transport chain,ATP generation

**Unit II – Basic of Microbiology**

Structure of Bacteria, fungi and algae. Microscopy. Ecological aspects of single celled organisms, Carbon utilization -Autotrophs, heterotrophs, lithotropes.. Sterilization and media compositions. Growth kinetics

**Unit III – Characteristics of sewage, stream sanitation and biological process**

Characteristics of sewage: physical, chemical and biological, effluent standards as per CPCB/MPCB norms. Stream sanitation: Self-purification of natural streams, Oxygen Sag Curve, Streeter -Phelp's equation and terminology (without derivation and numerical). Classification of biological process.

**Unit IV – Theory of preliminary and primary treatment units for sewage treatment**

Theory and concept of pumping station, flow measurement equalization basin, screen chamber, grit chamber, oil and grease trap. Theory of circular sanitary sewers pipe system. Theory of primary sedimentation tank.

**Unit V– Biological treatment of waste water- I. (Aerobics)**

Concept of Secondary Biological treatment unit: Suspended growth process. Parameter consideration for biological process such as HRT, MCRT, F/M ratio, OLR, Qty. of oxygen required, Power required, sludge production, sludge flow rate, recycling ratio. Concept of Secondary Biological treatment unit: Attach growth process. Concept of tricking (NRC equation), introduction to bio- towers, concept rotating biological contactor

**Unit VI– Biological treatment of waste water- II. (Anaerobic)**

Concept in anaerobic treatment process, anaerobic reactor types. Principle of anaerobic digestion, stages of digestion, bio–gas production its characteristics & application, factors governing anaerobic digestion, Dewatering of sludge by gravity thickener, sludge drying bed, decanters. Methods of sludge treatment And disposal, advantages & disadvantages. Theory of Up-flow Anaerobic Sludge Blanket (UASB)

Reactor– Principle, advantages & disadvantages. Biological detoxification mechanisms: Bio sorption of heavy metals, enzymatic degradation of pollutants (pesticides, cyanides etc.), Biotransformation

**Text books:**

1. Environmental studies by Rajgopalan -Oxford University Press.
2. Waste Water Treatment & Disposal –Metcalf & Eddy –TMH publication.
3. Environmental Engg. -Peavy, Rowe-McGraw Hill Publication.
4. Waste Water Treatment -Rao &Dutta.
5. Brock Biology of Microorganism by Madigan.

**Reference books:**

1. Waste Water Engineering–B.C. Punmia & Ashok Jain –Arihant Publications.
2. Water Supply & Waste Water Engineering-B.S.N. Raju –TMH publication.
3. Sewage Disposal & Air Pollution Engineering –S. K. Garg–Khanna Publication.
4. Environmental Engineering –Davis -McGraw Hill Publication
5. Manual on sewerage and sewage treatment –Public Health Dept., Govt. of India.
6. Standard Methods by APHA.

I.S. Codes - I.S. 3025 (all parts)

**Suggested Reading (**e –Resources)

i) http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.
ii) http://cpcb.nic.in
iii) http://moef.nic.in
iii) http://moef.nic .in

# Mechanics of structures I (CVUA21183)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): - hr.<br>Practical (P): - hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Course Objectives:**

- To impart the knowledge about formulation of equilibrium equations and applying them to analyze beams, trusses with and without friction.
- To introduce the students with the concepts of stress, strain and Elastic Constants, stresses in beams.

**Course Outcomes: At the end of course, students will be able to:**

1. Classify force systems and perform resolution and composition of forces
2. Interpret coplanar force system with and without dry friction and apply principles of statics.
3. Analyze plane trusses and determine the centroid and moment of inertia of given laminae.
4. Apply equilibrium equations to calculate the internal forces namely shear forces and bending moments for determinate beams and draw SFD and BMD.
5. Understand and calculate simple stresses, strains elastic constants and relation between them.
6. Apply flexural formula and shear formula to determine bending stress and shear stress distribution in determinate beams.

**Unit I:Resolution and Composition of Forces**

Fundamental concepts and axioms, Laws of mechanics, system of forces, resolution and composition of forces.
Moment of a force, couple, application of Varignon's theorem of moments, equivalent force couple system, resultant of concurrent, parallel and general coplanar forces.

**Unit II – - Equilibrium of Forces**

Free body diagram, equilibrium of coplanar force system, equilibrium of three force member, types of simple beams, types of loads, supports and reactions.
Friction - Types of friction, Characteristics and laws of friction, wedge friction.

**Unit III: Analysis of Plane Trusses, Centroid and Moment of Inertia of Plane Laminae**

Equilibrium of two force members, analysis of plane trusses by method of joints and method of sections, First and second moment of area, centroid and moment of inertia of plane laminae, Parallel and perpendicular Axis Theorem, Polar Moment of Inertia – Radius of gyration.

**Unit IV: Shear Force Diagram and Bending Moment Diagram**

Calculation of Bending moment (BM) and shear force (SF) for statically determinate beams.BM and SF diagrams and salient features.

**Unit V: Simple Stresses and Strains**

Concept of stress and strain, elasticity and plasticity, Hooke's law, stress-strain diagram for mild steel, Types of stresses and strains, Elastic moduli and the relationship between them.
Bars of uniform and varying section, composite bars, Axial stresses and Temperature stresses.

**Unit VI: Shear and Bending Stresses in Beams**

Theory of simple bending, Assumptions, Determination of bending stresses and its distribution, Section modulus of rectangular and circular sections (Solid and Hollow), I, T sections.
Shear stress formula, Determination of shear stress and its distribution for beam sections of rectangular and circular sections (Solid and Hollow), I, T sections.

**Text books:**


1. Mechanics for Engineers - Fourth Edition, by F. P. Beer and E. R. Johnson, McGraw-Hill Publication.
2. Engineering mechanics - S. S. Bhavikatti, K. G. Rajashekharappa, New Age International (P) limited publisher
3. Applied Mechanics- R. K. Rajput, Laxmi Publications
4. Strength of Materials- S.S.Rattan- Tata Mc Graw Hill Education Pvt. Ltd. New Delhi
5. Strength of Materials- S.Ramamrutham- Dhanapat Rai Publishing Company
6. Strength of Materials- Dr. Sandhu Singh-Khanna Publishers
7. Mechanics of Structures Vol. I- S.B. Junnerkar and H.J. Shaha, Charotar Publishing House
8. Strength of Materials- Dr. R.K.Bansal-Laxmi Publications (P) Ltd.


**Reference books:**


1. Engineering Mechanics - statics and dynamics by J. L. Meriam and Craige, John Willey and Sons publication.
2. Engineering Mechanics by A. P. Boresi and R. J. Schmidt, Brooks/ Cole Publication.
3. Engineering Mechanics - Statics and dynamics by R. C. Hibbeler, McMillan Publication
4. Elements of Strength of Materials- S. Timoshenko and D.H.Young , East-West Press Ltd
5. Structural Analysis- R.C.Hibbler , Pearson.
6. Mechanics of Materials- E.P.Popov- Prentice Hall Publishers
7. Strength of Materials- F.L.Singer and Andrew Pytel-Harper and Row Publications

# Introduction to Fluid Mechanics (CVUA21184)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): NA<br>Practical (P): NA | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Course objectives:**

1. To impart knowledge of fluid properties and dimensional analysis.
2. To introduce students the concept of pressure and its use to solve fluid statics problems.
3. To inculcate an ability to apply the theories of fluid statics and fluid dynamics to solve problems related to fluid mechanics.
4. To introduce students the concept of laminar flow and principles of fluid mechanics to solve laminar flow problems.
5. To introduce students the concept of boundary layer theory and its use to calculate drag force.
6. To expose the students to the turbulent flow and flow through pipes.

**Course Outcomes: At the end of course, students will be able to:**

1. Determine fluid density, sp. Weight, viscosity, compressibility surface tension, capillary rise and establish relation between various fluid, flow, geometrical properties using Buckingham Pi Theorem
2. Determine fluid pressure at a point, total pressure, center of pressure, metacentric height using principles of fluid statics
3. Determine velocity, acceleration, discharge of fluid flow using principles of fluid kinematics.
4. Determine velocity, acceleration, discharge of fluid flow using energy equation and momentum equation.
5. Determine velocity, discharge, shear stress for laminar flow through fixed parallel plates, circular pipes and apply boundary layer theory to compute boundary layer thickness and drag on submerged objects.
6. Determine velocity, discharge, for turbulent flow through pipes, pipes in series , pipes in parallel.

**Unit I - Properties of Fluids & Dimensional Analysis**

Physical properties of fluids, Newton's law of viscosity, classification of fluids Dynamic andkinematic viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapor pressure.
Dimensions of physical quantities, dimensional analysis using Buckingham's π theorem method, geometric, kinematic and dynamic similarity, important dimensionless parameters

**Unit II - Fluid Statics**

The basic equation of hydrostatics, measurement of pressure, study of pressure measuring devices, Centre of pressure, total pressure on plane and curved surfaces.
Principle of floatation and buoyancy, equilibrium of floating bodies, stability of floating bodies, Metacenter and metacentric height and its determination (experimental &analytical).

| |
|---|
| **Unit III – Fluid Kinematics** |
| Velocity and acceleration of fluid, concept of stream line, stream tube, path line, and streak line, control volume, Classification of flow, Equation of continuity for three-dimensional flow in Cartesian co-ordinates, equation of continuity for one-dimensional flow along a streamline, types of motion, rotational and ir-rotational motion, velocity potential, stream function and flow net |
| **Unit IV - Fluid dynamics** |
| Euler's equation of motion along a streamline and its integration, Bernoulli's equation, kinetic energy Correction factor. Hydraulic grade line and total energy line. Linear momentum equation and momentum correction factor. Application of Bernoulli's equation: venturimeter, orifice, pitot tube. |
| **Unit V - Boundary layer theory and Laminar flow** |
| Development of boundary layer on a flat plate, boundary layer thickness, laminar sub layer, drag coefficients, hydro dynamically smooth and rough boundaries, Boundary Layer separation.<br>Laminar flow through a circular pipe, flow between two parallel plates-both stationary and one plate moving, Stokes' law, methods of measurement of viscosity, |
| **Unit VI - Turbulent flow and Flow through Pipes** |
| Definition of turbulent flow, Characteristics of turbulent flow, Prandtl's mixing length theory Flow through pipes: major losses and minor losses, Darcy Weisbach Equation, variation offriction factor for laminar flow and for turbulent flow, resistance to flow in smooth and rough pipes, Moody's diagram, pipes in series and parallel, branched pipes. |
| **Text Books:**<br>1. Hydraulics & Fluid Mechanics - Modi and Seth, Standard Book House<br>2. A text book of Fluid Mechanics – R. K. Rajput, S. Chand<br>3. A text book of Fluid Mechanics and Hydraulic Machines – S. Pati, Mc Graw Hill |
| **Reference books:**<br>1 Fluid Mechanics-Yunus Cengel, Jhon Cimbala- Tata Macgraw Hill, New Delhi<br>2 Fluid Mechanics by R. J. Garde, A.J Mirajgaonkar, SCITECH Publication<br>3. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill. |

## Societal and Global Impact of Civilization (ES21185CV)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): - NA<br>Practical (P): - NA | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Course Objective:**

- To provide a glimpse and an outline of impact of Civilization at societal and global levels
- To understand need of remedial measures to reduce the ill-effects of urbanization and industrialization for the betterment as well as the co-existence of Humans and other beings in the changing ecology.

**Course Outcomes:**

After completion of the course, student will be able to:

1. Explain historic events as well as the movement of human civilization along with development of agriculture, trade, commerce, art, sciences, technology, etc
2. Distinguish different phases structures, agricultural practices, changes in culture and societal aspects in India with introduction to the constitution of India
3. Compare Pros and cons of urban and industrial in the growth and development of diverse human cultures, needs, traditions, values, ethics, political revolution and explain impact of urbanization with environmental issues
4. Understand infrastructure development with its necessity at national/global level and global scenario of energy production, utilization
5. Describe renewable and non-renewable sources of energy, possibilities of energy storage, energy conservation, climate change.
6. Understand disasters with its aspects, agencies involved in disaster management, collecting, processing and analyzing spatial data for better decision-making in disaster risk management.

**Unit I: History of Civilization**

Meaning and History of Civilization, Characteristics and important stages/ regimes/ eras of Civilization. Spread by colonization, invasion, and religious conversion, the extension of bureaucratic control, agriculture, trade and commerce. and the technical, material and social dominance that civilization was engendered. Renaissance in Europe and enlightenment. Development of art, science, philosophy politics and psychology.

**Unit II**: **Culture and various aspects of Civilization**

Basic human needs and Maslow's hierarchy of needs. Meaning and characteristics of culture, Specific set of ideas, customs, and belief systems. Introduction to ethics, values and professionalism. Rise and fall of civilizations. Pros and Cons of Pre and post WW-II. Changes in culture and societal aspects in India. Introduction to the Constitution of India, Central and State lists. Traditional versus modern agriculture practices.

**Unit III: Societal impact of Civilization**

Pros and cons of urban and industrial revolution. Wars and turning points in the History of mankind. Changes in societal values, beliefs and customs. Introduction to Universal Human Values, increase in unrest and violence, Human rights, law and order issues. Environmental issues. An outline of employmentand education scenario in India, child labor. Impact of urbanization, constructions, infrastructure development in India. Human behaviour as individuals and in a group or a mob. Gender equality.

**Unit IV: Global impact of Civilization**

Introduction to infrastructure development – necessity, various sectors and activities, Role at the National and Global level. Private-Public Partnership and its types. Concept, features (components and characteristics), advantages and drawbacks of: Smart City, Bus Rapid Transportation System (BRTS), Intelligent Transportation System (ITS), Metro Rail, Mono Rail, Bullet Train, and Hyperloop. Water crisis, fuel (Energy) crisis. Global Scenario of Energy production and utilization, Introduction to clean (Green) technologies.

**Unit V: Introduction to Environment and Energy Science**

Meaning and need of sustainable development. Necessity of Green Constructions, Green materials. Introduction to Energy, Energy Science – Meaning, necessity of energy (Power) and necessity of study, Natural resources and their utilization. Introduction and comparison (Advantages & drawbacks) of non-renewable and renewable energy sources with emphasis on biomass energy and solar energy in Indian context. Introduction to economics of energy, linkages between economic and environmental outcomes. Nuclear Energy, Energy Audit.

**Unit VI: Introduction to Disasters and their Management**

Meaning and types of Disasters – functions & types (Natural and Man-made).
Reasons/ causes of: (i)Natural Disasters – Flood, drought, hurricane, earthquake, volcano eruption, tsunami, landslides, soil/ coastal erosion, forest fires; (ii)Man-made Disasters – Urban flooding, chemical leakages/ oil spills, nuclear radiation, terrorist attacks.
Local and global impact (effects) of disasters: Individual & social effects. Environmental/ ecological/ climate change, physical, and economic issues. Disaster Risk Reduction (DRR) and DRR Programs in India. Role and functions of National Disaster Management Authority. Disaster Management Cycle. Role and responsibilities of Governments, Local Authorities, Non-Government Organizations (NGOs). Ill-effects of extensive use of Cement, Steel and Concrete. Global warming.

**Text Books:**

(1) 'Ancient Civilization of the World'; Vishal Sood, APH Publishing.
(2) 'Energy Technology'; Dr. B. B. Parulekar, Khanna Publications
(3) 'Disaster Management'; Subramanian, Vikas Publishing
(4) 'Non-conventional Energy Sources'; G. D. Rai, Khanna Publications

**Reference Books:**

1. 'History of the Modern World 1500-2000 A.D.'; H. Jain, K. Mathur, Jain Prakashan Mandir,Jaipur World Politics since 1945'; Peter Calvocoressi
2. 'Energy and Civilization – A History'; Vaclav Smil, Gildan Media
3. 'Disaster Mitigation – Preparedness, Recovery and Response'; P. C. Sinha, SBS Publishers& Distributors
4. 'Non-conventional Energy Sources'; N. K. Bansal, Vikas Publishing

**Websites:** ---

1. IGNOU video lectures
2. E-pathshala video lectures

# Lab Practice – I (CVUA21186)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): hrs./week<br>Tutorial (T): - NA<br>Practical (P): 6 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 50 | - | - | - | 50 | - | 100 |

**Course Objectives:**

- To impart the knowledge of verification of basic principles of engineering mechanics and various tests to study mechanical properties of construction materials.
- To measure various fluid and flow properties and verify basic principles of Fluid Mechanics
- To analyze biological process & its application to treatment of wastewater

**Course Outcomes: At the end of course, students will be able to:**

1. Verify the principles of statics for coplanar concurrent and parallel force system
2. perform and interpret mechanical behavior of metals under impact, tension, torsion and compression, bending behavior of timber
3. Determine viscosity, surface tension, pressure, discharge, metacentric height, Reynold's number, friction factor of pipe and verify modified Bernoulli's equation.
4. Calibrate venturimeter, orificemeter and, draw flow-net for flow below the weir
5. Determine characteristic of waste water
6. Explain significance of characteristic of waste water in biological process

**Mechanics of Structures – I**

**The term work shall consist of a journal giving details of the following – Any 8 + Virtual lab**

1. Verification of law of parallelogram of forces/ polygon offorces
2. Support reaction of simple / compound beams.
3. Determination of coefficient friction of belt/ inclined plane.
4. Equilibrium of concurrent forces in a Space
5. Izod and Charpy impact test on mild steel, aluminum, brass and copper
6. Tension test on mild and TMT steel
7. Compression Test on Timber
8. Bending Test on Timber
9. Torsion test on mild steel and Aluminum
10. Any five experiments cited above by virtual laboratory

**Biology for engineers**

**List of Experiments (Any Eight)**

1. Study of microorganism - Microscopic observation of leaving bacteria, yeast fungi and algae,growth dynamics of singles cellular organism (growth curve by optical density method)
2. Determination of dissolved oxygen from wastewater.
3. Determination of biological oxygen demand from wastewater.
4. Determination of sludge volume index.
5. Determination of chemical oxygen demand.
6. Determination of solids such as total solids, dissolved, fixed, suspended.
7. Determination of phosphate from wastewater.
8. Study of sewer apprentices and pipe sizing.

9. Spread excel sheet for system component analysis of STP.
10. Determination of biosorption efficiency of different biomolecules

**Introduction to Fluid Mechanics**

**List of Experiments: Any 8-experiment mentioned below with experiments using virtual lab**

1. Measurement of viscosity by Redwood viscometer
2. Measurement of surface tension in a given liquid
3. Measurement of pressure using different pressure measuring devices
4. Determination of metacentric heights and study of stability of floating bodies.
5. Drawing flow net by electrical analogy for flow below weir (with & without sheet pile)
6. Experimental verification of Bernoulli's theorem with reference to loss of energy
7. Calibration of Venturimeter
8. Calibration of orificemeter
9. Study of laminar flow using Heleshaw's apparatus
10. Determination of friction factor for a given pipe
11. Virtual lab

# Material Testing and Evaluation (CVUA21187)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 2 hrs./week<br>Tutorial (T): - hr.<br>Practical (P): 2 hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | **-** | **-** | **50** | **-** | **-** | **50** | **100** |

**Course Objectives:**

1. Understand and gain fundamental knowledge of various construction materials including their properties.
2. Know the procedure to determine the properties of fresh and hardened concrete
3. Be acquainted with various concreting equipment.
4. Gain the knowhow of Destructive and Non-Destructive methods.
5. Be able to design concretes mixes using standards.

**Course Outcomes:** At the end of the course the students will be able to:

1. Identify the functional role of materials used in construction.
2. Explain tests on fresh concrete and equipment's used in concreting
3. Explain tests on Hardened concrete.
4. Determine the properties of Fresh and Hardened concrete using Destructive and Non-Destructive methods.
5. Design a concrete mix which fulfills the required properties for fresh and hardened concrete using Is code method.

**Unit I – Introduction to Construction Materials**

Cement – manufacture of Portland cement, basic chemistry of cement, hydration of cement, classification of cement, types of cement, tests on cement-field tests & laboratory tests Fly Ash: Classification of fly ash, properties of fly ash, tests on fly ash.
Aggregate and water – Different classifications, Fine aggregate, coarse aggregate, mechanical properties, physical properties, deleterious materials, soundness, alkali-aggregate reaction, sieve analysis: fineness tests on aggregates, artificial and recycled aggregate, mixing water, curing water, tests on water. Admixtures – functions, classification, types: mineral and chemical, IS: specifications (9103 and 456), compatibility of admixtures. Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete)
Bricks, Tiles (flooring and roofing), Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these materials

**Unit II – Properties, Production and Placement of Concrete**

Fresh concrete: Workability – factors affecting workability, cohesion and segregation, Bleeding, Laitance, mixing, handling, placing and compaction of concrete, Influence of temperature, maturity rule. Introduction to concrete related equipments – Batching plants, hauling, pumps, Types of concretemixers: Tilting, Non tilting and Reversible drum mixer, Types of vibrators Tests of fresh concrete – Workability by Slump cone, Compaction factor, Vee Bee consistometer and flow table test, Marsh cone test.

**Unit III – Properties and tests on hardened concrete**

Hardened concrete and Its Testing – Strength of concrete, factors affecting strength, micro-cracking and Stress - strain relationship, other strength properties, relation between tensile and compression strength, impact strength, abrasion resistance, elasticity and creep, shrinkage and swelling. Compression test on cube and cylinder, flexural test, indirect tensile strength, core test. Introduction to Non - destructive testing: Rebound hammer, Ultrasonic pulse velocity, Pull-out test and Impact echo test, Rebar locator.

**Unit IV– Concrete Mix Design**

Concepts of Mix Design, Factors for proportioning of concrete. Factors to be considered, Statistical quality control - Sampling and testing-Acceptance criteria, Laboratory trial mixes and guidelines to improve mix, methods of Mix Design for M25 and above grades by IS 10262-2019, 456

**Practicals:**

**List of Laboratory Experiments:**

The term work shall consist of a journal giving details of all the following experiments.

**Part A**

**I) Bricks &Tiles (Any two)**

1. Water absorption, efflorescence and Compressive strength test on bricks
2. Flexural strength of flooring and roofing tiles.
3. Abrasion test of flooring tiles

**II) Cement & fly ash**

4. Fineness and standard consistency of cement.
5. Initial and final setting time and soundness of cement.
6. Compressive strength of cement.

**III) Fine and Coarse Aggregates (Any Three)**

7. Moisture content, silt content, and Specific gravity of fine aggregate
8. Fineness modulus by sieve analysis of fine aggregate and gradation of fine aggregates
9. Moisture content, water absorption, and Specific gravity of coarse aggregate
10. Density of coarse aggregate and Fine Aggregate.

**IV) Fresh & Hardened Concrete**

11. Workability of concrete by slump test, compaction factor, Vee Bee test, effect of admixture and retarders on setting time concrete.
12. Compressive strength test of concrete by crushing and Rebound hammer.
13. Indirect tensile strength and flexural strength of hardened concrete
14. Concrete mix design by IS code method. Demonstration and application of concrete mix design software.

**Part B**

15. Site visit to RMC plant

**Text books and reference books:**


1. Concrete Technology by M. S. Shetty, S Chand, New Delhi-110055.
2. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.
3. Concrete Technology -- A R Santhakumar, Oxford University Press.

1. Properties of concrete by A. M. Neville, Longman Publishers.
2. Concrete Technology by R.S. Varshney, Oxford and IBH.
3. Concrete technology by A. M. Neville, J.J. Brooks, Pearson.
4. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
5. Concrete, by P. Kumar Metha, Gujrat Ambuja.


**Codes:**

**IS codes: 4031 all parts, IS 2386 all parts, IS 10262:2019, IS 383, IS 9103**

2) Ambuja cement booklets on concrete

3) ACC booklets on concrete

**e – Resources:**

1. www.nptel.iitd.ac.in/courses/iitdelhi

# Semester - II

## Architectural Planning and Computer Aided Civil Engineering Drawing (CVUA22181)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week<br>Tutorial (T): 1 hr.<br>Practical (P): - hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objectives:**

- To Understand the legal aspects in planning
- Understand the various byelaws related to planning of buildings
- Understand and Implement the basic fundamentals of computer aided design
- Understand and Implement the principles of planning of Doors, windows and vertical circulation
- State the principles of planning building services
- Sketch line plans of public buildings

**Course Outcomes:At the end of course, students will be able to:**

1. Understand substructure and superstructure components of a building
2. Understand the concepts of functional planning, building bye laws and planning concepts of green building
3. Design and Draw Plan, elevation and section of residential building, manually and on CAD.
4. Understand building services: Noise and Acoustics, Ventilation, Lighting, Plumbing, Telecommunication, Electrical, Smart services and Waste management
5. Understand the basic concepts of Town Planning and legal aspects related to construction.
6. Sketch line plans of public buildings

**Unit I – Introduction to Building construction and components**

**Introduction to building construction**– definition, types of building as per National Building Code. Building components and their basic requirements i.e substructure and superstructure requirements.

**Masonry:** Introduction of stone masonry and brick masonry, characteristics of good building bricks, IS specification and tests, classification of bricks, types of bonds: English, Flemish, Header, Stretcher, construction procedure, supervision. Plastering

**Doors, Windows and Vertical circulation:** Types and materials used.

**Flooring and roofing: T**ypes of roofing and flooring and their suitability, Types of flooring and roofing materials.

**Unit II – Functional Planning, Building bye laws and Introduction to Green Buildings**

**Functional Planning:** principles of planning, Architectural design relation between form and function.

**Building Bye laws:** National building code, Necessity of bye-laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), concept of V.P.R. Marginal distances, building line : control line, height regulations, room sizes, Area calculations (built-up area, carpet area etc.), Rules for ventilation, lighting, Vertical circulation, Sanitation and Parking of vehicles.

**Green Buildings:** Green buildings: salient features, benefits, planning concepts (site selection,

orientation, sun path and wind diagram etc.), Rating systems (LEED, GRIHA, TERI)

**Unit III- Architectural Drawing**

**Elements of planning building drawing**, Submission drawings, working drawings, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of residential buildings. (Class Assignment on Line plan for a residential building manually) Foundation plan. Structural plans Joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity. (Class assignment on drawing joints, joinery, fixtures- manually)

**Symbols and Sign Conventions:** Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols as per IS962, welding symbols; dimensioning standards. (Class assignment on drawing symbols -manually)

**Unit IV : Building services**

**Noise and Acoustics** – Sound insulation, Acoustical defects, Reverberation time, Sabine's formula, sound absorbents, planning for good acoustics.

**Ventilation –**Necessity of Ventilation, Natural ventilation: stack effect and wind effect, Thermal Insulation, Mechanical ventilation and its types, air conditioning systems.

**Lighting** – Principles of day lighting, design of windows, artificial illumination, SC, ERC, IRC, Daylight factor, Solar energy systems for lighting (BIPV).

**Plumbing** – Water storage tanks at ground level and on terrace (capacity), Plumbing systems, and various types of traps, Fixtures and Fittings, Rain Water Harvesting etc.

**Other services** – Telecommunication, Electrical, Smart services and Waste management.

**Unit V- Town Planning and legal aspects**

**Town Planning:** Necessity and evolution of town planning in India. Development plan and its importance, Objectives and Contents of DP, Land use zoning, Introduction to different zones of land in town planning, Requirements of various zones, Height zoning and Density zoning.

**Legal Aspects:** Role of Plan sanctioning authority, 7/12 abstract, meaning of different terms of 7/12 abstract, Form 6 and its types, Concept of TDR, List of documents to be submitted to local authority, Procedure for seeking Commencement and Occupancy Certificate, Various NOCs required.

**Unit VI: Planning of Public Buildings**

**Planning of Public buildings:** Functional requirements and planning of industrial buildings, commercial buildings, School, Colleges, Hostel, Auditorium, Restaurant/ Hotel building, Primary Health Center/ Hospital, Shopping complex, Sports complex, Vegetable market, Post office, Bank buildings.

**Line Plans:** Dimensioned line plans of above public buildings (A student will select any four types of buildings and draw line plan of the buildings)

**Text books:**


1. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. (5th edition.)
2. Building science and planning by Dr. S. V. Deodhar, Khanna Publishers.
3. Building Services Engineering by David V. Chadderton, sixth edition, London & New York.
4. Drawing for Civil Engineering by Jan A. Van Der Westhuizen


**Reference books:**


1. National Building Code (latest).
2. Building Design and construction by Frederick Merrit, Tata McGraw Hill.
3. Times Saver standards of Architectural Design Data by Callender, Tata McGaw Hill.
4. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
5. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.
6. Model building bye laws by MoUD, GoI.

**Tutorial**

1. Report on Extract of 7/12 .
2. Case study on Green building- Report
3. Commands of CAD
4. Plan, elevation and section of Residential/Commercial building with building services. - on sheet (full imperial)
5. Plates of Doors, windows, Masonry Bond - on sheet (Full imperial)
6. Plates of vertical circulation – on sheet (half imperial)
7. Planning of Residential/ Commercial building on CAD.

Bansilal Ramnath Agarwal Charitable Trust's

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

## Geotechnical Engineering (CVUA22182)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): - hr.<br>Practical (P): - hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Prerequisites:** Fundamentals of Engineering Mathematics and Engineering Mechanics.

**Course Objectives:**

- To impart knowledge about the soil properties, classification and its behavior under stress
- To impart knowledge about the methods for measurements and determination of index andengineering properties of soil
- To impart knowledge about the study the interaction between water and its effect on engineering behavior of soil

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

1. **classify** the different **types of soil/rock** and **define** their **index properties.**
2. **Explain permeability and seepage** through soil and **determine permeability** of different types of soils.
3. **determine compaction** properties and **stress**, and methods to **determine stress distribution** in the soils.
4. **calculate shear strength parameters** of soil and **explain** methods to determine shear strength of soils.
5. **compute** the lateral **thrust due to backfill** on the retaining walls.
6. **describe** soil slopes and their **failure modes** and **explain** methods to **determine strength of rocks.**

**Unit I – Introduction to soil and rock mechanics**

Need for soil and rock mechanics studies, Soil as an engineering material - Scope of Geotechnical engineering. Major soil deposits of India, Index properties of soil and rock, Three phase soil system, Soil minerals, Soil structures, Weight volume relationship, Index properties of soil and rock. Methods of determination of index properties rock and soil and its significance, Classification of soil and rocks.

**Unit II – Permeability and Seepage**

Soil water, permeability definition and necessity of its study, Darcy's law, factors affecting permeability. Laboratory measurement of permeability – Constant head method and Falling head method as per IS 2720. Field test for determination of permeability test as per IS. Permeability of stratified soil deposits.

Seepage and Seepage Pressure, quick sand phenomenon, critical hydraulic gradient, General flow equation for 2-D flow (Laplace equation), Flow Net, properties and application, Flow Net construction for flow under sheet pile and earthen dam.

**Unit III - Compaction and Stress Distribution**

Introduction, Standard Proctor test, Modified Proctor test, Zero air void line. Factors affecting compaction. Effect of compaction on soil properties. Field compaction methods and compaction equipment's for different types of soil, Field compaction control

Geostatic stress, Boussinesq's theory with assumptions for point load (with numerical), equations for circular load, line load and strip load, Pressure Distribution diagram on a horizontal and vertical plane, Pressure bulb and its significance. Westergaard's theory, equivalent point load method, Approximate stress distribution method.

**Unit IV– Shear Strength of soil**

Mohr's stress circle, Mohr-Coulomb failure theory. The effective stress principle- Total stress, effective stress and neutral stress / pore water pressure. Peak and Residual shear strength, factors affecting shear strength. Stress-strain behavior of sands and clays. Direct Shear test, Tri-axial compression test, Unconfined Compression test, Vane Shear test.(Different drainage conditions for shear tests). Sensitivity and thixotropy of cohesive soils.

**Unit V– Earth Pressure theory**

Earth Pressure – Introduction, Rankine's state of Plastic Equilibrium in soils- Active and Passive states due to wall movement, Earth Pressure at rest. Rankine's Theory : Earth pressure on Retaining wall due to submerged backfill. Backfill with uniform surcharge, backfill with sloping surface, layered backfill. Coulomb's Wedge theory. Rebhann's and Culmann's graphical method of determination of earth pressure.

**Unit VI - Stability of slopes and strength of rocks**

Classification and failure of slopes, Finite slope stability by Swedish circle method with slip circle and method of slices, Soil stabilization, its necessity and methods. Landslides- Causes and remedial measures. Rock quality designation, Laboratory methods to determine strength of rocks, Influence ofgeological conditions on construction of Dams andTunnel.

**Text Books:**

1. Soil Mechanics and Foundation Engineering by Dr. B. C. Punmia, Laxmi Publications
2. Geotechnical Engineering by Shashi K. Gulati &Manoj Datta, Tata McGrawHill
3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers
4. Soil Mechanics-Principles and Practice-Graham Barnes-PalgraveMacMillan
5. A Text Book of Geology, P. K. Mukherjee, Worldpress.

**Reference Books:**

**1.** Soil mechanics and engineering practice – By Terzaghi, Peck andMesri
**2.** Soil mechanics- By LambeandWhitman
**3.** Physical and Geotechnical Properties of Soils by Joseph.E.Bowles, International StudentsEdition
**4.** Geotechnical Engineering—C.Venkatramaiah—New Age InternationalPublishers
**5.** Principles of Geotechnical Engineering—BrajM.Das—CengageLearning

## Mechanics of Structures II (CVUA22183)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): - hr.<br>Practical (P): - hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Course Objectives:**

- To determine deflection of beams and analyse the solid and hollow circular shafts
- To prepare the students to analyse Columns, Chimneys, Dams and RetainingWalls
- To prepare students to analyse indeterminate beams, frames and trusses using Three Moments Theorem, Strain energy method, slope deflection method, flexibility method and stiffness method

**Course Outcomes: At the end of course, students will be able to:**

1. Determine slope and deflection of determinate beams and Apply torsion formula to hollow and solid circular shaft
2. Determine direct and bending stresses for short columns, chimneys and dams
3. Identify principal planes and compute principal stresses due to combination of axial forces, bending moments and shear.
4. Analyze indeterminate beams and frames using Three Moment Theorem and Castigliano's II Theorem.
5. Analyze indeterminate beams and frames using Slope-Deflection Method and Moment Distribution Method
6. Analyze indeterminate beams, frames and trusses using Stiffness method.

**Unit I: Deflection of Beams and Torsion of Circular Shaft**

Deflection of beams: Relationship between moment, slope and deflection, Macaulay's method, Castigliano's first theorem, unit load method. Concept of moment area method and conjugate beam method.

Torsion of circular shafts: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, transmission of power through circular shafts.

**Unit II: Direct and Bending Stresses**

Axially loaded compression members, crushing load, crippling or critical load Euler's theory of long columns and Rankine's formula.

Combined direct and bending stresses, eccentric load on short columns, kern of a section, eccentricity of load about both axes of section. Chimney subjected to wind pressure, simple problems on dams and retaining walls.

**Unit III: Principal Stresses and Strains**

Normal and tangential stresses, stress at a point on a plane Principal stress, Principal planes, normal and shear stresses on oblique plane, Ellipse of stress, Mohr's circle of stress. Determination of principal plane and principal stresses, analytical and graphical methods

**Unit IV: Statically indeterminate Beams and Frames**

Determinateness of structures, stability and indeterminacy, External and Internal Redundancy. Clapeyron's Theorem of Three Moments, Application of theorem for -General Loading, Fixed Beams, Sinking of supports. (involving not more than 2 unknowns)

Castigliano's Second Theorem, Application of theorem for General Loading, Fixed Beams, Sinking of

| |
|---|
| supports and frames. (Involving not more than 2 unknowns) |
| **Unit V: Slope-Deflection Method and Moment Distribution Method** |
| Slope Deflection Method, sign conventions, development of slope deflection equations, modification for simple ends, Application to beams and sway and non-sway Frames. (involving not more than 2 unknowns)<br>Moment Distribution Method, carry over moment, distribution factors, fixed end moments,modification of stiffness for simple ends, Application to beams and sway and non-sway frames. (involving not more than 2unknowns) |
| **Unit VI: Stiffness Method** |
| Fundamental concepts, formulation of stiffness matrix, application to beams using member approach. (Involving not more than 2 unknowns), application to sway and non-sway frames. (involving not more than 2 unknowns) |
| **Text books:**<br>1. Mechanics of Structures Vol. II- S.B. Junnerkar and H.J. Shaha, Charotar Publishing House<br>2. Theory of Structures-B. C. Punmia, Ashok kumar Jain and Arun Kumar Jain, Laxmi Publications (P) Ltd.<br>3. Structural Analysis- Madan Mohan Das, Bhargab Mohan Das and Mimi Das Saikia, PHI LearningPrivate Ltd.<br>4. Structural Analysis- S. S. Bhavikatti, Vikas Publishing House Pvt.Ltd. |
| **Reference books:**<br>1. Intermediate Structural Analysis- C. K. Wang, Tata Mc Graw Hill Education Pvt. Ltd. NewDelhi<br>2. Structural Analysis- R. C. Hibbler, Pearson.<br>3. Matrix Methods of Structural Analysis- Dr. A. S. Meghre and S. K. Deshmukh, Charotar Publishing House |

## Surveying (CVUA22184)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): - hr.<br>Practical (P): - hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Course Objectives:**

- To impart knowledge about principles of surveying, linear/angular measurement methods, bearing and leveling.
- To impart knowledge about different methods of survey such as traversing, triangulation, tachometry, and trigonometric leveling.
- To impart knowledge about elements of different types of curves and surveying applications in setting out of curves, buildings, culverts, bridges and tunnels
- To impart knowledge about modern advanced surveying techniques involved such as Remote sensing, Total station, GPS, Photogrammetry etc.
- To impart knowledge about components of GIS, data types and operations

**Course Outcomes: At the end of course, students will be able to:**

1. Plot traverse using compass and plane table in horizontal plane/Determine angle and distance by using compass and plane table.
2. Draw contour map and identify characteristics given land.
3. Measure horizontal and vertical angle using Theodolite.
4. Design and set out horizontal curve on ground.
5. Determine RL of point using Tacheometry.
6. Study use of total station / Understanding of fundamental function & use of Total station.

**Unit I –Compass and Plane Table Surveying**

Concept of bearing, meridian and their types, construction and use of prismatic compass, local attraction and correction for local attraction, dip, declination and calculation of true bearings.
Equipment required for plane table surveying and their uses, advantages and disadvantages, methods of plane table survey: Radiation and intersection method.

**Unit II–Levelling and Contouring**

Introduction to levelling, Types of levelling, Construction and use ofauto level, laser level in construction industry, reciprocal levelling, curvature and refraction corrections, distance to the visible horizon, trigonometric leveling (Plane Survey)
Contouring: direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, profile levelling and cross-sectioning and their applications.

**Unit III–Theodolite Surveying**

Study of vernier transit 20" theodolite, uses of theodolite for measurement of horizontal angles by repetition and reiteration, vertical angles and magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite.
Theodolite traversing: computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gales traverse table, omitted measurements, area calculation by independent co-ordinates, open traverse and its uses, measurement of deflection angles using transit theodolite, open traversesurvey, checks in open traverse.

**Unit IV–Curves**

Introduction to horizontal and vertical curves (no numerical and derivations to be asked on vertical curves andreverse curves), different types and their applications, simple circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord.

Angular methods: Rankine's method of deflection angles (one and two theodolite methods). (Numerical on simple circular curves to be asked), Transition curves: necessity and types.

**Unit V–Tachometry and Setting Out Works**

Tachometry: application and limitations, principle of stadia tachometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points.

Setting Out Works - buildings, maintaining verticality of tall buildings, drainage lines, canals, bridge (determination of the length of the central line and the location of piers) and tunnel (surface settingout and transferring the alignment underground)

**Unit VI–Electronic Measurement Techniques and Hydrographic Survey**

Surveying using total station – Construction, types, principle features, field equipment, method of use, introduction to various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stake out. Levelling using digital level

hydrographic survey - Objects, applications, Establishing controls, Shore line survey, Sounding, Sounding Equipment, Methods of locating soundings – conventional and using GPS, Nautical Sextant and its use, Three point problem and its use, solution of three point problem analytical method, determination of MSL.

**Text books:**

1. Surveying and Levelling by Vol. I and Vol. II – T. P. Kanetkar and S. V. Kulkarni
2 Surveying and Levelling by Subramanian, Oxford University Press.
3 Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain
4. Surveying for Engineers-John Uren & Bill Price—Palgrave Macmillan

**Reference books:**

1. Plane Surveying----A .M. Chandra New Age International Publishers
2. Surveying and Levelling N. N. Basak, Tata Mc-Graw Hill
3. Surveying Vol. I&II--Dr. K. R. Arora
4. Surveying: Theory and Practice James M. Anderson, Edward M. Mikhail
5. Surveying theory and practices -- Devis R. E., Foot F.S.
6. Plane and Geodetic surveying for Engineers. Vol. I – David Clark
7. Principles of Surveying. Vol. I by J. G. Olliver, J. Clendinning
8. Surveying, Vol. I & II by S. K. Duggal, Tata Mc-Graw Hill

Bansilal Ramnath Agarwal Charitable Trust's

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

## Hydraulic Engineering (CVUA22185)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 3 hrs./week<br>Tutorial (T): - hr.<br>Practical (P): - hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | 20 | 30 | 20 | 30 | - | - | 100 |

**Course Objectives:**

- To apply principles learnt in Fluid Mechanics I to various applications like flow around submerged bodies, unsteady flow, open channel flow, hydraulic machines.

**Course Outcomes: At the end of course, students will be able to:**

1. Determine drag, lift forces on submerged bodies and solve unsteady flow problems of time of emptying a tank, water hammer.
2. Apply Manning's and Chezy's equation for uniform flow computations and design hydraulically most efficient channel section for uniform flow.
3. Determine depth energy relationship using sp. Energy, sp. Force, critical flow concepts and compute the sequent depth ratio, energy loss in a hydraulic jump occurring in horizontal rectangularchannel .
4. Classify the water surface profiles and solve dynamic equation of GVF using direct step method.
5. Determine impact of jet on flat plates, curved vanes and understand working of centrifugal pump.
6. Understand working of pelton wheel, Francis turbine and design the pelton wheel turbine.

**Unit I - Fluid Flow around Submerged Objects & Unsteady Flow**

Fluid Flow around Submerged Objects: drag, lift, Types of drag, Drag on sphere, cylinder, flat plate and aerofoil, Development of lift on cylinder (Magnus effect) and Aerofoil, Induced drag on aerofoil, Polar diagram.
Unsteady Flow: Flow through orifice under varying head, Water hammer phenomenon.

**Unit II–Uniform flow in Open Channels**

Classification of channels and Channel flows, Basic governing equations of Channel flow One dimensional approach, Geometric elements of channel, Velocity distribution in open channel flow, uniform flow
formulae viz., Chezy's formula, Manning's formula, Factors affecting Manning's roughness coefficient, Uniform flow computations, Most efficient channel section.

**Unit III- Critical flow in Open Channels**

Specific energy, Specific force, Critical depth, Conditions for occurrence of critical flow; Froude's number, critical flow, Critical flow computations, channel transitions, Phenomenon of hydraulic
jump, Application of momentum equation to hydraulic jump in rectangular channel Energy dissipation in hydraulic jump, Practical uses of hydraulic jump.

**Unit IV– Gradually Varied flow**

Basic Assumptions of GVF; Differential equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, their general characteristics and examples of their
occurrence; Control section. Gradually varied flow computations: Direct Step method, Graphical Integration method, Standard Step method, VenTe Chow method

**Unit V: Impact of jet and Centrifugal pump**

Impact of Jet: Force and work done due to impact of jet on stationary and moving, flat and curved surfaces using linear momentum principle.
Centrifugal Pumps: General Classification, theory, working, Work done by impeller, Heads and efficiencies, minimum starting speed, Cavitation in centrifugal pumps, multistage pumping.

**Unit VI: Hydraulic turbines**

Elements of hydropower plant; hydraulic turbines- Classification, heads and efficiencies, Design and governing of Pelton Wheel, Francis turbine-parts and working, Cavitation in hydraulic turbines, Performance of hydraulic turbines, Prediction of performance in terms of unit quantities and specific quantities, Specific speed, Characteristic curves, selection of turbines

**Text books**

1 Hydraulics and Fluid Mechanics by P. N. Modi and S. N. Seth Standard book house
2 Open Channel Flow by K Subranmanya, TMH, ThirdEd
Open Channel Flow: K. G. RangaRaju - Tata Mc GrawHill.

**Reference Books**

1. Engineering Fluid Mechanics by R. J. Garde and A. G. Mirajgaonkar, Scitech Publications,2003
2. Fluid Mechanics and Machinary by C.S.P.Ojha, R. Berndtsson, P. N. Chandramouli, OxfordUniversity Press,2010
Flow through Open Channels by Rajesh Srivastava, Oxford University Press,2015

# Lab Practice II (CVUA22186)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): - hrs./week<br>Tutorial (T): - hr.<br>Practical (P): 6 hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | 50 | - | - | - | 50 | - | 100 |

**Course Objectives:**

- Develop skills in use of surveying instruments including compass, auto/digital levels, Vernier/optical/electronic theodolites, and Total Station.
- To determine flow parameters like Reynold's number, drag, lift, velocity, discharge, coefficient of impact, efficiency of hydraulic machines.
- To impart the knowledge of various tests to determine soil properties.

**Course Outcomes: At the end of course, students will be able to:**

1. Plot traverse, profile of ground and contour map
1. Perform Traversing using a 20" vernier Theodolite
2. Determine the drag, lift around submerged bodies, impact of jet on flat plate and curved vane, efficiency of pump and turbine, loss of energy in hydraulic jump, Manning's roughness coefficient, velocity distribution in open channel flow and analyze gradually varied flow using spread sheet.
3. Analyze flow over hump and calibrate standing wave flume, broad crested weir
4. Perform the test to study soil properties and Interprets the results based on it
5. Review field geotechnical investigation report and suggest suitable type of foundation based on it

**Surveying & Geomatics**

Total four Practicals to be performed of the following. First three are compulsory. Any one of 4thand 5th.

1. Study and use of Prismatic compass and observing bearings of lines of traverse
2. Study and use of 20" Vernier Theodolite and measurement of :
   a. Horizontal angle by repetition method and
   b. Vertical angle
3. Differential levelling by using Digital level and introduction to Auto level.
4. Study and use of Tachometer for:
   a. Working out constants of instrument
   b. finding horizontal and vertical distance
5. Study and use of Plane Table surveying and its methods
   a. Radiation
   b. Intersection

Projects: All compulsory

1. Profile levelling : Drawing L-section and C-section for a road of minimum 200m length
2. Radial contouring: Plotting of contours from two stations minimum 60m apart.
3. Theodolite traversing : Plotting traverse and finding out area traverse using 20" Vernier transit Theodolite

**Hydraulic Engineering**

**List of Experiments: Any 8**

1. Flow around a Circular Cylinder
2. Flow around an airfoil
3. Study of Uniform Flow Formulae of Open channel.
4. Velocity Distribution in Open Channel Flow.
5. Calibration of Standing Wave Flume / Venturiflume
6. Study of Hydraulic Jump as Energy Dissipater
7. Study of flow over hump
8. Graphical determination of loss of energy in hydraulic jump
9. Solving GVF problem using Excel
10. Impact ofjet
11. Determining characteristics of centrifugal pump
12. Determining characteristics of Pelton wheel turbine

**Geotechnical Engineering**

List of Experiments: Any 8 + Sr. No 13 and 14 are compulsory.

1. Determination of water content and specific gravity of soil
2. Sieve analysis, particle size determination and IS classification as per I. S. Codes.
3. Determination of Consistency limits and their use in soil classification. as per I. S. Codes.
4. Field density test by a) Core cutter b) Sand Replacement
5. Determination of coefficient of permeability by a) constant head and b) variable head method.
6. Direct shear test.
7. Unconfined compression test.
8. Vane Shear test.
9. Standard Proctor test / Modified Proctor test.
10. Differential free swell test.
11. Demonstration of Tri-axial test
12. Swelling Pressure test
13. Any one of the following assignments-
    a) Review of any field geotechnical investigation report.
    b) Construction of pressure bulb by using any geotechnical engineering software.
14. Assignments on the following topics
    a) Rebhann's and Cullman's graphical method for determination of earth pressure.
    b) Solution of problems on shear strength parameters using graph.

**Text books:**

1. Hydraulics & Fluid Mechanics by Modi and Seth, Standard BookHouse
2. Theory and Applications of Fluid Mechanics—K. Subramanya- TataMcGraw
3. Surveying and Levelling by Vol. I and Vol. II – T. P. Kanetkar and S. V.Kulkarni
4. Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, ArunK.Jain
5. Soil Mechanics and Foundation Engineering by Dr. B. C. Punmia, LaxmiPublications
6. Geotechnical Engineering by Shashi K. Gulati &ManojDatta, Tata McGrawHill

**Reference books:**

1. Fluid Mechanics-YunusCengel, JhonCimbala- Tata Macgraw Hill, NewDelhi
2. Fluid Mechanics by .R. J. Garde, A.J Mirajgaonkar, SCITECHPublication
3. Plane Surveying----A.M.Chandra------New Age InternationalPublishers
4. Surveyingand Levelling ----- N. N. Basak, Tata Mc-GrawHill
5. Geotechnical Engineering—C. Venkatramaiah—New Age International Publishers
6. Principles of Geotechnical Engineering—Braj M. Das—CengageLearning

# Construction Engineering and Management (CVUA22187)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 2 hrs./week<br>Tutorial (T): NA<br>Practical (P): 2 hrs./week | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | - | - | 50 | - | - | 50 | 100 |

**Course Objectives:**

- To impart knowledge about the importance of project management in construction industry.
- To impart knowledge about analyze and solve problems on network analysis, resource allocation and updating.
- To impart knowledge about the concept of materials management and classification of material.
- To impart knowledge about the basic concepts of construction project monitoring and control

**Course Outcomes: At the end of course, students will be able to:**

1. Implement the concepts of Project Management from planning to execution of construction projects
2. Apply Critical Path Method and Programme Evaluation Review Technique to construction projects
3. Summarize the Processes related to material management and apply ABC analysis and economic order quantity for inventory control
4. Explain the concepts of project monitoring, control processes and safety on project.

**Unit I – Introduction to Project Management**

Importance, objectives & functions of management, Categories of project , Project--- life cycle Concept and Cost Components, Project management Institute and Certified Project Management Professionals (PMP), Importance of organizational Structure in Management- Authority / Responsibility Relation.

**Unit II – Project Planning & Scheduling.**

WBS – Work Breakdown, Gantt/Bar chart, Network Analysis, C. P. M .- . Activity on Arrow (A.O.A.), Critical path and type of floats, Precedence network analysis ( A.O.N. ), Network Crashing – Time- Cost –Resource optimization, P. E. R.T.

**Unit III – Resource Allocation and Materials Management**

Resource Allocation – Resource Smoothening and levelling, Histograms and S-Curves., Project Monitoring- Updating, Earned Value.
Objectives of Materials management – Primary and secondary Material Procurement Procedures- material requirement- raising of indents, receipts, Inspection, storage, delivery, record keeping– Use of Excel sheets, ERP software, Inventory control- ABC analysis, EOQ and its variation.

**Unit IV– Project Monitoring & Control**

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites:accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

**Text books:**

1. Projects – Planning, Analysis, Selection, Implementation and Review, Prasanna Chandra, TataMcGraw Hill Publications.
2. Total Project Management – The Indian Context – P. K. Joy, Macmillan Publications
3. Materials Management– Gopalkrishnan & Sunderasan, Prentice Hall Publications.
4. Financial management by Shrivastava- Oxford University Press
   Construction Equipments & its Management: S.C Sharma, Khanna Publication

**Reference books:**

1. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, TataMcGraw Hill Publishing Company, New Delhi.
2. Construction Management and Planning by B. Sengupta and H Guha, Tata McGraw HillPublishing Company, New Delhi.
3. Construction Planning Methods &Equipment: Puerifoy –Tata MC Graw Hill
4. Construction Management practice and contract management practice- Dr. V.K. Raina, 2ndEdition, SPD publications, New Delhi.

**Practical - Any 10 Assignments**

1. Site Visit to understand organization structure, Gantt chart, progress reports etc.
2. Assignment on Life cycle of a project based on a case study
3. To draw C.P.M network for a small Civil engineering Project having about 15activities. Determination of Critical path and calculation of floats for the project.
4. Assignment using free software for Project Planning and Scheduling
5. Assignment on PERT Networking
6. Assignment on Resource allocation
7. Assignment on Crashing
8. Assignment on updating
9. Assignment on ABC Analysis
10. Assignment on EOQ and variation
11. Seminar on any one topic from syllabus
12. Poster presentation on safety in construction
13. Preparation of checklist for a construction activity.

# Instrumentation and Sensor Technologies for Civil Engineering (CVUA22188)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 2<br>Lecture (L): 2 hrs./week<br>Tutorial (T): - NA<br>Practical (P): - NA | **CIE** | **ISE** | **SCE** | **ESE** | **PR/OR** | **TW** | **Total** |
| | 50 | - | 50 | - | - | - | 100 |

**Course Objectives:**

- To introduce fundamentals of Instrumentation systems, sensors and provides essential knowledge about different Measurement techniques.
- To introduce current state of art for data analysis and statistical tools for interpretation of the sensed data.

**Course Outcomes: At the end of course, students will be able to:**

1. Analyze the errors during measurements and specify the requirements in the calibration of sensors and instruments
2. Describe the noise added during measurements and transmission and measurement of electrical variables
3. Describe the requirements during the transmission of measured signals and construct Instrumentation/Computer Networks
4. Design and set up measurement systems and do the studies and suggest proper sensor technologies for specific applications

**Unit I: Fundamentals of Measurement, Sensing and Instrumentation**

Definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.

**Unit II**: **Sensor Installation and Operation**

Predict the response of sensors to various inputs, Construct a conceptual instrumentation and monitoring program. Describe the order and methodology for sensor installation. Differentiate between types of sensors and their modes of operation and measurement and Approach to Planning Monitoring Programs,
Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty

| **Unit III: Data Analysis and Interpretation** |
|---|
| a) Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range) |
| **Unit IV: Frequency Domain Signal Processing and Analysis** |
| Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reductionwith filters, Leakage, Frequency resolution |
| **Text Books:**<br>1. W. Bolton; "Mechatronics, Electronic Control Systems in Mechanical and Electrical Engineering"; Pearson Education; 4thEdition<br>2. Curtis Johnson; "Process Control Instrumentation Technology"; Prentice Hall of India Pvt.Ltd.; 8th Edition<br>3. David G. Alciatore, Michael B Histand; "Introduction to Mechatronics and Measurement System";Tata Mc Graw Hill 3rdEdition<br>4. Madhuchhanda Mitra, Samarjit Sen Gupta; "Programmable Logic Controllers<br>5. and Industrial Automation, An Introduction"; Penram International<br>6. Publishing India (Pvt)Ltd<br>7. Liptak; "Handbook of Process control"<br>8. H. S. Kalsi; "Electronic Instrumentation" Tata Mc GrawHill |
| **Reference Books:**<br>1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann<br>2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press<br>3. S. Tumanski (2006), Principle of Electrical Measurement, Taylor &Francis<br>4. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer |