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 multidisciplinary 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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Department of Civil Engineering

Second Year B. Tech. Civil Engineering (SYBT) - Semester III (Pattern 2018)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE T1	ISE T2	CE	ESE	PR/ OR		
ES21181CV	Engineering Mathematics III	TH	3	1	-	20	10	20	50	-	100	4
ES21182CV	Biology for Engineers *	TH	3	-	-	20	10	20	50	--	100	3
CVUA21183	Mechanics of structures - I *	TH	3	-	-	20	10	20	50	-	100	3
CVUA21184	Introduction to Fluid Mechanics *	TH	3	-	-	20	10	20	50	-	100	3
ES21185CV	Societal and Global Impact of Civilization	TH	3	-	-	20	10	20	50	-	100	3
CVUA21186	Lab Practice - I *	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
CVUA21187	Material, Testing and Evaluation	CE	2	-	2	-	-	100	-	-	100	3
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total		**17**	**1**	**8**	**100**	**50**	**250**	**250**	**50**	**700**	22
	Total	-										

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

*Courses have lab practice component of 2 hrs./week each under Lab Practice head.

List of Mandatory Courses: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge.

BOS Chairman | Dean Academics | Director

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Second Year B. Tech. Civil Engineering (SYBT) - Semester IV (Pattern 2018)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
						ISE		CE	ESE	PR/ OR		
			L	T	P	T1	T2					
CVUA22181	Architectural Planning and Computer Aided Civil Engineering Drawing	TH	3	1	-	20	10	20	50	-	100	4
CVUA22182	Geotechnical Engineering*	TH	3	-	-	20	10	20	50	-	100	3
CVUA22183	Mechanics of Structures - II	TH	3	-	-	20	10	20	50	-	100	3
CVUA22184	Surveying*	TH	3	-	-	20	10	20	50	-	100	3
CVUA22185	Hydraulic Engineering*	TH	3	-	-	20	10	20	50	-	100	3
CVUA22186	Lab Practice – II *	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
CVUA22187	Construction Engineering and Management	CE	2	-	2	-	-	100	-	-	100	3
CVUA22188	Instrumentation and Sensor Technologies for Civil engineering applications	CE	2	-	-	-	-	100	-	-	100	2
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total		19	1	8	100	50	350	250	50	800	24

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1hr. = 1 Credit, AU: No Credits
*Courses have lab practice component of 2 hrs./week each under Lab Practice head.

List of Mandatory Courses: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge.

BOS Chairman | Dean Academics | Director

Semester – I

Engineering Mathematics III (ES21181CV)

Teaching Scheme
Credits: 4
Lectures: 3 hrs./ week
Tutorial : 1 hr./ week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Course Objectives:

- To develop the ability, to know the concepts of Engineering Mathematics and to apply these to solve engineering problems in various fields. The Tutorial sessions and assignments will help the students to practice more problems on all the topics mentioned in the course contents.

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

1. Solve the Linear Differential equations, modelling of mass spring systems, free and forced damped and undamped systems.
2. Analyze data applying Numerical techniques
3. Analyze data applying Statistical techniques
4. Solve examples related to different Probability Distributions..
5. Apply study of Complex variables to various problems
6. Solve boundary value problems (Wave, Heat, & Laplace equations).

Unit- I : Linear Differential Equations

Linear Differential Equations (LDE) Solution of nth order LDE with Constant Coefficients, Method of Variation of Parameters, Cauchy's & Legendre's DE, Solution of Simultaneous & Symmetric Simultaneous DE, Modeling of problems on bending of beams, whirling of shaft and mass spring system.

Unit –II : Numerical Methods

Roots of Algebraic and Transcendental equations by Bisection method, Newton -Raphson method, Regula- Falsi Method. Solutions of Differential equations by Euler method, Euler modified method, Runge kutta 4thorder method. Numerical Integration, The Trapezoidal rule, Simpson's one-third Rule, Simpson's three-eight Rule.

Unit III : Statistics

Measures of Central Tendency, Standard Deviation, Coefficient of Variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression Estimates

Unit - IV : Probability

Theorems and Properties of Probability, Probability Distributions: Binomial, Poisson, Normal and Hypergeometric; Test of Hypothesis: Chi-Square test, t-Test.

Unit - V : Complex Variables

Complex Variables Functions of Complex Variables, Analytic Functions-R Equations, Conformal Mapping, Bilinear Transformation, Cauchy's Theorem, Cauchy's Integral formula, Laurent's Series, Residue Theorem.

Unit - VI : Applications of Partial Differential Equations

Basic concepts, modeling of vibrating string ,wave equations, one and two dimensional heat flow equations, method of separation of variables, use of Fourier series. Applications of PDE to problems of civil Engineering

Text books : 1. A Text book of Applied Mathematics by P.N. Wartikar, U. N. Wartikar (Pune Vidyarthi Griha Prakashan ,Pune) (Volume II & III) 2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)
Reference Books : 1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.). 2. Advanced Engineering Mathematics by Wylie C.R &Barrett L.C.(McGraw-Hill, 3. Advanced Engineering Mathematics by Peter V. O'Neil
ENGINEERING MATHEMATICS-III (Tutorial) 1 Practice Problems on C.F & P.I, Method of Variation of Parameters, Cauchy's & Legendre's DE 2 Practice Problems on Bending of beam etc 3 Practice Problems on Fourier Transform (FT) 4 Practice Problems on Fourier Transform (FT) 5 Practice Problems on Statistics 6 Practice Problems on Probability 7 Practice Problems on Numerical methods 8. Practice Problems on Numerical methods 9 Practice Problems on Complex Variables 10 Practice Problems on Complex Variables

Biology for Engineers (ES21182CV)

Teaching Scheme
Credits: 3
Lectures: 3hrs / week;

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

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
At the end of course students will be able to

1. Study Fundamental of biology. Understand applied aspects of biology and biomolecules.
2. Apply Fundamental of microbiology
3. Demonstrate Characteristics of waste water and biological process.
4. Design Preliminary and primary treatment process.
5. Analyze Aerobic biological process.
6. Analyze anaerobic biological process.

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 -Phelps 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 Engg. –B.C. Punmia& Ashok Jain -Arihant Publications. 2. Water Supply & Waste Water Engg.-B.S.N. Raju –TMH publication. 3. Sewage Disposal & Air Pollution Engg. –S. K. Garg–Khanna Publication. 4. Environmental Engg. –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
Credits : 3
Lectures : 3 Hrs./week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Course Objectives:

- To demonstrate formulation of equilibrium equations and applying them to perform analysis of beams, trusses and frames, including friction and its few applications
- To compute axial stresses, bending and shearing stresses in beams

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

1. Classify various force systems, employ composition and resolution of forces
2. Interpret and solve equilibrium equations to coplanar force system and Examine dry friction and its applications
3. Analyze plane trusses and frames and determination of centroid and moment of inertia
4. Apply equilibrium equations to calculate the internal forces like shear force and bending moments for various beam configurations
5. Demonstrate knowledge of various types of stresses and strains induced due to various kinds of loads
6. Apply flexural formula and shear formula to study bending stress and shear stress distribution

Unit I: Forces and Force Systems

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. Resultant of concurrent and parallel space forces.

Unit II – - Equilibrium of Forces

Free body diagram, equilibrium of concurrent, parallel and general forces in a plane, equilibrium of three forces in a plane, types of simple beams, types of loads, supports and reactions. Equilibrium of concurrent and parallel space forces.
Friction - Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction.

Unit III: Analysis of Structures and Properties of surfaces

Two force member, analysis of plane trusses by method of joints and method of sections, Centroid of composite sections, Area moment of inertia- Definition, Moment of inertia of plane sections, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections

Unit IV: Shear Force Diagram and Bending Moment Diagram

Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers and simply supported beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads and uniformly distributed loads, uniformly varying loads, application of moments.

Unit V: Simple Stresses and Strains
Concept of stress and strain, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law , stress – strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain, Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses.
Unit VI: Shear and Bending Stresses in Beams
Flexural Stresses-Theory of simple bending, Assumptions, Derivation of bending equation: M/I = f/y = E/R, Neutral axis, Determination of bending stresses, Section modulus of rectangular and circular sections (Solid and Hollow), I, T sections Shear Stresses- Derivation of formula, Shear stress distribution across various beam sections like rectangular, circular, triangular, 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:
Credits : 3
Lectures: 3hrs / week

Examination Scheme:
Formative Assessment: 50 Marks
Summative assessment : 50 Marks

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 different fluid properties.
2. Establish relation between various fluid, flow and geometrical properties using dimensional analysis.
3. Evaluate total pressure, center of pressure, metacentric height using principles of statics.
4. Use principles of kinematics and dynamics to solve fluid flow problems
5. Solve problems related to laminar flow, turbulent flow and boundary layer formation.
6. Analyze flow through pipes.

Unit I - Properties of Fluids & Dimensional Analysis

Physical properties of fluids, Newton's law of viscosity, classification of fluids Dynamic and kinematic 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. 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 of friction 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: 1. Hydraulics & Fluid Mechanics - Modi and Seth, Standard Book House 2. A text book of Fluid Mechanics – R. K. Rajput, S. Chand 3. A text book of Fluid Mechanics and Hydraulic Machines – S. Pati, McGraw Hill
Reference books: 1 Fluid Mechanics-Yunus Cengel, JhonCimbala- Tata Macgraw Hill,New Delhi 2 Fluid Mechanics by .R. J. Garde, A.J Mirajgaonkar, SCITECH Publication 3. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill.

Societal and Global Impact of Civilization (ES21185CV)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs./week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Course Objective:
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. **Recall and explain** historic events as well as the movement of Human Civilization along with development of agriculture, tread, commerce, art, sciences, technology, etc.
2. **Identify,** and **compare** different phases in the growth and development of diverse Human cultures, needs, traditions, values, ethics, political structures and regimes, economies and the process of globalization.
3. **Outline** relevant aspects or components of the Constitution of India and **relate** them to the fields of Civil Engineering.
4. **Summarize** and **discuss** the significance and impact of human activities and Civil Engineering on societal, political and market economy at the National as well as global levels.
5. **Identify** and **analyze** the societal impact of Human civilization.
6. **Relate** Human civilization and needs of infrastructure development.
7. **Describe** renewable and renewable sources of energy, possibilities of energy storage and energy conservation.
8. **Classify** the disasters and **describe** various aspects and agencies of disaster 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 employment and 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, JaipurWorld 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
Credits : 3
Practical: 6 hrs./week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment : 50Marks

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 waste water

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

1. Identify and quantify, the development of reactive forces to counteract applied forces for equilibrium
2. Interpret , the mechanical behavior of materials under various load conditions in the form of deformations and corresponding stresses
3. Analyze waste water characteristics
4. Apply fundamentals of biotechnology in design of biological process.
5. Measure various flow and fluid properties such as viscosity, surface tension, pressure, velocity, discharge and verify basic principles of fluid mechanics like Bernoulli's equation etc.
6. Determine pipe flow parameters like friction factor, minor loses, Reynold's number.

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 of forces
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 waste water.
3. Determination of biological oxygen demand from waste water.
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 waste water.
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 orifice meter
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
Credits: 3
Lectures: 2 hrs./ week
Practical: 2 hrs./ week

Examination Scheme
Formative Assessment: 100 Marks

Course Objectives:

- Understand and gain fundamental knowledge of various ingredients of concrete including their properties.
- Review and apply the QAQC norms as per standards in constriction practices.
- Acquire the knowhow of special concretes and NDT methods for concrete.
- Be cognizant of various technologies in concreting.
- Be able to design concretes mixes using standards.
- Acquire the knowledge of durability requirements of concrete and its maintenance.

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

1. Identify the materials used to make concrete; including their sources, production and properties.
2. Appraise and practice standard tests relevant to the use and QAQC norms of fresh concrete and Identify and select concrete handling equipment.
3. Appraise and practice standard tests relevant to the use and QAQC norms of Hardened Concrete and Evaluate the different types of special concretes and techniques.
4. Design concrete mix as per standard codes and examine the durability requirements of concrete and Choose suitable measures.

Unit I – Introduction to Concrete as a Construction Material

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.

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 concrete mixers: 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 and Special Concretes

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. Special concreting techniques: pumping of concrete, under water concreting, ready mix concrete, roller compacted concrete Cold weather concreting, hot weather concreting.
Special concretes – Lightweight concrete, Cellular light weight concrete-Form concrete and autoclave C.L.C, polymer concrete, types of fibers, fiber reinforced Concrete, high density concrete, self-compacting concrete and applications. Ferrocement: Definition, Basic concepts in forming Ferro cement composites.

Unit IV– Concrete Mix Design and Deterioration and repairs.

Concepts of Mix Design, Factors for proportioning of concrete. Factors to be considered, Statistical quality control, Laboratory trial mixes and guidelines to improve mix , methods of Mix Design for M25 and above grades by IS (10262-2009, 456) and DOE methods with and Without fly ash, Deterioration and repairs of concrete.

Practical:

List of Laboratory Experiments: (any 8)

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

1. Fineness and standard consistency of cement.
2. Initial and final setting time and soundness of cement.
3. Compressive strength of cement.
4. Moisture content, silt content, and Specific gravity of fine aggregate
5. Fineness modulus by sieve analysis of fine aggregate.
6. Moisture content , water absorption, and Specific gravity of coarse aggregate
7. Density of coarse aggregate and Fine Aggregate.
8. Fineness modulus by sieve analysis and gradation of fine aggregates.
9. Workability of concrete by slump test, compaction factor, Vee Bee test, effect of
10. admixture and retarders on setting time concrete.
11. Compressive strength test of concrete by crushing and Rebound hammer.
12. Indirect tensile strength and flexural strength of hardened concrete
13. Concrete mix design by IS code method and DOE method. Demonstration and application of concrete mix design software.
14. Site visit to RMC plant

Text books:

1. Concrete Technology by M. S. Shetty, S Chand, New Delhi-110055.
2. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.

Reference books:

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. Ferrocement Construction Manual by Dr. D. B. Divekar-1030,Shivaji Nagar, Model
5. Colony, Pune.
6. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
7. Learning from Failures: Deficiencies in Design, Construction and Service, R& D Center, 1987.

IS Codes :

IS 456, IS 383, IS 9103, IS 10262 Latest revised editions.

Semester - II

Architectural Planning and Computer Aided Civil Engineering Drawing (CVUA22182)

Teaching Scheme
Credits: 4
Lectures: 3 hrs. / week
Tutorial: 1hr/week

Examination Scheme
Formative Assessment. : 50 Marks
Summative Assessment : 50 Marks

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. Discuss legal aspects in planning
2. Discuss byelaws relating to planning of buildings
3. Use commands of computer aided design
4. Implement the principles of planning building services
5. Implement the principles Doors, windows and vertical circulation
6. Sketch line plans of public buildings

Unit I – 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 II – Architectural Planning , Building bye laws and Introduction to Green Buildings

Principles of Architectural design relation between form and function, utility, aesthetics. 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: salient features, benefits, planning concepts (site selection, orientation, sun path and wind diagram etc.), Rating systems (LEED, GRIHA etc.)

Unit III- Architectural Drawing

Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings as per IS 962. Glass Assignment on Line plan for a building. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity.
Symbols And Sign Conventions: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

Unit IV : Masonry Bonds , Doors, windows and vertical circulation
English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick walls Doors windows and Vertical Circulation
Unit V- 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 etc.
Unit VI: 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 etc . Dimensioned line plans of above public 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 IS962, Extract of 7/12 . 2. Case study on Green building- Report 3. Command of CAD 4. Plates of Doors, windows 5. Plates of vertical circulation 6. Plates on Masonry Bond 7. Planning of Residential/Commercial building with building services. 8. Principles of isometrics and perspective drawing.

Geotechnical Engineering (CVUA22182)

Teaching Scheme
Credits: 3
Lectures: 3 hrs./ week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

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 and engineering properties of soil
- To impart knowledge about the study the interaction between water and its effect on engineering behavior of soil

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

1. Classify the different types of soil/rock and describe their engineering properties
2. Explain influence of water flow on engineering properties of soil
3. Describe the concept of compaction and stress, its influence on soil properties.
4. Determine compaction properties and calculate shear strength parameters of soil.
5. Describe soil slopes and their failure modes
6. Evaluate bearing capacity of the soil and design shallow foundation

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 and Stability of slopes
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, Graphical methods of Determination Earth Pressure. Classification and failure of slopes, Soil stabilization, its necessity and methods. Types and functions of geo-synthetics.
Unit VI – Bearing capacity and Settlement of Foundation
Basic definitions, Modes of shear failure, Bearing capacity analysis- Terzaghi's and IS code method. Bearing Capacity evaluation- Plate Load Test and SPT, Bearing capacity of layered soil. Effect of water table on bearing capacity. Presumptive bearing capacity. Introduction to concept of settlement and causes of settlement. Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, consolidation settlement.
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 McGraw Hill 3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers 4. Soil Mechanics-Principles and Practice-Graham Barnes-Palgrave MacMillan 5. A Text Book of Geology, P. K. Mukherjee, World press.
Reference Books: **1.** Soil mechanics and engineering practice – By Terzaghi, Peck and Mesri 2. Soil mechanics- By Lambe and Whitman 3. Physical and Geotechnical Properties of Soils by Joseph.E.Bowles, International Students Edition 4. Geotechnical Engineering—C.Venkatramaiah—New Age International Publishers 5. Principles of Geotechnical Engineering—Braj M.Das—Cengage Learning

Mechanics of Structures II (CVUA22183)

Teaching Scheme
Credits : 3
Lectures: 3 hrs. / week

Examination Scheme
Formative Assessment : 50Marks
Summative Assessment : 50 Marks

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 Retaining Walls
- 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 various types of beams and Apply torsion formula to hollow and solid circular shaft
2. Determine direct and bending stresses for 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) 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 2 unknowns)
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: 1. Mechanics of Structures Vol. II- S.B. Junnerkar and H.J. Shaha, Charotar Publishing House 2. Theory of Structures- B. C. Punmia, Ashok kumar Jain and Arun Kumar Jain, Laxmi Publications (P) Ltd. 3. Structural Analysis- Madan Mohan Das, Bhargab Mohan Das and Mimi Das Saikia, PHI Learning Private Ltd. 4. Structural Analysis- S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd.
Reference books: 1. Intermediate Structural Analysis- C. K. Wang, Tata Mc Graw Hill Education Pvt. Ltd. New Delhi 2. Structural Analysis- R. C. Hibbler , Pearson. 3. Matrix Methods of Structural Analysis- Dr. A. S. Meghre and S. K. Deshmukh, Charotar Publishing House

Surveying (CVUA22184)

Teaching Scheme
Credits: 3
Lectures: 3 hrs./ week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

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.
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.

Unit I –Compass and Plane Table Surveying

a) 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.
b) 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

a) 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)
b) 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

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

Unit IV–Curves

Introduction to horizontal and vertical curves (no numerical and derivations to be asked onvertical curves and reverse curves), different types and their applications, simple circular curves,elements and setting out by

linear methods such as radial and perpendicular offsets, offsets fromlong chord, successive bisection of chord. Angular methods: Rankine's method of deflection angles (one and two theodolite methods). (Numerical on simplecircular curves to be asked), Transition curves: necessity and types.
Unit V–Tachometry and Setting Out Works
a)Tachometry: application and limitations, principle of stadia tachometry, fixed hair methodwith vertical staff to determine horizontal distances and elevations of points. b)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 setting out and transferring the alignment underground)
Unit VI–Electronic Measurement Techniques and Hydrographic Survey
a)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 remoteelevation measurements, remote distance measurements and co-ordinate stake out.Levelling using digital level b) 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, ArunK.Jain 4.Surveying for Engieers-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,TataMc-Graw Hill

Hydraulic Engineering (CVUA22185)

Teaching Scheme
Credits : 3
Lectures: 3 hrs. / week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment : 50 Marks

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. Analyze flow around submerged bodies and determine drag and lift forces acting on them
2. Analyze and solve unsteady flow problems
3. Design open channels in non-alluvial soils
4. Evaluate energy loss in hydraulic jump
5. Classify the channel profiles and solve the dynamic equation of gradually varied flow
6. Analyze working of hydraulic machines like pump and 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, Ven Te 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, Third Ed 3 Open Channel Flow: K. G. RangaRaju - Tata McGraw Hill.
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, Oxford University Press, 2010 3. Flow through Open Channels by Rajesh Srivastava, Oxford University Press, 2015

Lab Practice II (CVUA22186)

Teaching Scheme
Credits : 3
Practical: 6hrs / week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Course Objectives:

- Develop skills in use of surveying instruments including compass, auto/digital levels, Vernier/optical/electronic theodolites, and Total Station.
- Learn modern surveying techniques like Remote sensing, photogrammetry.
- 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
2. Find scale of aerial photograph and interpret RS image
3. Determine the drag, lift around submerged bodies, impact of jet on flat plate and curved vane as well as efficiency of pump and turbine.
4. Analyze uniform flow, varied flow in an open channel.
5. Conduct the tests to study soil properties and soil behavior
6. Review field geotechnical investigation report or Use software related to Geotechnical Engineering

Surveying & Geomatics

List of Experiments – Any 8 and All projects are mandatory:

1. Measurement of magnetic bearings of sides of a triangle or polygon, correction for local attraction and calculations of true bearings using prismatic compass.
2. Plane table survey by Intersection method.
3. Finding horizontal and vertical distance using Tachometer.
4. Simple and differential levelling with at least three change points using digital level.
5. Measurement of horizontal and vertical angles using Theodolite (Vernier/optical/electronic).
6. Setting out a circular curve by Rankine's method of deflection angles.
7. Determination of elevation of inaccessible objects by trigonometrical levelling.
8. Practical based on various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stakeout .
9. Study and use of nautical sextant and measurement of horizontal angles
10. Study of aerial photograph and finding out the scale of the photograph.
11. Determination of air base distance using mirror stereoscope.
12. Use of RS images and visual interpretation

Surveying Projects:

1. Project I: Profile levelling : Drawing L-section and C- section for a road of minimum 200m length
2. Project II: Radial contouring: Plotting of contours from two stations minimum 60m apart.
3. Project III: Theodolite traversing : Plotting traverse and finding out area traverse using Vernier/electronic 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 / Venturi flume
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 of jet
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 Book House
2. Theory and Applications of Fluid Mechanics—K. Subramanya- Tata McGraw
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, Arun K. Jain
5. Soil Mechanics and Foundation Engineering by Dr. B. C. Punmia, Laxmi Publications
6. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta, Tata McGraw Hill

Reference books:

1. Fluid Mechanics-Yunus Cengel, JhonCimbala- Tata Macgraw Hill, New Delhi
2. Fluid Mechanics by .R. J. Garde, A.J Mirajgaonkar, SCITECH Publication
3. Plane Surveying----A. M. Chandra---- New Age International Publishers
4. Surveying and Levelling ---- N. N. Basak, Tata Mc-Graw Hill
5. Geotechnical Engineering—C. Venkatramaiah—New Age International Publishers
6. Principles of Geotechnical Engineering—Braj M. Das—Cengage Learning

Construction Engineering and Management (CVUA22187)

Teaching Scheme
Credits: 3
Lectures: 2 hrs./ week
Practical: 2 Hrs/ Week

Examination Scheme
Formative Assessment : 100 Marks

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. Explain project life cycle and importance of organizational structure of a project.
2. Prepare a Plan of construction projects with respect to time and cost.
3. Discuss the functions of materials management
4. Explain the basic concepts of project monitoring and control

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, Tata McGraw 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, Tata McGraw Hill Publishing Company, New Delhi.
2. Construction Management and Planning by B. Sengupta and H Guha, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction Planning Methods & Equipment:Puerifoy –Tata MC Graw Hill
4. Construction Management practice and contarct management practice- Dr. V.K.Raina, 2nd Edition, 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 15 activities. 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
Credits: 3
Lectures: 2 hrs./ week
Practical: 2 Hrs/ Week

Examination Scheme
Formative Assessment : 100 Marks

Course Objectives:
" Providing principle knowledge, practical training and measurement best practice for a range of temperature, pressure, electrical, velocity, acceleration and vibration systems"

- The objective of this Course is to understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decision making. This course introduces theoretical and practical principles of design of sensor systems. Topics include: transducer characteristics for acoustic, current, temperature, pressure, electric, magnetic, gravity, salinity, concentration of contaminants, velocity, heat flow, and optical devices; limitations on these devices imposed by building/structure/pavement environments; signal conditioning and recording; noise, sensitivity, and sampling limitations; and standards. Lectures will cover the principles of state-of-the-art systems being used in physical infrastructure/bridges/buildings/pavements, etc. For lab work, the course will allow students to prepare, deploy and analyze observations from standard instruments.

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

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

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 reduction with filters, Leakage, Frequency resolution

Text Books:

1. W. Bolton; "Mechatronics, Electronic Control Systems in Mechanical and Electrical Engineering"; Pearson Education; 4th Edition
2. Curtis Johnson; "Process Control Instrumentation Technology"; Prentice Hall of India Pvt. Ltd.; 8th Edition
3. David G. Alciatore, Michael B Histand; "Introduction to Mechatronics and
4. Measurement System"; Tata Mc Graw Hill 3rd Edition
5. Madhuchhanda Mitra, Samarjit Sen Gupta; "Programmable Logic Controllers
6. and Industrial Automation, An Introduction"; Penram International
7. Publishing India (Pvt) Ltd
8. Liptak; "Handbook of Process control"
9. H. S. Kalsi; "Electronic Instrumentation" Tata Mc Graw Hill

Reference Books:

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press
3. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
4. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

Tutorials from the above modules demonstrating clearly the understanding and use for the sensors and instruments used for the problems posed and inferences drawn from the measurement and observations made along with evaluation report

Practicals:

(Laboratory experiments shall be used on application of concepts introduced in the lectures.)

1. Instrumentation of typical civil engineering members/structures/structural elements Use of different sensors, strain gauges, inclinometers,
2. Measurement of discharge, pressure, velocity [Open channel and closed channel , pipe flow]
3. Errors during the measurement process
4. Calibration of measuring sensors and instruments
5. Measurement, noise and signal processing
6. Analog Signal processing
7. Digital Signal Processing
8. Demonstration & use of sensor technologies

List of Practicals:

1. Measurement of Temperature and Pressure.
2. Study of Design and testing of Signal conditioning circuits for Thermocouple and RTD (Voltage and Current Output).
3. Study of Measurement Instruments: UV /VIS spectrophotometer, gas chromatography, auto-titrator.
4. Study of Measurement Instruments: Atomic absorption Spector photo meter, flame photo meter,
5. Measurement of Water Parameters : TDS, DO, Conductivity, pH , turbidity,
6. Measurement of Air Parameters : high volume sampler for air pollution , ambient noise level measurement , five gas analyzer for vehicle pollution,
7. Measurement of discharge, pressure, velocity : [in open channel and closed channel (pipe flow)]
8. Sensor interface with microcontroller through Instrumentation amplifier and ADC