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 2020)

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 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 the activities of construction projects

PSO2: Engineering graduates will be able to analyze and design components of Civil Engineering Systems.

Department of Civil Engineering

S.Y. B. TECH (CIVIL ENGINEERING), SEMESTER III (PATTERN 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ES21201CV	Statistics and Probability	TH	3	1	-	20	30	20	30	25	125	4
ES21202CV	Mechanics of Solids-I *	TH	3	-	2	20	30	20	30	25	125	4
CVUA21203	Environmental Engineering I*	TH	3	-	2	20	30	20	30	25	125	4
CVUA21204	Fluid Mechanics*	TH	3	-	2	20	30	20	30	25	125	4
ES20205	Universal Human Values 2	TH	2	1	-	20	30	20	30	25	125	3
CVUA21206	Concrete Technology	CE	2	-	2	-	-	-	-	50	50	3
CVUA21207	Data Structures & Algorithms	CE	1	-	2	-	-	-	-	50	50	2
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total		17	2	10	100	150	100	150	225	725	24

***Course has Oral Examination**

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

Mandatory Course: Environmental Sciences

BoS Chairman Dean Academics Director

S.Y. B. TECH CIVIL ENGINEERING, SEMESTER IV (PATTERN 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
CVUA22201	Material Science & Computer Aided Drawing *	TH	3	-	2	20	30	20	30	25	125	4
CVUA22202	Hydraulic Engineering	TH	3	-	2	20	30	20	30	25	125	4
CVUA22203	Surveying *	TH	3	-	2	20	30	20	30	25	125	4
CVUA22204	Geotechnical Engineering*	TH	3	-	2	20	30	20	30	25	125	4
CVUA22205	Mechanics of Solids-II	TH	3	-	-	20	30	20	30	-	100	3
CVUA22206	Irrigation Engineering – I	CE	2	1	-	-	-	-	-	50	50	3
CVUA22207	Data Analytics	CE	1	-	2	-	-	-	-	50	50	2
M2	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total		18	1	10	100	150	100	150	200	700	24

***Course has Oral Examination**

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

Mandatory Course: Environmental Sciences

BoS Chairman Dean Academics Director

Semester – I

Department of Civil Engineering

Statistics and Probability (ES21201CV)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 1 hr./week Practical (P): 0 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Course Objectives:

1. Impart knowledge and develop the ability of students to analyze the data for a given problem and represent in the mathematical and statistical form
2. Impart knowledge and develop the ability of students to systematically solve the problems using knowledge of probability, distributions, sampling and formulating hypothesis
3. Impart knowledge and develop the ability of students to carry out test of hypothesis, and apply the concept of correlation and regression, goodness of fit and distributions

Course Outcomes: Upon completion of this course, students will be able to,

1. Understand the basic concepts of Statistics and its analysis and applications
2. Solve the problems related to probability and various probability distributions.
3. Apply the concept of sampling and carry out various tests
4. Analyse and test of hypothesis
5. Interpret problems using concept of correlation and develop regression
6. Examine variance and test for goodness of fit

Unit I: **Statistical**

Introduction, collection, classification and representation of data, various databases related to Civil Engineering applications (like hydraulic, hydrologic, meteorological, coastal and oceanographic, structural, material testing, geotechnical, concrete technology, construction management, environmental, transportation, foundation and geological etc.), measures of statistical parameters like central value (mean, median, mode), standard deviation, Skewness, moment, Kurtosis, coefficient of variation, measures of dispersion.

Unit II: Probability and Probability

Introduction and definition and of probability, probability and set notations, theorem of total probability, independent events, Bay's theorem, Random variables (discrete and continuous), discrete probability distribution, continuous probability distribution, moments and expectations, generating function, repeated trials, probability distributions including Binomial, Poisson, Normal, probable error, Examples for each distribution type preferably based on various databases related to civil engineering applications mentioned in Unit I.

Unit III: **Population and sampling**

Introduction, sampling distribution, standard error, four types of sampling, importance of population sampling, sample size determination, chi-square test, z test, Student T test. Examples to be framed and solved based on various databases related to civil engineering applications mentioned in Unit I.

Unit IV: Test of hypothesis

Introduction of test of hypothesis, Three parts of hypothesis. Steps in Hypothesis testing: assumptions test statistics, Rejection region, Calculations and conclusions. Characteristics and qualities of a good hypothesis, Examples to be framed and solved based on various databases related to civil engineering applications mentioned in Unit I.

Unit V: Correlation and regression
Introduction of correlation, correlation analysis, coefficient of correlation, probable error, , regression, regression analysis, line of regression, standard error of estimate, Rank of correlation. single and multiple regression, linear, non-linear regression, Examples to be framed and solved based on various databases related to civil engineering applications mentioned in Unit I.
Unit VI: Goodness of fit and Variance
Concept and necessity of goodness of fit , K-S test for goodness of fit and distribution. Variance, co variance, analysis of variance on one way & two-way classification. Examples to be framed and solved based on various databases related to civil engineering applications mentioned in Unit I.
Text books: 1. Gupta S.P., (2014), "Statistical Methods",43rd edition, S. Chand Publication. 2. Grewal B.S., (2020), "Higher Engineering Mathematics ",42nd edition, Khanna Publishers.
Reference Books: 1. Johnson Richard A., Miller I., Freund J.E., (2016), "Probability and Statistics for Engineers", 9th edition, PHI publications 2. Rao G. S., (2018), "Probability and Statistics for Science and Engineering", 11th edition, Universities press publication – G Shankar Rao
Tutorials: Term work Total 12 numerical assignments based on all units. (2 assignments should be drafted for one unit)

Department of Civil Engineering

Mechanics of Solids I (ES21202CV)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Course Objectives:

1. To prepare the students to analyze determinate beams to compute direct stresses, shear stresses, bending stresses, torsional stresses, Principal Stresses and deflection at any point along the span.

Course Outcomes: Upon completion of the course, students will be able to,

1) Understand and calculate simple stresses, strains elastic constants and relation between them
2) Apply equilibrium equations to calculate the internal forces namely axial forces, shear forces and bending moments for determinate beams and draw AFD, SFD and BMD
3) Apply flexural formula and shear formula to determine bending stress and shear stress distribution in determinate beams
4) Identify principal planes and compute principal stresses due to combination of axial forces, bending moments and shear
5) Determine direct and bending/buckling stresses for columns
6) Determine slope and deflection of determinate beams and Apply torsion formula to hollow and solid circular shaft

Unit I: Concept of Stress at a point

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 II: Force Analysis

Calculation of Bending moment (BM) and shear force (SF) for statically determinate beams.BM and SF diagrams and salient features, Concept of axial force/thrust diagram.

Unit III: 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, L sections.
Shear stress formula, Determination of shear stress and its distribution for beam sections of rectangular and circular sections (Solid and Hollow), I, T, L sections.

Unit IV: Principal Stresses and Mohr's Circle

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. Location of principal plane and principal stresses, analytical and graphical methods, failure methods

Unit V: 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.

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Unit VI: Deflection due to Bending and Torsion of Circular Shaft

Deflection of beams: Relationship between moment, slope and deflection, Double Integration Method, Macaulay's 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.

List of Experiments:
Any 6 experiments from the following:

1. Tension test on mild and TMT steel
2. Shear test on mild and TMT steel
3. Compression Test on Timber
4. Bending Test on Timber
5. Torsion test on mild steel and Aluminum
6. Izod and Charpy Impact test on mild steel, aluminum, brass andcopper
7. Abrasion test on tile
8. Bending test on tile
9. Compression test on bricks
10. Experiment using Virtual Laboratory

Oral Exam based on Practicals

Text books:

1. S.S.Rattan (2011), "Strength of Materials", Tata Mc Graw Hill Education Pvt. Ltd. New Delhi
2. S.Ramamrutham (2011), "Strength of Materials", Dhanapat Rai Publishing Company
3. Dr. Sandhu Singh (2013), "Strength of Materials", Khanna Publishers
4. S.B. Junnerkar and H.J. Shaha,(2012), "Mechanics of Structures Vol. I", Charotar Publishing House
5. Dr. R.K.Bansal (2018), "Strength of Materials",Laxmi Publications (P) Ltd.

Reference books:

1. S. Timoshenko and D.H.Young, (2003), "Elements of Strength of Materials", East-West Press Ltd
2. R.C.Hibbler, (2017), "Structural Analysis", Pearson.
3. E.P.Popov,(2017), "Mechanics of Materials", Prentice Hall Publishers
4. F.L.Singer and Andrew Pytel (1987), "Strength of Materials", Harper and Row Publications

Department of Civil Engineering

Environmental Engineering – I (CVUA21203)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Course objectives :

1. To understand the concept of water treatment process.

Course Outcomes :Upon the completion of the course, students will be able to,

1. Explain water supply system, characteristics of water and estimate water requirements.
2. Understand the conveyance of water by source works, material and appurtenances.
3. Explain the process of aeration, coagulation, flocculation, sedimentation.
4. Analyze the process of filtration and disinfection
5. Explain advanced treatment systems through Membrane filtration, adsorption, Ion Exchange Process and packaged drinking water plant
6. Explain the water distribution system, leakage and maintenance.

Practical – Course Outcome

7. Determine chemical characteristics of water such as pH , alkanity, hardness, chloride, chlorine demand, iron or manganese, sulphate, fluoride , design of 1 MLD WTP by using excel or any software and site visit.

Unit I :Water demand, quality and quantity

Water supply system: Introduction, components
Water demand: Usage and rates, governing factors, variation, estimation (present, intermediate and ultimate)
Water Quality: Physical, chemical and biological parameters, IS 10500-2012, quantity of water required, population forecasting.

Unit II: Conveyance of water

Source works: Intake (types and location), types of river intake, jack well, pumping system, power and capacity of pump , conveyance system ,forces acting, materials (Ductile Iron, Mild steel and Plastic), laying of pipes, hydraulic analysis.
Appurtenances: Valves type, thrust block concept.

Unit III :Water treatment (Aeration, mixing and settling)

Treatment: Philosophy, unit processes and operations
Aeration: process, types of aerator, design of cascade aerator
Coagulation: Physics and chemistry, practice, design of rapid mixer
Flocculation: Theory, design of clariflocculator.
Settling: Theory, types of settling tanks, design of rectangular and circular types sedimentation tank. Concept of for type 1 and 2 settling.

Unit IV :Water treatment (Filtration and disinfection)

Granular Filtration: Classification, theory of deep mono and dual bed filter, components of deep bed filter, clean filter bed head loss, filter operation, problems in filtration.
Disinfection: Types, kinetics, chlorination, chemistry of chlorination, Chicks law, chlorine demand, chlorination practice, UV and Ozone disinfection

Unit V :Advanced water treatment

Membrane filtration: Types, basic concepts, applications.
Adsorption: Introduction, basics of carbon adsorption.
Ion Exchange: Theory and principal of softener, package drinking water plant concept, concept of 24x7 water supply and SCADA system.

Unit VI :Water distribution system and Operation-Maintenance

Water distribution: Methods, system configurations, hydraulic and functional requirements.
Service reservoirs: Necessity, components, location, head, and capacity
Leakage: Causes, detection and control
Water quality in distribution: Causes of deterioration, Source trace, Water age, Nodal constituent concentration
Operation and maintenance: Water supply system

Practicals

List of Experiments- (Any 6)

1. Determination of pH and alkanity from water.
2. Determination of Hardness from water.
3. Determination of chlorides from water.
4. Determination of optimum dose of alum.
5. Determination of chlorine dose and chlorine demand.
6. Determination of Iron or Manganese from water.
7. Determination of sulphate from water.
8. Determination of fluoride from water.
9. Design of 1MLD WTP in spread sheet or any software.
10. Site Visit on WTP describing Unit Operations in Water Treatment.

List of Assignments:

1. Study of Plumbing fixture and accessories.
2. Types of Intake Structures.
3. Automation in Water Supply.

Oral Exam based on Practicals

Text books:

1. S.K. Garg, Water Supply Engineering Vol. -1, Khanna Publicaiton, New Delhi,
2. B C Punmia, ,Environmental Engineering Vol. -1, Laxmi Publicaiton, New Delhi

Reference books:

1. G.S. Birdi -, Water supply & Sanitary Engg. Laxmi publications (p) Ltd. New Delhi
2. Mark J., Water & waste Water technology. Hammer ,Prentice – Hall of India, New Delhi
3. H.S. Paeavy& D.R. Rowe, Environmental Engineering. McGraw Hill Book Co. New Delhi
4. G.M. Fair & J.C. Geyer, 1968, Water & Waste Water Technology. New York, NY, John Wiley &Sons Incorporated,

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Fluid Mechanics (CVUA21204)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

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

1. Determine fluid density, Specific 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 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 streamline, 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.

Practicals

Laboratory experiments:
Student should complete any 8-experiment mentioned below (*Experiment no 11 is mandatory)

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. Anyone experiment mentioned in the above list should be completed using Virtual lab

Oral Exam based on Practicals

Text books:

1. Modi .P.N. and Seth S.M., (2019), "Hydraulics & Fluid Mechanics including Hydraulics Machines " –22nd edition, Rajsons Publications, Standard Book House.
2. Rajput R. K., (2018), "A text book of Fluid Mechanics", S. Chand Publications
3. Pati S., (2017), "A text book of Fluid Mechanics and Hydraulic Machines",3rd edition, McGrawHill Publications

Reference Books:

1. Cengel Y.,and CimbalaJ.,(2019), "Fluid Mechanics", Tata Mac graw Hill, New Delhi
2. Garde R. J.and Mirajgaonkar A.J,(2010), "Engineering Fluid Mechanics", SCITECH Publication
3. Streeter V.I., & Wylie B.E and Bedford K.w.,(2014), "Fluid Mechanics", 9TH edition, Tata McGraw Hill.

Department of Civil Engineering

Universal Human Values 2 (ES20205)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): 1 hr./week Practical (P): 0 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Course Objectives:

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

Course Outcomes: Upon completion of the course, students will be able to,

1. Perform self-exploration on human values to ensure fulfillment of basic universal human aspirations.
2. Commit to lead a life of responsibility by becoming aware of their individual reality
3. Apply understanding of human- human relationship in family and society to behave ethically and professionally
4. Demonstrate awareness and sensitivity towards nature/existence leading to ethical and sustainable solution to engineering problem

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value

Purpose and motivation for the course, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit II – Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristicsand activitiesof 'I' and harmony in 'I',

Understanding the harmony of I with the Body, correct appraisal of Physical needs, meaning of Prosperity in detail.

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

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness, Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and Competence,

Understanding the meaning of Respect, Difference between respect and Differentiation; the other salient values in relationship,

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals,Visualizing a universalharmonious order in society- Undivided Society, Universal Order- from family toworld family.

Unit IV- Understanding Harmony in the Nature and Existence - Whole existence as Coexistence with Implications of the Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values , Definitiveness of Ethical Human Conduct,

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

Competence in professional ethics:

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

Discussion on the conduct as an engineer or scientist.

List of Tutorial: (Any 7 tutorials can be taken)

1. Practice session to discuss natural acceptance in human being.
2. Practice session to discuss the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.
3. Practice session to discuss the role others have played in making material goods available to me.
4. Identifying from one's own life.
5. Practice session to differentiate between prosperity and accumulation.
6. Practice session to discuss program for ensuring health vs dealing with disease.
7. Practice session to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc.
8. Practice session to reflect on Gratitude as a universal value in relationships. Discuss with scenarios.
9. Practice session to reflect on Gratitude Elicit examples from students' lives.
10. Practice session to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
11. Case Study session e.g. to discuss the conduct as an engineer or scientist etc.

Text Book

1. R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books, New Delhi, 2010

Reference Books

1. A Nagaraj, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).

Concrete Technology (CVUA21206)

Teaching Scheme	Examination Scheme						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	-	-	-	50	50

Course Objectives:

1. Understand and gain fundamental knowledge of various ingredients of concrete 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: Upon completion of this course, students will be able to,

1. Identify the functional role of materials used in concrete.
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 Concrete and Ingredients of Concrete:

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)

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

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, IS 456-2000

Practicals

List of Laboratory Experiments: The term work shall consist of a journal giving details of all the following experiments.

Part A

I) Cement & fly ash
1. Fineness and standard consistency of cement.
2. Initial and final setting time and soundness of cement.
3. Compressive strength of cement.

II) Fine and Coarse Aggregates (Any Three)
4. Moisture content, silt content, and Specific gravity of fine aggregate
5. Fineness modulus by sieve analysis of fine aggregate and gradation of fine aggregates
6. Moisture content, water absorption, and Specific gravity of coarse aggregate
7. Density of coarse aggregate and Fine Aggregate.

III) Fresh & Hardened Concrete
8. Workability of concrete by slump test, compaction factor, Vee Bee test, effect of admixture and retarders on setting time concrete.
9. Compressive strength test of concrete by crushing and Rebound hammer.
10. Indirect tensile strength and flexural strength of hardened concrete
11. Concrete mix design by IS code method. Demonstration and application of concrete mix design software.

Part B

12. Site visit to RMC plant

Textbooks:

1. M. S. Shetty, (2018), "Concrete Technology" S. Chand Publication, New Delhi-110055.
2. M. L. Gambhir (2017), "Concrete Technology" Tata McGraw- Hill Publishing Company Limited,
3. A R Santhakumar,(2006)" "Concrete Technology" Oxford University Press.

Reference books:

1. A. M. Neville,(2012) "Properties of concrete" Longman Publishers.
2. R.S. Varshney, "Concrete Technology" Oxford and IBH.
3. A. M. Neville, J.J. Brooks, (2019), "Concrete Technology" Pearson.
4. A. P. Remideos, (2018), "Concrete Mix Design" Himalaya Publishing House.
5. Mehta P. and Monteiro Paulo J.M.,(2006), "Concrete Microstructure, Properties and Materials", Tata McGraw-Hill Publishing Company Limited, New Delhi.

Department of Civil Engineering

Codes:

1. IS codes: 4031 : Methods of physical tests for hydraulic cement, New Delhi: Bureau of Indian Standards
2. IS 2386 Part 1 to 9 Methods of test for aggregates ", New Delhi: Bureau of Indian Standards
3. IS 10262:2019 "Concrete mix proportioning – Guidelines", New Delhi: Bureau of Indian Standards
4. IS 383:2016 : Specification for Coarse and Fine Aggregates, New Delhi: Bureau of Indian Standards
5. IS 9103: Specification for Concrete Admixture , New Delhi: Bureau of Indian Standards
6. Ambuja cement booklets on concrete
7. ACC booklets on concrete

e – Resources:

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

Department of Civil Engineering

Data Structures & Algorithms (CVUA21207)

Teaching Scheme	**Examination Scheme**						
Credits: 2 Lecture (L): 1 hr./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	-	-	-	50	50

Course Objectives:

1. To study data structures and their implementations and applications.
2. To learn different searching and sorting techniques.
3. To study some advanced data structures such as trees, graphs and tables.
4. To learn algorithm development and analysis of algorithms

Course Outcomes: Upon completion of the course, students will be able to,

1. Perform basic analysis of algorithms with respect to time and space complexity.
2. Select appropriate searching and/or sorting techniques and Implement data structures for given application.

Unit I–Introduction

Introduction to Data Structures: Concept of data, Data object, Data structure, Concept of Primitive and non-primitive, linear and Nonlinear, static and dynamic, persistent and ephemeral data structures, Definition of ADT Analysis of algorithm: Frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Sequential Organization: Single and multidimensional array, Linked Organization: Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete).
Searching and Sorting: Need of searching and sorting, Concept of internal and external sorting, sort stability, Searching methods: Linear and binary search algorithms, Sorting methods: Bubble, insertion, Quick, Merge and comparison of all sorting methods w.r.to its worst case time complexity.

Unit II – Stack, Que and Trees

Stack:- Concept of stack, Concept of implicit and explicit stack, stack as an ADT using sequential and linked organization, Applications of stack: recursion,

Queue: Concept of queues as ADT, Implementation of queue using array and linked organization, Concept of circular queue, priority queue, Applications of queue:

Trees: Trees and binary trees-concept and terminology, Expression tree, Binary search tree,
Recursive algorithms for binary search tree traversals Applications of trees.

Graph -Concept and terminologies

Practicals

List of Assignments: (1 Assignment 2 turns each)

1. Represent matrix using two dimensional arrays and perform following operations
   a) Addition
   b) multiplication
   c) Transpose
   d) Saddle point
   e) Lower and Upper triangular Matrix
2. Write a menu driven Program in C++ for the following operations on Singly Linked List (SLL) of Student Data with the fields: PRN, Name, Branch, Semester, Cell Number
   a) Create a SLL of N Students
   b) Display the SLL and count the number of nodes in it
   c) Perform Insertion
   d) Perform Deletion
3. Perform implementation of STACK using Array
   a) Push an Element on to Stack
   b) Pop an Element from Stack
   c) Demonstrate Overflow and Underflow situations on Stack
   d) Display Stack
   e) Support the program with appropriate functions for each of the above operations
4. Implement FCFS (Queue) algorithm of job scheduling in operating system with the help of suitable data structure.
5. Write C++ program to maintain club members, sort on roll numbers in ascending order. Write function for Binary Search and Linear Search to search whether particular student is member of club or not.
6. Department maintains student's database. The file contains roll number, name, division andaddress. Write a program to create a sequential file to store and maintain student data. It should allow the user to add, delete information of student. Display information of particular student. If record of student does not exist an appropriate message is displayed. If student record is found it should display the student details.
7. Represent graph as adjacency matrix or list and perform Depth first Traversal and Breadth First Traversal
   OR
8. Create BST and perform Depth first Traversal and Breadth First Traversal

Textbooks:

1. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi, 1995, ISBN 16782928
2. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.

Reference books:

1. G. A.V, PAI , "Data Structures and Algorithms ", McGraw Hill, ISBN -13: 978-0-07-066726-6
2. A Tharp ,"File Organization and Processing", 2008 ,Willey India edition, 9788126518685
3. M. Folk, B. Zoellick, G. Riccardi, "File Structure An Object Oriented Approach with C++", Pearson Education, 2002, ISBN 81 - 7808 - 131 - 8.
4. M. Welss, "Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN81-7808-670-0

Semester II

Material Science & Computer Aided Drawing (CVUA22201)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Course Objectives:

1. To understand substructure, superstructure and Masonry components of a building
2. To describe different components of building: Doors, Windows, Vertical circulation, Flooring and roofing
3. To describe Protective coatings, Miscellaneous Materials and safety in Construction
4. To Design and Draw Plan, elevation and section of residential building, manually/ CAD
5. Discuss building services: Noise and Acoustics, Ventilation, Lighting, Plumbing
6. To Plan public buildings

Course Outcomes: Upon completion of the course, students will be able to,

1. Understand substructure, superstructure and Masonry components of a building
2. Understand different components of building: Doors, Windows, Vertical circulation, Flooring and roofing
3. Discuss Protective coatings, Miscellaneous Materials and safety in Construction
4. Design and Draw Plan, elevation and section of residential building, manually/ CAD
5. Understand building services: Noise and Acoustics, Ventilation, Lighting, Plumbing
6. Discuss architectural requirements of public buildings and Sketch line plans of public buildings

Unit I Introduction to Building Construction and Masonry

Introduction to building construction- definition, types of building as per national building code. Substructure and superstructure, Types of shallow and deep foundation and their suitability. Damp proof course, plinth filling and soling

Masonry- Stone masonry- Principal terms, types of stone masonry. Brick masonry- characteristics of good building bricks, IS specification and tests, classification of bricks (silica, refractory, fire and fly ash bricks). Reinforced Masonry, Brick work, types of bonds- English, Flemish, Header, Stretcher, construction procedure, supervision, Formwork, Scaffolding- Purpose, types, suitability, Introduction to temporary structures.

Unit II Components of Building: Doors, Windows, Vertical circulation, Flooring and roofing
Doors and Windows: Definition of technical terms, installation of doors and window frames and their size specifications, Different types of doors and windows: Ventilators: purpose and types. Vertical circulation: Types: Staircase- Types and materials used, ramps escalators. Arches and Lintels – Introduction of arch construction, Lintels: necessity and types, chajja or weather shade necessity and types Flooring: Functional requirement of flooring, types of floor finishes and their suitability, Types of flooring. Roofing: Materials: GI, AC fiber sheets. Roof construction: types and their suitability, method of construction, types of trusses.
Unit III: Protective coatings, Miscellaneous Materials and safety in Construction
Protective coatings: plastering types and application, plastering methods, modern materials for plaster. pointing- purpose & types, mortar- Preparation and types, painting and varnishing, white washing, distempering, oil paints. Wall cladding: materials, method, wall papering and glazing work. Miscellaneous materials: Properties, types and uses of following materials, lime, polymers, plastic, gypsum, clay tiles and glazed wares, aluminium panel cladding, Steel. Structural 3-D printing, Glass, Eco-friendly materials Safety in construction: safety on site, storage of materials, construction safety, prevention of accidents
Unit IV: Building Bye Laws and Architectural Planning
Building Byelaws: 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. Minimum Standard Dimensions, Principles of Green Building. Introduction to Architectural drawing: Principles of Building Planning and Principles of Architectural design relation between form and function, utility, aesthetics, Concept of Line plan, Developed Plan, Elevation, Section, Selection of scales for various drawings, dimensioning, abbreviations and symbols as per IS 962, Elements of perspective drawings, parallel and angular perspective of small building elements, CAD Drawing.
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

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 Centre/ 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)

Practicals

List of Practicals:

1. Presentation on Types of materials used in construction with application.
2. Commands of CAD
3. Plan, elevation and section of Residential/Commercial building- on sheet (full imperial)
4. Layout/ Site plan indicating water supply and drainage line (with area statement.
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.

Oral Exam based on Practicals

Text Books:

1. Shah, M.G, Kale, C.M. and Patki, S.Y. (2017), "Building Drawings with an integrated Approach to Built-Environment", Tata McGraw Hill. (5th edition.), New Delhi
2. Deodhar, S.V., (1972), "Building science and planning", Khanna Publishers, New Delhi
3. Arora S.P. and Bindra, S.P., (2005)," Building Construction", Dhanpat Rai Publications, India
4. Malik and Mayo,(2009), "Civil Engineering Drawing", Computech Publication Ltd., New Asian Publishers, New Delhi
5. www.Autodesk.in

Reference books:

1. National Building Code (latest).
2. Frederick M. and Ricketts J. (2000), "Building Design and construction", by, Tata McGraw Hill.
3. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
4. Development plan and DCP Rules the City

Department of Civil Engineering

Hydraulic Engineering (CVUA22202)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	25	125

Course Objectives:

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

Course Outcomes: Upon completion of this 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 Specific Energy, Specific Force, critical flow concepts and compute the sequent depth ratio, energy loss in a hydraulic jump occurring in horizontal rectangular channel.
4. Classify the water surface profiles and solve dynamic equation of GVF using direct step method.
5. Determine impact of je ton 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, 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

Term Work

Laboratory experiments:

Student should complete any8-experimentmentionedbelow

1. Flow around a Circular Cylinder
2. Flow around an airfoil
3. Studyof 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 of jet
11. Determining characteristics of centrifugal pump
12. Determining characteristics of Pelton wheel turbine

Text books:

1. Modi .P.N. and Seth S.M., (2019), "Hydraulics & Fluid Mechanics including Hydraulics Machines " –22nd edition, Rajsons Publications, Standard Book House.
2. Subranmanya K., (2019), "Flow in Open Channels", Macgraw Hill Publications
3. Rangaraju K.G., (2001), "Flow through open chnnels",2rd edition, Mc Graw Hill Publications

Reference Books:

1. Garde R. J. and Mirajgaonkar A.J,(2010), "Engineering Fluid Mechanics", SCITECH Publication
2. Ojha C.S.P.,Berndtsson P., and Chandramouli P.N.,(2010), "Fluid Mechanics and Machinery", ", Oxford University Press
3. Srivastava R.,(2015), "Flow through Open Channels", Oxford University Press

Surveying (CVUA22203)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Course Objectives:

1. To impart knowledge about principles of surveying, linear/angular measurement methods, bearing and leveling.
2. To impart knowledge about different methods of survey such as traversing, tachometry.
3. To impart knowledge about elements of different types of curves and surveying applications in setting out of curves, buildings, drainage lines, canals.
4. To impart knowledge about modern surveying techniques such as Total station, GPS, Remote sensing and GIS

Course Outcomes: Upon completion of the course, students will be able to,

1. Plot traverse using compass and plane table in horizontal plane and Determine angle and distance by using compass and plane table.
2. Perform levelling for a Road Project and Draw L-section, Plan and Cross-section for the same
3. Perform traversing using a Theodolite.
4. Determine reduced level of points using Tacheometry and draw a contour map
5. Design and set out horizontal curve on ground.
6. Explain concept, advantages and limitations of Remote Sensing, GPS and GIS

Unit I: Compass and Plane Table Surveying

Introduction to Surveying: Definition, object, uses, classification, principle of surveying. Different terms used in surveying. Types of scales.
Compass 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.
Plane Table Surveying: 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

Levelling: Introduction to levelling, Types of levelling, Construction and use of auto 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

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

Unit IV: 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. Study and use of Electronic Tacheometer (Total station) types, functions (remote elevation measurements, remote distance measurements, area measurement).
Setting-Out Works - buildings, maintaining verticality of tall buildings, sewer lines, bridges and tunnels.

Unit V: Curves

Introduction to horizontal and vertical curves (no numerical and derivations to be asked on vertical curves and reverse curves), different types and their applications, simple and compound circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord and offsets from chords produced. 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 VI: Space Based Positioning System (SBPS), Remote Sensing and Geographical Information System (GIS)

Satellite based positioning systems (SBPS): SBPS systems - GPS, Glonoss, Galileo, NavIC, Compass, etc. and their features, Segments of SBPS (Space, Control and User), role in SBPS in surveying
Remote Sensing: Introduction & definition, different platforms used, types, advantages & limitations, and applications of remote sensing
Geographical Information System (GIS): Introduction & definition, different components, types of data (spatial and non-spatial), GIS applications, Errors in GIS

Practicals

List of practicals – Minimum 8 (All projects are mandatory):

1. Measurement of magnetic bearings of sides of a polygon, correction for local attraction and calculations of true bearings using prismatic compass.
2. Plane table survey by Intersection method.
3. Differential levelling with at least three change points using digital/auto level.
4. Measurement of horizontal and vertical angles using vernier Theodolite by repetition method.
5. Finding horizontal and vertical distance using Tachometer.
6. Setting out a building from a given foundation plan (minimum six co-ordinates).
7. Setting out a circular curve by Rankine's method of deflection angles.
8. Measurement of irregular area by digital planimeter
9. Practical based on measurement with total station (angles, distance, remote elevation measurements, and remote distance measurements)

10. Determination of coordinates of a traverse using Global Positioning System (GPS)
11. Project I: Road project using Auto/Digital level for a minimum length of 200 m including fixing of alignment, Profile levelling, cross-sectioning, plotting of L section and Cross Section. (One A-1sheet including plan, L-section and any three typical Cross-sections)
12. Project II: Theodolite traversing: Plotting traverse and finding out its area using Vernier/Electronic Theodolite
13. Project III: Radial contouring: Plotting of contours from two stations minimum 60m to 100m apart.

Oral/Practical Exam based on Practicals.

Textbooks:

1. R. Subramanian, (2007),"Surveying and Levelling", Oxford University Press
2. Dr. B.C. Punmia, Ashok K. Jain, Arun K. Jain, (2005) "Surveying Vol. I and Vol. II", Laxmi Publications Pvt Limited
3. N.N. Basak, (2014),"Surveying and Levelling", McGraw Hill Education
4. S. S. Bhavikatti, (2010), "Surveying and Levelling", I.K. International Publishing House Pvt. Limited

Reference Books:

1. J. Uren, W.F. Price, (2010), "Surveying for Engineers", Palgrave Macmillan
2. S.K. Duggal, (2013), "Surveying Vol. Iand Vol. II", McGraw Hill Education
3. James McMurry Anderson, James M Anderson, Edward M Mikhail, (1998), "Surveying: Theory and Practice", McGraw-Hill Education
4. Russell C. Brinker, (2013), "The Surveying Handbook", Springer US

Department of Civil Engineering

Geotechnical Engineering (CVUA22204)

Teaching Scheme	Examination Scheme						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	25	-	125

Course Objectives::

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

Course Outcomes: Upon completion of this course, students 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, Rock mass classification, Laboratory methods to determine strength of rocks, Determination of Bearing capacity

Practicals

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

1. Determination of water content and specific gravity ofsoil
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.

Oral Exam based on Practicals.

Text books:

1. Punmia B. C, (2017), "Soil Mechanics and Foundation Engineering". Laxmi Publications.
2. Shashi K. Gulati and Manoj Datta (2018), "Geotechnical Engineering", Tata McGraw Hill.
3. Murthy, V. N. S., (2000), "Principles of Soil Mechanics and Foundation Engineering", UBS Publishers
4. Mukherjee, P. K. (2013), "A Text Book of Geology", World press Publishers.

Reference books:

1. Terzaghi and Peck (1996), "Soil mechanics and engineering Practice" John Wiley & Sons
2. Joseph. E. Bowles (2001), "Physical and Geotechnical Properties of Soils", International Students Edition
3. Das B. M. (2010), "Principles of Geotechnical Engineering", Cengage Learning

Mechanics of Solids II (CVUA22205)

Teaching Scheme	**Examination Scheme**						
Credits: 3 Lecture (L): 3 hrs./week Tutorial (T): 0 hr./week Practical (P): 0 hr./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	20	30	20	30	-	-	100

Course Objective:

1. To prepare the students to analyze indeterminate beams, trusses and frames having degree of indeterminacy up to two.

Course Outcomes: Upon completion of the course, students will be able to,

1) Analyze the determinate beams using the concept of Influence Line Diagram and Analyze three hinged arches
2) Analyze the indeterminate beams using Force Method, Three Moment Theorem and Castigliano's II Theorem
3) Analyze the indeterminate beams and frames using Slope-Deflection Method
4) Analyze the indeterminate beams and frames using Moment Distribution Method
5) Analyze the indeterminate beams and frames using Stiffness Method.
6) Understand the concepts of plastic analysis and perform the analysis of beams and frames using equilibrium and mechanism methods

Unit I– Influence Line Diagram and Three Hinged Arches

Influence Line Diagram: Basic concepts, influence line diagram for reactions, shear and bending moment for simply supported and overhanging beams and Trusses
Three Hinged Arches: Concept, analysis of parabolic and semicircular arch with supports at same and different levels. Horizontal thrust, radial shear and normal thrust for parabolic and semicircular arch.

Unit II- Three Moment Theorem, Force method and Castigliano's Second Theorem

Static and Kinematic redundancy of beams, trusses and frames.
Clapeyron's Theorem of Three Moments, Application of the theorem to indeterminate beams with settlement of supports having static indeterminacy not more than 2.
Castigliano's Second Theorem, Application of the theorem to indeterminate beams having static indeterminacy not more than 2.
Force Method-Application to indeterminate beams with static indeterminacy of 2.

Unit III–Slope Deflection Method

Introduction to Slope Deflection Method, sign conventions, fixed end moments, development of slope deflection equations, Application to indeterminate beams and non-sway Frames having degree of Indeterminacy not more than 2.

Unit IV– Moment Distribution Method

Introduction to Moment Distribution Method, Carry over moment, distribution factors, modification of stiffness for simple ends, Application to indeterminate beams and non-sway frames having degree of indeterminacy not more than 2.

Unit V–Stiffness Method
Fundamental concepts, formulation of stiffness matrix, application to indeterminate beams and non-sway frames using member approach. (involving not more than 2 unknowns)
Unit VI – Introduction to Plastic Analysis
Introduction to plastic theory: Plastic hinge concept, plastic section modulus, shape factor, plastic collapse load, Collapse mechanism. Theorem of Plastic Analysis: Static/lower bound theorem, Kinetic/upper bound theorem, plastic analysis of beams and portal frames by equilibrium and mechanism methods.
Text books: 1. S.B. Junnerkar and H.J. Shah, (2015), "Mechanics of Structures-Vol II", Charotar Publishing House 2. B.C.Punmia, Ashok kumar Jain and Arun Kumar Jain, (2017), "Theory of Structures", Laxmi Publications (P) Ltd. 3. S.Ramamrutham and R. Narayan , (2017), "Theory of Structures", Dhanpat Rai Publishing Company 4. S.S.Bhavikatti (2018), "Structural Analysis-II", Vikas Publishing House Pvt. Ltd.
Reference books: 1. Devdas Menon (2009), "Advanced Structural Analysis" Narosa Publishing House, Mumbai 2. R.C.Hibbler, (2017) , "Structural Analysis" , Pearson Publications 3. Dr. A.S.Meghre and S.K.Deshmukh, (2016), "Matrix Methods of Structural Analysis", Charotar Publishing House 4. M.R.Shiyekar, (2017), "Limit State Design in Structural Steel", PHI Learning Private Limited.

Department of Civil Engineering

Irrigation Engineering - I(CVUA22206)

Teaching Scheme	**Examination Scheme**						
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): 1 hr./week Practical (P): NA	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	-	-	-	50	50

Course Objectives:

1. To understand various components of hydrologic cycle
2. To apply hydrological principles to calculate runoff
3. To understand the concepts of irrigation and water requirement of crops
4. To understand concept of groundwater movement and storage.

Course Outcomes: Upon completion of the course, students will be able to,

1. Explain hydrologic cycle and analyze precipitation, infiltration, evaporation, transpiration and evapotranspiration
2. Explain Rainfall-Runoff relationship and Compute peak flood using unit hydrograph method, rational method and flood frequency analysis.
3. Explain concepts of groundwater movement and storage, and estimate well yields under steady flow condition
4. Compare methods of irrigation and estimate water requirement of crops

Unit I: Hydrology

Introduction: Hydrologic cycle, application of hydrology (water supply, agriculture, navigation, flood control, droughts, hydraulic structures, urban & rural development, energy, environmental aspects).
Precipitation: Types and forms of precipitation, measurement, analysis of precipitation data, mass rainfall curves, intensity-duration curves, concepts of depth-area-duration analysis, frequency analysis (frequency of point rainfall and plotting position), computation of mean rainfall (arithmetic mean method, Thiessen's polygon, isohyetel)
Evaporation and Infiltration: Elementary concepts, factors affecting, measurement of evaporation, transpiration, evapo-transpiration (consumptive use) and infiltration (Horton's method and infiltration indices)
Stream Gauging: Selection of site, various methods of discharge measurement (velocity-area method, dilution method, slope-area method). Advance techniques / equipment's used in gauge discharge measurements such as Radar, Shaft Encoders, Bubblers System, ADCP(Acoustic Doppler Current Profiler)

Unit II: Runoff & Floods

Runoff: Factors affecting runoff, rainfall-runoff relationships, runoff hydrograph, unit hydrograph, theory, S-curve hydrograph, use of unit hydrograph.
Floods: Estimation of peak flow, rational formula and other methods, frequency of point rainfall and plotting position, flood frequency analysis Gumbel's method, design floods.

Unit III: Groundwater Hydrology

Occurrences and distribution of ground water, specific yield of aquifers, movement of ground water, Darcy's law, permeability, safe yield of basin. Hydraulics of wells under steady flow condition in confined and unconfined aquifers, specific capacity of well, well irrigation: tube wells, open wells and their construction

Unit IV: Irrigation

Introduction: definition, functions, advantages and necessity, methods of irrigation, surface irrigation, subsurface irrigation, micro-irrigation, lift irrigation

Water Requirements of Crops: Soil moisture and crop water relationship, factors governing consumptive use of water, principal Indian crops, their season and water requirement, crop planning, agricultural practices, calculations of canal and reservoir capacities – duty, delta, irrigation efficiency.

Assessment of Canal Revenue:

Various methods (Area basis or crop rate basis, volumetric basis, seasonal basis, composite rate basis, permanent basis or betterment levy basis)

Termwork

List of Tutorials: Following are the assignments to be completed: (any 8)

1. Analysis of rainfall data (Double mass curve technique/Missing rainfall data).
2. Marking catchment area on a topo-sheet and working out average annual precipitation and determining yield by various methods.
3. Analytical method of measurement of infiltration
4. Determination of peak flood discharge in a basin using unit hydrograph technique.
5. Flood frequency studies assuming Gumbel's extreme value distribution.
6. Application of HEC-RAS for Hydrologic routing.
7. Determination of water requirement of crop/frequency of irrigation
8. Determine yield of an open well.
9. Review of case study of an Irrigation Project
10. Video demonstration of evaporation by Pan Evaporimeter and/or infiltration by Infiltrometer

Text Books

1. K. Subramanyam, (2013) "Engineering Hydrology", Tata McGraw Hill.
2. Dr. P. Jaya Rami Reddy, (2005), "Hydrology", Laxmi Publications Pvt. Limited
3. P. N. Modi, (2008), "Irrigation, Water Resources, and Water Power engineering", Standard Book House.
4. S. K. Garg, (2009), "Irrigation Engineering and Hydraulic Structures", Khanna Publishers
5. Dr. B. C. Punmia, Dr. Pande Brij Basi Lal, Ashok Kumar Jain, Arun Kumar Jain, (2009),"Irrigation and Waterpower Engineering", Laxmi Publications Pvt. Limited

Reference books:

1. G.L. Asawa, (2006), "Irrigation and Water Resources Engineering", New Age International (P) Ltd. Publishers
2. David Keith Todd, (2006), "Groundwater Hydrology", Wiley-India
3. M.J. Deodhar, (2008), "Elementary Engineering Hydrology", Pearson Education
4. C. Shekhar P. Ojha, Ojha, R. Berndtsson, P. Bhunya, (2008), "Engineering Hydrology", Oxford University Press.

Department of Civil Engineering

Data Analytics (CVUA22207)

Teaching Scheme	**Examination Scheme**						
Credits: 2 Lecture (L): 1 hr./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	CIE	ISE	SCE	ESE	PR/OR	TW	Total
	-	-	-	-	-	50	50

Course Objectives:

1. To introduce conceptual understanding using simple and practical examples and make you comfortable using analytics in your career. This course will make you know how to work with real data and choose the right methodology to correctly interpret the result.

Course Outcomes: Upon completion of the course, students will be able to,

1. Apply statistical concepts and probability theory to analyze data that can assist present and future business managers in making better decisions.
2. Develop both one-and two-tailed null and alternative hypotheses and that can be tested in a business setting by examining the rejection and non-rejection regions in light of Type I and Type II errors.
3. Calculate the coefficient of determination and confidence intervals to measure the fit for regression models

Unit I: Introduction to Data Analytics and Probability Theory

Classification of data analytics, importance of data analytics, levels of data, types of variables, central tendency: mean, mode, percentile, and dispersion: skewness, kurtosis, range, variance, coefficient of variation, probability distributions: Binomial, Poisson, Hypergeometric, Exponential, Normal, and central limit theorem.

Unit II: Sampling Distributions and Hypothesis Testing

Sampling distributions: sample mean, sample proportion and sample variance, Hypothesis testing: p-value, critical value and confidence interval value, type-I and II errors, test for population mean, proportion and variance.

Term Work

List of Experiments- (Any 8)

1. Assignment of central tendency and dispersion.
2. Assignment on probability distributions.
3. Assignment on sampling distribution -I.
4. Assignment on sampling distribution - II
5. Assignment on testing of hypothesis for population mean
6. Assignment on testing of hypothesis for population proportion
7. Assignment on testing of hypothesis for population variance
8. Assignment on simple linear regression
9. Assignment on multiple linear

Textbooks:

1. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2010.
2. P.V. Sukhatme, Sampling Theory of Surveys with Applications, Indian Society for Agricultural Statistics, New Delhi.
3. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, Wiley, Year: 2018, ISBN: 1119409535
4. Ken Black, Business Statistics for Contemporary Decision Making, 6th Edition, Wiley

Reference books:

1. Douglas C. Montgomery, Design and Analysis of Experiments, John Wiley, Year: 2001
2. Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Introduction to Linear Regression Analysis, Wiley, 2012