



I Semester:

S. No.	Course Code	Course Title	Category	Type	Credit	L	T	P
1.	22CET101	Engineering Drawing and Sketching	PC	Theory	2	1	0	2
2.	22CYT101	Engineering Chemistry	PC	Theory	3	3	0	0
3.	22HST101	Basic Economics	PC	Theory	2	2	0	0
4.	22HST102	English Communication Skills (Basic)	PC	Theory	2	2	0	0
5.	22MAT101	Mathematics I	PC	Theory	4	3	1	0
6.	22MET101	Introduction to Mechanical Systems	PC	Theory	2	2	0	0
7.	22CHT101	Introduction to Chemical Engineering	PC	Theory	3	3	0	0
8.	22CHT102	Chemical Engineering Thermodynamics-I	PC	Theory	4	3	1	0
9.	22CYP102	Engineering Chemistry Lab	PC	Lab	1	0	0	2
10.	22HSP104	Communication Skills lab (Basic)	PC	Lab	1	0	0	2
11.	22MEP102	Product Realization through Manufacturing	PC	Lab	1	0	0	2
Total						25		



SEMESTER – I



- 1. Subject Code: 22CHT101** **Course Title: Introduction to Chemical Engineering**
2. Contact Hours: L:3 T:0 P:0
3. Credits: 3 Semester: I
4. Pre-requisite: Nil.
5. Objective: To introduce the basic features and concepts of Chemical Engineering to the students.
6. Course Outcomes: Upon completion of this course, the students will be able to:
- Understanding the chemical engineering and its future prospects
 - To acquire knowledge of chemical process industries
 - To acquire knowledge of basic principles of chemical engineering
 - Knowledge of new developments in chemical engineering and career prospects
7. Details of Course:

Unit No.	Contents	Contact Hours
1.	Introduction: Definition of chemical engineering, historical perspective and contribution; job description and attributes of a chemical engineer, chemical engineering and its seamless integration with other sciences and engineering disciplines; Societal needs and role of chemical engineer for society development; Economic scale of production; Waste utilization and recycle, sustainable technology; Employment opportunities, knowledge resources; Frontiers & future roadmap; Challenges of chemical engineering practice.	8
2.	Chemical Process Industries: Framework of chemical industry and its classification, Evolution of chemical industries, Technological developments in major challenges; Chemical industries structure and segments of chemical industry, raw material and production pattern; Petroleum, petrochemical and fertilizer industry integration; Cleaner and greener technologies.	8
3.	Basic Principles of Chemical Engineering: Basic principles of chemical processes, unit processes and unit operations and various routes to produce chemicals; Material and Energy balances; Basic concept of mass, energy, and momentum transport; Equilibrium and rate-based processes.	8
4.	Reaction engineering and reactors; Measuring instruments, automation, and control; Concept of equipment design, modelling and simulation.	8
5.	Process Engineering Design Software (Aspen Plus, Hysys, Matlab, etc.), Engineering computation using Microsoft Excel, Process Flow and Instrumentation Diagram, Important developments and milestones in chemical engineering, R&D in chemical engineering; Recent advances in Chemical Engineering	8

8. Books:



(A) Text Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Nnaji, U., "Introduction to Chemical Engineering: For Chemical Engineers and Students", Wiley.	2019
2	Solen, K.A. and Harb, J.N., "Introduction to Chemical Engineering Tools for Today and Tomorrow", 5 th edition, John-Wiley.	2011
3	Denn, M.M., "Chemical Engineering: An Introduction", Cambridge University Press.	2012

(B) Reference Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Pushpavanam, S., "Introduction to Chemical Engineering", PHI Learning Pvt. Ltd.	2012
2	Ghosal, S.K., Sanyal, S.K., Datta, S., "Introduction to Chemical Engineering", Tata McGraw Hill.	1997
3	Himmelblau D.M. and Riggs J.B., "Basic Principles and Calculations in Chemical Engineering", 8 th Edition, PHI.	2014
4	Austin, G. T., "Shreve's Chemical Process Industries", 5 th Edition, McGraw-Hill, Company.	1984



- 1. Subject Code: 22CHT102 Course Title: Chemical Engineering Thermodynamics-I**
2. Contact Hours: L:3 T:1 P:0
3. Credits: 4 Semester: I
4. Pre-requisite: Nil.
5. Objective: To learn the principles of work and energy and understand the laws of thermodynamics to apply in industries.
6. Course Outcomes: Upon completion of this course, the students will be able to:
- To understand the basic concepts and first law of thermodynamics
 - To understand the PVT behaviour of fluids
 - To understand the heat effects
 - To understand the second law of thermodynamics
 - To understand the concepts of statistical thermodynamics

7. Details of Course:

Unit No.	Contents	Contact Hours
1.	Introduction: Definitions and Concepts: System, Surroundings, Property, Energy, Work, Thermodynamic equilibrium, stability of equilibrium states. Zeroth Law of Thermodynamics: Perfect gas scale. First Law of Thermodynamics: First law of Thermodynamics and Its Applications, First law analysis of processes, Control mass and control volume analysis, Steady state, and Transient state flow processes.	8
2.	Volumetric Properties of Pure Fluids: PVT behavior of pure substances, virial equation and its applications, cubic equations of state, generalized correlations for gases and liquids.	8
3.	Heat Effects: Sensible heat effects, heat effects accompanying phase changes of pure substances, standard heats of reaction, formation and combustion, effect of temperature on the standard heat of reaction.	8
4.	Second law of Thermodynamics: Limitation of First Law, Kelvin-Planck and Clausius Statements, Reversible and Irreversible Processes, Carnot cycle, Entropy, Second Law analysis of a control volume. Exergy.	8
5.	Basic Concepts & Application of Statistical Thermodynamics: Need of statistical thermodynamics, Macrostates and microstates, Degenerate energy levels, Bose-Einstein statistics, Fermi-Dirac statistics, Entropy, Ideal gas, Maxwell speed distribution, Einstein model of solid, Debye model of solid	8



8. Books:

(A) Text Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Smith, J. M., Van Ness, H. C. and Abbott, M. M., "Introduction to Chemical Engineering Thermodynamics", 8 th Ed., McGraw-Hill.	2019
2	Rao, Y. V. C., "An Introduction to Thermodynamics," University Press.	2004

(B) Reference Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Cengel, Y.A., "Thermodynamics: An Engineering Approach," 9 th Ed., McGraw-Hill.	2019
2	Nag, P.K., "Engineering Thermodynamics", 6 th Ed., McGraw-Hill	2017

**II Semester:**

S. No.	Course Code	Course Title	Category	Type	Credit	L	T	P
1.	22CET102	Environmental Science	PC	Theory	2	2	0	0
2.	22CST101	Programming with Python	PC	Theory	2	2	0	0
3.	22EET101	Basic Electrical and Electronics Engg	PC	Theory	3	3	0	0
4.	22MAT102	Mathematics II	PC	Theory	4	3	1	0
5.	22PHT101	Classical Physics	PC	Theory	3	3	0	0
6.	22CHT103	Chemical Process Calculations	PC	Theory	4	3	1	0
7.	22CHT104	Process Instrumentation	PC	Theory	3	3	0	0
8.	22CSP102	Programming with Python Lab	PC	Lab	1	0	0	2
9.	22ECP101	Electronics Engineering Lab	PC	Lab	1	0	0	2
10.	22EEP102	Electrical Engineering Lab	PC	Lab	1	0	0	2
11.	22PHP103	Classical Physics Lab	PC	Lab	1	0	0	2
12.	ICP101	CREATIVE ARTS / SPORTS / NSS			1			
13.	ICP102	DISCIPLINE			1			
Total					27			



SEMESTER – II

**1. Subject Code: 22CHT103**

2. Contact Hours: L:3 T:1 P:0

3. Credits: 4 Semester: II

4. Pre-requisite: Nil.

5. Objective: To introduce to the fundamental principles of chemical process analysis.

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

- i. Correlate between different Unit systems and their conversions for various process variables.
- ii. Learn how to perform materials balance in any chemical processes with or without chemical reactions.
- iii. Apply the gas laws to solve problems related to ideal gases and mixtures.
- iv. Apply the energy balance to solve particular problems with and without chemical reactions
- v. Solve de-coupled and coupled equations of mass and energy balance, numerically and computationally.

7. Details of Course:

Unit No.	Contents	Contact Hours
1.	Introduction to Chemical Engineering Calculations: Conversion of Units, dimensional consistency and data analysis, significant figures, precision and accuracy, concepts of molarity, molality, normality, ppm, weight fraction, mole fraction and volume fraction, density and specific gravity, process variables and principles of stoichiometry.	10
2.	Materials balance with and without chemical reactions: Flowchart, mole and mass balance for multi-component systems under: steady and unsteady state, single-phase and multiphase, material balances in processes including recycle, bypass and purge, Steady state material balances for reactions: species and elemental balances, combustion reactions, concept of limiting, excess reactants, fractional conversion and percentage of conversion, yield, ultimate and proximate analysis of fuels, excess air, air-fuel ratio calculations.	10
3.	Thermodynamics of Multi-phase System: Vapor-liquid equilibrium: Ideal and real gas, equation of state, Bubble point, dew point calculations, Phase diagram, Gibbs phase rule, Antoine equation, phase equilibria of vapour-liquid, solid-liquid and immiscible liquid-liquid systems.	10
4.	Energy Balance with and without Chemical Reactions: De-Coupled and coupled mass and energy balances, calculation of enthalpy changes, steady state mass and energy balance with and without reactions, heats of solution and mixing, Use of Psychometric chart, and steam table, thermochemistry, Hess's law of summation- heat of formation, Hess's Law and heats of combustion, Unsteady state material and energy balances, isothermal and adiabatic processes, Numerical and computation approach to solve problems with simultaneous mass and energy balance.	10



8. Books:

(A) Text Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Himmelblau, D., Riggs, J., "Basic Principles and Calculations in Chemical Engineering", 8 th Ed., Pearson.	2012
2	Hougen, O.A, Watson, K.M and Ragatz R.A, "Chemical Process Principles: Part .1 (Chemical Process Principles: Material and Energy Balances)", 2 nd Ed., CBS	2004

(B) Reference Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Bhatt B.I, and Vora S.M, "Stoichiometry", 4 th Ed., McGraw-Hill.	2004
2	Felder, R.M., Rousseau, R.W., and Bullard, L.G., "Elementary Principles of Chemical Processes", 4 th Ed., John Wiley and Sons.	2016
3	Narayanan, K.V., and Lakshmikutty, B., "Stoichiometry & Process Calculations", 2 nd Ed., Prentice Hall Publishing.	2016
4	Chopey, N., Hicks, T., "Handbook of Chemical Engineering Calculations", 4 th Ed., McGraw-Hill Education.	2012

**1. Subject Code: 22CHT104**

2. Contact Hours: L:3 T:0 P:0

3. Credits: 3 Semester: II

4. Pre-requisite: Nil.

5. Objective: To study various types of instruments in terms of fundamental concepts, functional elements, calibration, and characteristics.

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

- i. To understand scientific concepts, principles, and theories appropriate to instrumentation.
- ii. Students developed an understanding of various process instruments, control valves, pressure measurement, temperature measurement, flow measurement devices.
- iii. Students gained understanding of the performance criteria of instruments (range: precision, accuracy, sensitivity and range ability).
- iv. To understand scientific concepts, principles, and theories appropriate to instrumentation.
- v. Students developed an understanding of various process instruments, control valves, pressure measurement, temperature measurement, flow measurement devices.

7. Details of Course:

Unit No.	Contents	Contact Hours
1.	Introduction: Application of instrument systems, functional elements of a measurement system, classification of instruments, standards and calibration, instrument symbols & tag numbering system.	6
2.	Temperature Measurement: Temperature scales, temperature measuring instruments, liquid in glass thermometer, bimetallic thermometer, resistance temperature detectors (RTD), thermocouples, pyrometry.	4
3.	Pressure Measurement: Measurement of moderate pressure, high pressure and low pressure (vacuum), calibration and standardization.	3
4.	Flow Measurement: Positive displacement meters, variable head meters, variable area meters (rotameters), Weirs and notches, pitot tube, electromagnetic flow meter, hot wire anemometer, ultrasonic flow meters, laser Doppler anemometer.	5
5.	Acoustics Measurement: Characteristics of sound, Sound pressure, Power and intensity levels, Loudness, Typical Sound Measuring systems & Microphones.	3
6.	Static characteristics of instruments: Liquid level, pH, viscosity, conductivity, humidity, gas composition, and nuclear radiation, Errors and uncertainties in performance parameters, propagation of uncertainties in compound quantities, static performance parameters.	6
7.	Dynamic characteristics of instruments: Formulation of system	5



	equations, dynamic response, compensation, Transducers, building blocks of an instrument, Control centre, Instrumentation diagram, online instrumentation in modern plants.	
8.	Control Valves: Valve terminology, Valve capacity, Valve rangeability, Valve type based on body Design: Globe bodies, Angle, Needle, Ball, Eccentric rotating, Plug, Butterfly, Diaphragm, Pinch, Drag flow characteristic, Trim design, Mechanical feature, Actuator, Pneumatic types, Electric types, Electro-hydraulic types. Positioner-Pneumatic, Electro pneumatic, Positioner features & accessories, Control Valve Accessories-Testing procedure of control valve: CV and Rangeability (Valve sizing- initial level), Pressure Relieving Devices: Relief valve, Safety valves and Rupture discs.	6
9.	Signal Converting Elements: Pneumatic to electrical convertors, Electric to Pneumatic convertors, Voltage to Current convertor, Current to Voltage convertor, Frequency to voltage & voltage to Frequency convertor, Transmitter and Transducer signals.	4



8. Books:

(A) Text Books

S. No.	Authors / Name of Book / Publisher	Year of Publication
1	Eckman, D. P., "Industrial Instrumentation," Wiley Eastern	2004
2	Nakra, B.C. and Chaudhry, K.K., "Instrumentation, Measurement and Analysis," 2 nd Ed., Tata McGraw Hill, New Delhi.	2006

(B) Reference Books

S. No.	Authors / Name of Book / Publisher	Year of Publication
1	Patranabis, D., "Principles of Industrial Instrumentation," Tata McGraw Hill, New Delhi.	2007
2	E.O. Doebelin, "Measurement Systems", McGraw Hill, 4 th Ed.	1990
3	Lipták, B.G., "Instrument Engineers' Handbook: Process Measurement and Analysis," Vol 1 & 2, CRC Press.	2003

S. No.	Course Code	Course Name	Category	Type	Credit	L	T	P
1	CET-201	Construction Materials	PC	Theory	3	3	0	0
2	CET-202	Fluid Mechanics	PC	Theory	4	3	1	0
3	CET-203	Surveying	PC	Theory	3	3	0	0
4	CET-204	Mechanics of Solids	PC	Theory	4	3	1	0
5	CET-205	Engineering Geology	PC	Theory	2	2	0	0
6	MAT-206	Mathematics III	PC	Theory	4	3	1	0
1	CEP-207	Construction Materials Lab	PC	Lab	1	0	0	2
2	CEP-208	Fluid Mechanics Lab	PC	Lab	1	0	0	2
3	CEP-209	Surveying Lab	PC	Lab	1	0	0	2
4	CEP-210	Geology Lab	PC	Lab	1	0	0	2

UG/PG: UG	Department: Civil Engineering
Course Code: CET 201	Course Name: Construction Materials
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus :

Stones- classification, natural bed, tests and preservation of stones; Bricks- raw materials, drying- burning, strength and durability, mortar for masonry, tiles; Timber- classification, seasoning, application, defects in timbers; Cement- chemical composition, manufacturing, hydration, properties of cement compounds, types of cement; Concrete- proportioning, transportation and placing, sampling and acceptance for quality control, fresh concrete: batching, mixing, workability, effect of admixture, influence of aggregate on properties of concrete, hardened concrete: mechanical properties, corrosion, chloride and sulphate attack, water-cement ratio, porosity, curing of concrete, concrete mix design; Steel- types, properties, structural steel selection; Green materials- concept of being green, concrete vs steel vs timber, low e- glasses, high reflectance material, concepts of reduce-reuse and recycle in construction; Advanced materials: newer and improved materials for construction, steel having greater ductility, tensile strength and corrosion resistance, high performance concrete, self compacting concrete, chemicals, epoxies, latexes and bonding agents for repairs, geo-textiles and geo-membranes.

Text books

1. Engineering Materials Rangwala SC
2. Handbook of Concrete Mixes SP23, BIS Delhi
3. Concrete technology by A. M. Neville, Pearson education India
4. Concrete Technology by M.S. Shetty, S. Chand Ltd. India
5. Sustainable Construction: Green Building Design and Delivery by C. Kibert, Wiley pub.

Reference Books

1. National Building Code of India, BIS, Delhi.
2. Repair and Rehabilitation of RCC buildings CPWD, Delhi

UG/PG: UG	Department: Civil Engineering
Course Code: CET 202	Course Name: Fluid Mechanics
Credit: 4	L-T- P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Properties of Fluids, Newtonian and non-Newtonian fluids, Properties of Fluids continued, Examples/Numerical Problems, Fluid Statics-Introduction and Pressure Measurement, Fluid Statics-Hydrostatic Forces on submerged surfaces, Fluid Statics-Buoyancy and Floatation, Problems on Fluid Statics, Flow-Classifications, terminologies, concepts, Flow-Classifications, terminologies, concepts (Contd.), Forces on a Fluid particle and Development of various equations including N.S. equations, Continuity Equation , Energy Equation, Momentum Equation, Problems of Kinematics of Fluid flow, Problems on Continuity equation/ Energy equation/ Momentum equations, Flow Measurements in Pipes, Flow Measurements in Open Channels, Problems on Flow Measurements, Major and Minor Losses in pipe flow/ Darcy-Weisbach equation, Hydraulic Gradient, TEL etc., Analysis Pipe network and simple problems, Notches & Weirs, Orifices & Mouth pieces, Flow through nozzles & Jets, and problems, Dimensional Analysis – Introduction, Dimensional Analysis-Rayleigh's Method, Dimensional Analysis-Buckingham's PI Method, Similitude, Problems on Dimensions Analysis & Similitude, Flow Classification in pipes: Laminar Flow, turbulent flow & Brief Introduction to Boundary Layer Theory, Flow between parallel plates (Plain Poiseuelle Flow/ Couette Flow), Laminar Flow Contd. (Hagen-Poiseuelle Flow), Open Channel Flow, Manning's Formula/ Chezy's formula and basics terminology, Most efficient prismatic channel sections, Open Channel Flow Problems, Review of Course/ Problems.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Fluid Mechanics by Streeter, Wylie and Bedford. 2. Principles of Fluid Mechanics by M.K. Natarajan. 3. Fluid Mechanics Thorough Problems by R.J. Garde 4. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar 5. Fluid Mechanics by A.K. Jain. 	

UG/PG: UG	Department: Civil Engineering
Course Code: CET 203	Course Name: Surveying
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	
<p>Syllabus</p> <p>Basic principles, Maps, their scales, referencing system and uses, plotting accuracy; Map coordinate system; projections and their types, Compass and other instruments; Measurement of distances and directions; Theodolite, Temporary and permanent adjustments of Theodolite, Traversing, Adjustment of survey data; Computation of coordinates, Levelling, Tacheometry, Trigonometrical levelling, Introduction to Total Station Plane Table survey, , Contouring, Curves.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Surveying Instruments by James M.Anderson & Edward M.Mikhail 2. Surveying Vol. I & II by S.K.Duggal 2. Surveying, by A. M. Chandra, Narosa Pub. House., New Delhi 	

UG/PG : UG	Department: Civil Engineering
Course Code: CET204	Course Name: Mechanics of Solids
Credit: 4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Moment of inertia of an area; Polar moment of inertia; Perpendicular and parallel axes theorems; Principal axes and principal moment of inertia; Direct stress and strain; Shear stress and strain; Hook's law; Young's modulus; Modulus of rigidity; Pure shear; Complex stress system; Poisson's ratio; Relationships between elastic constants; Theory of simple bending; Support reaction, shear force and bending moment diagrams in determinate beams and plane frames; Bending and shear stress distribution in beams; Combined bending and direct stresses; Buckling of columns; Introduction to torsion, Method of joints and method of section for analysis of determinate truss.

Books

1. Mechanics of Structures, Vol. I by S.B. Junnarkar & H.J. Shah
2. Strength of Materials by William Nash & Merle Potter
3. Elementary Structural Analysis by J.B. Wilbur & C.H. Norris

UG/PG: UG	Department: Civil Engineering
Course Code: CET 205	Course Name: Engineering Geology
Credit: 2	L-T-P: 2-0-0
Pre-requisite course:	
<p>Syllabus</p> <p>Physical geology and mineralogy; An introduction to rocks, Classification of rocks and their uses as building and road materials; properties of rock materials, water content, porosity, density and related, point load strength index of rocks, strength of rock materials in triaxial compression, Historical geology; Structural geology: Folds, faults, unconformity etc.; Engineering geology: Geological investigations at dam, tunnel and bridge sites and influence of various structures. Precautions against faulting, folding, bedding planes, joints, cracks, fissures, permeability and ground water condition.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Leonard Obert and Wilbur I. Duvall, "Rock Mechanics and Design of Structures in Rock", John Wiley and Sons, Inc., New York. 2. Billings, "Structural Geology". 3. Price, David George, "Engineering Geology: Principles and Practice", Springer. 4. D. Venkat Reddy, "Engineering Geology", Vikas Publishers. 5. Legget, Robert F., and Karrow, Paul F, "Handbook of geology in civil engineering", McGraw-Hill Book Company. 	

UG/PG: UG	Department: Civil Engineering
Course Code: MAT 206	Course Name: Mathematics III
Credit: 4	L-T-P: 3-1-0
Pre-requisite course:	
<p>Syllabus:</p> <p>Numerical Methods :</p> <p>Roots of Algebraic and Transcendental Equations: Bisection method, Regula-falsi method, Iteration method, Newton-Raphson method. Interpolation Finite Differences: Newton's forward and backward differences interpolation formulae, relations between forward and backward operators, Lagrange's interpolation formula,</p> <p>Probability and Statistics</p> <p>Formal concepts: sample space, outcomes, and events; random variable Probability, conditional probability, Bayes Theorem . Specific discrete and continuous distributions, e.g. Binomial, Poisson, Uniform, Exponential, Weibull, Normal distributions. Testing of hypothesis. Chi-Square test as a test of Goodness of fit.</p> <p>Corelation and Regression analysis.</p> <p>Linear Algebra</p> <p>Vector Spaces, Sub Spaces, Linear combinations, spanning sets, Basis and Dimensions, Linear Transformations. Rank and Nullity of linear Transformation. Representation of transformations by matrices. Eigen values and Eigen Vectors. Characterstics Polynomials, minimal polynomials. Cayley Hamilton's theorem</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. M.K.Jain,S.R.K. Iyengar and R.K.Jain,Numerical Methods for Scientific and Engineering Computation,Wiley Eastern Limited. 2. J N Sharma, Numerical methods for Engineers and Scientists, 2nd edition Narosa Publishing House New Delhi. 3. Hogg, R.V., & Craig, A.T., Introduction to Mathematical Statistics, 5th Ed.,Prentice-Hall, Inc., Englewood Cliffs, N.J., 1995. 4. Freund, W.J., Mathematical Statistics, 5th Ed., Prentice-Hall, Inc., Englewood Cliffs, N.J., 1994.. 5. Linear Algebra – K. Hoffman and R. Kunze. 	

UG/PG : UG	Department: Civil Engineering
Course Code: CEP 207	Course Name: Construction Materials Laboratory
Credit: 1	L-T-P: 0-0-2
Version:	Approved on:
Pre-requisite course: -	
<p>List of Experiments</p> <ol style="list-style-type: none"> 1. To determine crushing strength and water absorption of sample of stone. 2. To determine water absorption, compressive strength and efflorescence of bricks 3. To determine water absorption and crushing value of aggregate. 4. To determine fineness, specific gravity and consistency of cement 5. To determine setting times, and comp strength of cement 6. To determine abrasion and wet transverse strength of concrete tiles. 7. To determine workability of concrete in the lab 8. To design concrete mixes and determine compressive strength at 7days and 28 days. 	
<p>Books</p> <ol style="list-style-type: none"> 1. Relevant IS codes, BIS, Delhi 2. SP 23 Handbook of concrete mix design, BIS, Delhi. 	

UG/PG : UG	Department: Civil Engineering
Course Code: CEP 208	Course Name: Fluid Mechanics Laboratory
Credit: 1	L-T-P: 0-0-2
Version:	Approved on:
Pre-requisite course:	
<p>List of Experiments</p> <ol style="list-style-type: none"> 1. Experiments for Hydrostatics principles on a fluid. 2. Experiments on pressure measurement. 3. Experiments to study the flow through a variable area duct and verification of Bernoulli's energy equation. 4. Experiments for determination of coefficient of velocity & discharge for a Mouthpiece. 5. Experiments for determination of coefficient of velocity & discharge for an Orifice. 6. Experiments to determine the discharge coefficient for a V and rectangular notch. 7. Experiments on Flowmeter to determine the coefficient of discharge and coefficient of discharge for an obstruction flow meter namely orifice meter. 8. Experiments on Flowmeter to determine the velocity distribution for pipeline flow with a pitot static probe. 9. Experiments to determine coefficient of discharge for an obstruction flow meter e.g. venturi meter. 10. Experiments to determine the friction coefficients and head losses for pipes of different materials and diameters. 11. Experiments to determine the head loss (minor losses) in a pipe line due to sudden expansion/ sudden contraction/ elbows/ fittings / bend. 	
<p>Books</p> <ol style="list-style-type: none"> 1. Fluid Mechanics by Streeter, Wylie and Bedford. 2. Principles of Fluid Mechanics by M.K. Natarajan. 3. Fluid Mechanics Thorough Problems by R.J. Garde 4. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar 5. Fluid Mechanics by A.K. Jain. 	

UG/PG: UG	Department: Civil Engineering
Course Code: CEP 209	Course Name: Surveying Laboratory
Credit: 2	L-T-P: 0-0-2
Pre-requisite course:	
<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Introduction demonstration of surveying equipments 2. Introduction to different distance measurement methods and equipments like chains and tapes 3. Measurement of bearings using Compass 4. Measurement of angles and determination of local attraction using compass 5. Temporary adjustment of Theodolite 6. Measurement of horizontal using Theodolite 7. Measurement of vertical angles using theodolite 8. Compass Traversing 9. Theodolite traversing 10. Differential levelling using Dumpy level 11. Differential levelling using Tilting level 12. Contouring exercise 	
<p>Books/Manual</p> <ol style="list-style-type: none"> 1. Departmental Lab Manual 	

UG/PG: UG	Department: Civil Engineering
Course Code: CEP 210	Course Name: Geology Lab
Credit: 1	L-T-P: 0-0-2
Pre-requisite course:	
<p>List of Experiments</p> <ol style="list-style-type: none"> 1. Identification of minerals and rocks. 2. Determination of hardness. 3. Determination of strength of rock materials. 4. Determination of water content, porosity, density and related properties of rock materials. 5. Demonstration of structural discontinuities. 6. Geologic Map & Cross Section Field Project. 7. Outcrop Prediction. 8. Attitude Measurements, True and Apparent Dips. 	
<p>Books</p> <ol style="list-style-type: none"> 1. Leonard Obert and Wilbur I. Duvall, "Rock Mechanics and Design of Structures in Rock", John Wiley and Sons, Inc., New York. 2. Pamela J. Nelson "Geology Laboratory Manual". 3. David T. Allison, "Structural Geology Laboratory Manual". 4. Donal M. Ragan, "Structural Geology: An Introduction to Geometrical Techniques" Cambridge University. 	

S. No.	Course Code	Course Name	Category	Type	Credit	L	T	P
1	CET-221	Building Technology	PC	Theory	2	2	0	0
2	CET-222	Pipe & Channel Hydraulics	PC	Theory	4	3	1	0
3	CET-223	Advanced Surveying	PC	Theory	2	2	0	0
4	CET-224	Highway Engineering	PC	Theory	3	3	0	0
5	CET-225	Structural Analysis-I	PC	Theory	4	3	1	0
6	CET-226	Water Supply Engineering	PC	Theory	3	3	0	0
1	CEP-227	Building Drawing	PC	Lab	1	0	0	2
2	CEP-228	Hydraulics Lab	PC	Lab	1	0	0	2
3	CEP-229	Advanced Surveying Lab	PC	Lab	1	0	0	2
4	CEP-230	Road Material Testing Lab	PC	Lab	1	0	0	2
5	CEP-231	Public Health Engineering Lab	PC	Lab	1	0	0	2

UG/PG: UG	Department: Civil Engineering
Course Code: CET 221	Course Name: Building Technology
Credit: 2	L-T-P: 2-0-0
Pre-requisite course:	

Syllabus

Classification of Buildings, low-rise and high-rise buildings, load bearing and framed construction; Building planning, building planning concepts, and Introduction to National building codes and byelaws; Concepts of various foundation types, foundation of walls, columns etc., foundation layout, foundation construction practices and failure issues; Stone and brick masonry construction, reinforced brick construction, lintel and arches; Roof construction and roofing materials, flat and pitched roofs, drainage of roofs, green roof concepts; Doors and windows Stairs and ramps, Lifts and Escalators, floors and floor finishes, wall finish; Thermal insulation, damp and fire proofing, Expansion and construction joints; Temporary supporting structures concepts for construction of buildings; Advances in building construction practices, prefabrication and pre-casting, modular construction.

Text books

- 1 Handbook of Building Construction Vol 1, M M Goyal, 2010, Jain Book Depot
- 2 Brick and Reinforced Brick Structures Dayaratnam P, Oxford & IBH

Reference books

- 1 National Building Code of India, BIS, Delhi.
- 2 Building Construction Handbook, R Chudley and Roger Greeno, 2013

UG/PG: UG	Department: Civil Engineering
Course Code: CET 222	Course Name: Pipe & Channel Hydraulics
Credit: 4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Comparison of Pipe and Channel Flows, Types of flows, Velocity distribution in Channels, Most Economical Channels: Rectangular and other geometrical channel sections, Concept of Specific Energy, Specific Force Concept, Gradually Varied Flow and Types Surface Profiles, Direct Step Method, Rapidly Varied Flow, Hydraulic jump and Surges.</p> <p>Navier-Stokes equation, Laminar & Turbulent Flow in pipes, Laminar Flow, Hagen-Poiseuille Flow equation, Turbulent Flow, Hydro-dynamically Smooth and Rough pipes, Pandtl's mixing length theory, Moody's diagram.</p> <p>Boundary Layer theory, laminar sub-layer, various b.l. thicknesses, Application of equations in b.l. including momentum integral equations, Establishment of flow, reduction of b.l. Concept of Drag and lift, flow around immersed bodies.</p> <p>Hydraulic Machines- Introduction, Impact of free jets on flat and curved plates/vanes, efficiency of water wheel, efficiency, Power and related concepts.</p> <p>Brief introduction to various Types of turbines and pumps.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Open Channel Hydraulics by Subramanya 2. Hydraulics & Hydraulic Machines by Modi & Seth 3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar 4. Open Channel Hydraulics by V.T. Chow 	

UG/PG : UG	Department: Civil Engineering
Course Code: CET 223	Course Name: Advance Surveying
Credit: 2	L-T-P: 2-0-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Theory of errors; Adjustment of surveying observations; Triangulation and Trilateration; Various triangulation schemes; Type of triangulations; Triangulation measurements; Adjustment of triangulation scheme; Principles of photogrammetry; Aerial photography, Interpretation, Measurements from aerial photographs; Introduction to astronomy ; Terms of reference planes and astronomical coordinates; Astronomical triangle /shortest distance determination; Time in astronomy; Uses of Total Station and other Advance surveying instruments.

Text Books

1. Wolf, P. R., A text book on Photogrammetry, 4th edition, 2012.
2. C.D. Burnside, Electromagnetic Distance Measurement, Crosby Lockwood and Son Ltd., London.
3. Punmia, B.C., Surveying Vol. II & III, 2005.

Reference Books

1. Kavanagh, B., Surveying Principles and Applications, Seventh Edition, Prentice Hall, 8th edition, 2008.
2. G.L. Hosmer, Geodesy, John Wiley & Sons, New York, 1946.

UG/PG: UG	Department: Civil Engineering
Course Code: CET 224	Course Name: Highway Engineering
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus

Introduction: Highway Material subgrade soil, stone aggregates, Cement, Concrete & bituminous material viz. bitumen, tar, cut back emulsions, Significance, and application of various tests on soil, stone aggregate bitumen and modified Binders..

Proportioning of materials by graphical method, Geometric Design: Highway classification, design, cross-sectional elements, horizontal & vertical alignment, sight distance, types of road crossings, roundabout, grade-separated intersections. Camber, Super-elevation, Radius of curve Horizontal and Transition Curves, Gradients, Valley curve, Summit curve. Design of pavement for Rural Roads as per IRC SP:72.

Soil stabilization for rural roads.

Books

1. Highway Engineering By S. K. Khanna and C.E.G Justo
2. Highway Materials by HMSO London .
3. IRC SP 72

UG/PG : UG	Department: Civil Engineering
Course Code: CET 225	Course Name: Structural Analysis -I
Credit: 4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course: Mechanics of Solids	

Syllabus

Slopes and deflections in determinate beams using conjugate beam method and moment area method; Generalized coordinate system; Principles of real and virtual work; Maxwell's reciprocal theorem; Betti's theorem; Castiglano's theorems; Strain energy expressions; Strain energy method and virtual work (unit load) method for slopes and deflections in statically determinate frames and trusses; Static indeterminacy and released structure; Force method – method of consistent deformation for analysis of statically indeterminate beams, frames and trusses; Three moment theorem; Column analogy method; Moving loads and influence lines; Application to statically determinate structures; Muller Breslau's principle.

Books

1. Mechanics of Structures, Vol. I & II by S.B. Junnarkar & H.J. Shah
2. Theory of Structures, Vol. I& II by G.S. Pandit and S.P. Gupta
3. Structural Analysis by C.K. Wang
4. Structural Analysis (6/e) by R.C. Hibbeler

UG/PG : UG	Department: Civil Engineering
Course Code: CET 226	Course Name: Water Supply Engineering
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Water supply; Demand; Sources; Quality standards; Water treatment: Method of purification of water; Screens, plain and coagulant aided sedimentation; Filtration-slow sand and rapid sand, disinfection; Water softening; Iron, Manganese, Fluoride, and Nitrate removal; Electro dialysis, R.O. and Ion exchange process, desalination. Different type of pipes and pipe joints, Pumping stations; Rural water supply management. Introduction to the concept of integrated water resources management.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Manual of Water Supply by CPHEEO, Ministry of Urban Dev., GOI 2. Water Supply by P.N. Modi 3. Water Works Engineering S.R. Qasim, E.M. Motley and G. Zhu 	

UG/PG: UG	Department: Civil Engineering
Course Code: CEP 227	Course Name: Building Drawing
Credit: 1	L-T-P: 0-0-2
Pre-requisite course:	

Syllabus

The lab course intends to train students in reading and developing drawings of various types of buildings. The assignment will include reading various construction drawings, symbols used and strengthen concepts of converting drawings in to reality. The course will focus on developing plans, elevations, and sections of buildings, along with detailing of MEP drawings. The labs also introduces the software (s) used for the same.

Books/Manual

1. Time Saver Standards.
2. Neuferts Architects Data
3. Building Planning and Drawings by Shah, Kale and Patki
4. NBC -2005

UG/PG : UG	Department: Civil Engineering
Course Code: CEP 228	Course Name: Hydraulics Laboratory
Credit: 1	L-T-P: 0-0-2
Version:	Approved on:
Pre-requisite course:	
List of Experiments	
<p>1. Experiments on determination of the performance characteristics of <u>Pelton turbine</u></p> <ul style="list-style-type: none"> a. Production and analysis of graphs of inlet pressure, flow rate, torque and power against speed for a selection of nozzle positions. b. Determination of overall efficiency of conversion of fluid to mechanical energy, over a range of conditions. <p>2. Experiments on determination of the performance characteristics of <u>Francis turbine</u>.</p> <ul style="list-style-type: none"> a. Efficiency of a Francis turbine. b. Performance of a Francis turbine at different flow rates. c. The effect of different guide vane settings on turbine performance. <p>3. Experiment for Demonstration of the water hammer effect to produce a pumping action in Hydraulic Ram pump.</p> <p>4. Experiments on Two stage (<u>series & parallel</u>) pumps.</p> <ul style="list-style-type: none"> a. Centrifugal pump performance and characteristics, typically head versus flow and efficiency versus flow. b. Non-dimensional performance characteristics c. Operation of centrifugal pumps in series. d. Operation of centrifugal pumps in parallel <p>5. Experiments on Water hammer & Pipe Surge.</p> <p>6. Establishment of uniform flow in channels (Tilted bed flume).</p> <p>7. Study of hydraulic jump in tilted bed flume.</p>	
Books <ol style="list-style-type: none"> 1. Open Channel Hydraulics by Subramanya 2. Hydraulics & Hydraulic Machines by Modi & Seth 3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar 4. Open Channel Hydraulics by V.T. Chow 	

UG/PG : UG	Department: Civil Engineering
Course Code: CEP 229	Course Name: Advanced Surveying Laboratory
Credit: 1	L-T-P: 0-0-2
Version:	Approved on:
Pre-requisite Course:	
<p>List of Experiments</p> <ol style="list-style-type: none"> 1. To determine horizontal angles in a triangle by 2-4-6 method of repetition. 2. To determine horizontal distance and vertical height using tangential method 3. To determine Tacheometric constants 4. To determine R.L. using Tacheometry 5. Contouring using radial method 6. To determine horizontal distance by Substance bar 7. Precise leveling using Auto Level 8. Triangulation using advance surveying equipments 9. Observations on Stereo-pair of photograph 10. Total station/EDM 	
<p>Text Books</p> <ol style="list-style-type: none"> 1. Punmia, B.C., Surveying Vol. II & III, 2005. 2. Wolf, P. R., A text book on Photogrammetry, 4th edition, 2012. 3. C.D. Burnside, Electromagnetic Distance Measurement, Crosby Lockwood and Son Ltd., London. 	
<p>Reference Books</p> <ol style="list-style-type: none"> 1. Kavanagh, B., Surveying Principles and Applications, Seventh Edition, Prentice Hall, 8th edition, 2008. 2. G.L. Hosmer, Geodesy, John Wiley & Sons, New York, 1946. 	

UG/PG: UG	Department: Civil Engineering
Course Code: CEP 230	Course Name: Road Material Testing Laboratory
Credit: 3	L-T-P: 0-0-2
Pre-requisite course: (CE- 224) HIGHWAY ENGINEERING	
<p>List of Test Experiments</p> <ol style="list-style-type: none"> 1. Proctor & Modified Proctor Test. 2. Sieve Analysis (Sieve Shaker) 3. Liquid Limit Test. 4. Plastic Limit Test. 5. California Bearing Ratio (CBR) Test. 6. Aggregate Impact Value Test. 7. Aggregate Abrasion Value Test. 8. Aggregate Crushing Value Test. 9. Specific gravity test (aggregates & bitumen) Pycnometer. 10. Flakiness & Elongation Index Test (Thickness Gauge, Length Gauge) 11. Bitumen Softening Point Test. 12. Bitumen Ductility Value Test. 	

UG/PG: UG	Department: Civil Engineering
Course Code: CEP 231	Course Name: Public Health Engineering Laboratory
Credit: 1	L-T-P: 0-0-2
Pre-requisite course:	
<p>Syllabus</p> <p>Water quality: principles of measurement and testing of water for parameters like pH, TDS, alkalinity, NO₃, PO₄-P, Hardness, Turbidity, residual chlorine, breakpoint chlorination, DO, Chlorides, Jar test for coagulant dosing, Assessment of biological quality of water.</p> <p>Books</p> <ol style="list-style-type: none"> 1. APHA (1995): Standard methods for the examination of water and wastewater. 17th edition APHA, Washington DC. 	

S. No.	Course Code	Course Name	Category	Type	Credit	L	T	P
1	CET-301	Sanitary Engineering	PC	Theory	3	3	0	0
2	CET-302	Structural Analysis-II	PC	Theory	4	3	1	0
3	CET-303	Design of RC Structure	PC	Theory	3	3	0	0
4	CET-304	Hydrology	PC	Theory	4	3	1	0
5	CET-305	Soil Mechanics	PC	Theory	4	3	1	0
6	CET-306	Estimating & Costing	PC	Theory	3	2	1	0
1	CEP-307	RC Design and Drawing	PC	Lab	1	0	0	2
2	CEP-308	Structural Analysis Lab	PC	Lab	1	0	0	2
3	CEP-309	Soil Mechanics lab	PC	Lab	1	0	0	2

UG	Department: Civil Engineering
Course Code: CET 301	Course Name: Sanitary Engineering
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Sewage disposal; Layout of Sewerage system; Characteristics of municipal wastewater; Basics of microbiology and biological oxidation.

Wastewater Treatment: Treatment scheme; Screening; Grit removal; Sedimentation; Floatation; Activated sludge process; Extended aeration; Trickling filters; RBC, UASB; aerated lagoons; Septic tank; Sludge handling and disposal.

Introduction to tertiary treatment. Recycle and reuse of treated sewage.

Introduction to natural systems like Stabilization ponds, wetlands etc. Rural wastewater management including introduction to total sanitation campaign.

Books

1. Wastewater Treatment by Metcalf & Eddy, TMH.
2. Manual of Sewage treatment by CPHEEO, Ministry of Urban Dev., GOI
3. Environmental Engineering by Davis and Cornwell, McGraw Hill
4. Wastewater treatment for pollution control and reuse by Soli J. Arceivala abd Shyam R. Asolekar, TMH.

UG	Department: Civil Engineering
Course Code: CET 302	Course Name: Structural Analysis -II
Credit: 4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course: Structural Analysis - I	
<p>Syllabus</p> <p>Degree of Kinematic indeterminacy and restrained structure; Displacement approach of analysis – Slope deflection method, Moment distribution method for analysis of continuous beams and rigid – jointed plane frame; Use of symmetry; Three hinged and two hinged arches; Matrix method using system approach – flexibility and stiffness method for analysis of pin-jointed plane frame, continuous beams and rigid – jointed plane frame; Introduction to Direct Stiffness method; Assembly of stiffness and load vectors; Boundary condition and solutions; Application to planer structures – trusses beams and frames & its computer formulations.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Structural Analysis- A Matrix Approach by G.S. Pandit and S.P. Gupta 2. Structural Analysis by C.K. Wang 3. Basic Structural Analysis by Reddy 	

UG	Department: Civil Engineering
Course Code: CET 303	Course Name: Design of RC Structures
Credit: 3	L-T-P: 3-1-0
Pre-requisite course:	
<p>Syllabus</p> <p>Basic philosophy of Working Stress and Limit state Methods for Design of concrete structures; Design of beams; singly and doubly reinforced rectangular beams; Design of secondary & main beams, cantilevers, balconies and staircases (excluding spiral staircase); Design of slabs; one way slabs; two-way slabs with corners free to lift up and held down; design of continuous slab; T-beams subjected to flexure, shear & torsion and T-beam floors; Design of columns; axially loaded and eccentrically loaded columns; effect of small and large eccentricities; Design of footings; isolated and combined footings; Portal frames with fixed and hinged supports.</p> <p>(Note: Limit state method of design will be adopted except otherwise specially mentioned).</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. RCC by Jain & Jaykrishna 2. Design of RCC Structures by Menon & Pillai 3. RCC by Sinha 	

UG	Department: Civil Engineering
Course Code: CET 304	Course Name: Hydrology
Credit: 4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
Syllabus	
<p>Hydrological cycle and hydrologic budget; Elements of geomorphology; Precipitation; Measurement and analysis; Hydrology abstraction - interception, evaporation, infiltration; Rainfall–Runoff relationship; Stream flow; Hydrographs & applications; Frequency analysis; Regression and correlation analysis; Flood Routing, Groundwater, Hydraulics of groundwater.</p>	
Text Books <ol style="list-style-type: none"> 1. Applied Hydrology, Ven Tee Chow, D. R. Maidment and Larry W. Mays, Tata McGraw-Hill. 2. Engineering Hydrology, K. Subramana, Tata McGraw-Hill 	
Reference Books <ol style="list-style-type: none"> 1. Handbook of Hydrology, Ven Tee Chow, D. R. Maidment and Larry W. Mays, Tata McGraw-Hill. 2. Hydrology for Engineers by Linsley, Kohler and Paulhus 	

UG	Department: Civil Engineering
Course Code: CET 305	Course Name: Soil Mechanics
Credit: 4	L-T-P: 3-1-0
Pre-requisite course: Basic Civil Engineering knowledge	

Syllabus

Introduction, Simple soil properties, Phase relations (weight volume relationships), index properties, classification of soils, soil structure and clay minerals. Principle of effective stress, Capillarity, permeability, Laboratory tests and Field pumping tests for permeability determination and seepage through soils: Two-dimensional flow; Flow nets and their characteristics; Uplift pressure, exit gradient, and piping; Criteria for filters, compressibility characteristics of Soils, compaction, compaction tests, field compaction methods and control, effect of compaction on soil properties, consolidation, Terzaghi's one-dimensional consolidation theory, consolidation test, computation of settlement, secondary consolidation, vertical sand drains, shearing strength of soils, Mohr-Coulomb failure criterion, Laboratory tests for shear strength determination, stress path concept, determination of pore pressure coefficients, Shear strength characteristics of clays and sands, Stress distribution, Boussinesq equations, Newmark's influence chart, Westergaard's analysis, Properties of rock materials, Point load strength index of rocks, Strength of rock materials in triaxial compression.

Books

1. T. William Lambe, Robert V. Whitman, "Soil Mechanics", John Wiley and Sons, New York.
2. John N. Cernica, "Geotechnical Engineering: Soil Mechanics", John Wiley and Sons, New York.
3. Rodrigo Salgado, "The Engineering of Foundations", Tata McGraw Hill Education Limited, New Delhi.
4. Leonard Obert and Wilbur I. Duvall, "Rock Mechanics and Design of Structures in Rock", John Wiley and Sons, Inc., New York.
5. Muni Budhu, "Soil Mechanics and Foundations", John Wiley and Sons, New York.
6. Alam Singh, "Modern Geotechnical Engineering", CBS Publishers and Distributors Pvt. Ltd.
7. Gopal Ranjan and A.S.R Rao, "Soil Mechanics and Foundation Engineering", New Age International Pvt. Ltd, Publishers, New Delhi.
8. V.N.S. Murthy, "Principles of Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi.
9. Shamsher Prakash and P.K. Jain, "Engineering Soil Testing", Nem Chand & Bros. Roorkee.

UG	Department: Civil Engineering
Course Code: CET 306	Course Name: Estimating and Costing
Credit:3	L-T-P:2-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction: Drawings and specifications use in estimating, Role and qualities of an estimator, Process/flow of estimation, Units of measurement, and Types of estimates, Specifications, Introduction to estimating software, Estimate of Buildings and BOQ preparation: Methods, Earth work for buildings, Substructure work, super structure work, roofs, stairs, openings, arches, wall and floor finishes, RCC work, steel work, detailed estimate of a two storey building, Introduction to mechanical-electrical-plumbing work estimating, Estimate of Roads: Earthwork, Detailed estimate of bitumen and cc road,</p> <p>Material estimation and Analysis of rates: abstract of materials, material cost, labour cost, and equipment cost, contingencies, overhead and profit, Misc. Charges, Analysis of rates, Tender, Tender Notice, Earnest money, Security money, Contracts, Work measurement and Payment: Measurement book use, payment process and mode of payment, Valuation: valuation of building, Method of valuation.</p>	
<p>Text books</p> <ol style="list-style-type: none"> 1. Estimating and Costing in Civil Engineering by B. N. Dutta UBSPD publication 	
<p>Reference Material</p> <ol style="list-style-type: none"> 1. Estimating in Building Construction by Frank R. Dagostino 	

UG	Department: Civil Engineering
Course Code: CEP 307	Course Name: RC Design and Drawing
Credit:2	L-T-P: 0-0-2
Version:	Approved on:
Pre-requisite course: Structural Analysis-I, Build. Tech. II	
<p>Syllabus</p> <p>Design of real field structures with detailed drawings of following structures; Singly and doubly reinforced beams, cantilevers, balconies, staircases, slabs, T-beam floors, columns, Beam column connections, isolated and combined footings and Portal frames.</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. RCC by Jain & Jaykrishna 2. RCC by Krishnaraju 3. RCC by Sinha 	

UG/PG : UG	Department: Civil Engineering
Course Code: CEP 308	Course Name: Structural Analysis Laboratory
Credit: 1	L-T-P: 0-0-2
Version:	Approved on:
Pre-requisite course:	

List of Experiments

1. To verify the reactions in a simply supported beam.
2. To measure deflections under unsymmetrical bending condition.
3. To verify Hooke's law and find Modulus of elasticity of a given wire material from load deflection graph.
4. To verify the buckling loads for the given struts.
5. To verify the centrifugal force formula
6. To determine Brinell's Hardness Test.
7. To draw influence lines for horizontal thrust of three hinge arch.
8. To verify of reciprocal theorem.
9. To verify deflections in curved members.
10. To verify Muller's Breslau's principle and to measure carry over factor for a prismatic beam.
11. To perform Charpy's impact test.
12. To determine tensile strength of steel bar and compressive strength of concrete using universal testing machine.
13. To determine fatigue load.
14. To determine torsional properties of cylindrical specimen.

Reference : Lab Manuals

UG	Department: Civil Engineering
Course Code: CEP 309	Course Name: Soil Mechanics Laboratory
Credit: 1	L-T-P: 0-0-2
Pre-requisite course: Soil Mechanics	

List of Experiments

1. Water content determination
2. Specific gravity test
3. Sieve analysis
4. Hydrometer analysis
5. Atterberg limits determination
6. Permeability tests
7. Compaction test
8. Core-cutter and sand replacement methods for in-situ density determination.
9. Determination of density index or relative density of soils.
10. Determination shear strength parameters using Direct shear test.
11. Determination shear strength parameters using Unconfined compression test.
12. Consolidation characteristics of soils using Consolidometer/ Odeo meter.

Books

1. Shamsher Prakash and P.K. Jain, "Engineering Soil Testing", Nem Chand & Bros.
2. Roorkee.
3. Head, K.H, "Manual of Soil Laboratory Testing", John Wiley and Sons, New York.
4. T. William Lambe, "Soil Testing for Engineers", Wiley Eastern Limited, New Delhi.
5. Joseph E. Bowles, "Engineering Properties of Soil and their Measurement", McGraw Hill Inc., New York.

S. No.	Course Code	Course Name	Category	Type	Credit	L	T	P
1	CET-321	Railway & Airport Engineering	PC	Theory	4	3	1	0
2	CET-322	Design of Steel Structures	PC	Theory	4	3	1	0
3	CET-323	Design of Foundations & Earth Structures	PC	Theory	4	3	1	0
4	CET-324	Design of RC Systems	PC	Theory	4	3	1	0
5	CET-325	Design of Masonry Structures	PC	Theory	3	2	1	0
6	CET-326	Water Resources Engineering	PC	Theory	4	3	1	0
1	CEP-327	Structural Design & Drawing	PC	Lab	1	0	0	2
2	CEP-328	Environmental System Design	PC	Lab	1	0	2	0
3	CEP-329	Geotechnical Engineering Laboratory	PC	Lab	1	0	0	2

UG	Department: Civil Engineering
Course Code: CET 321	Course Name: Railway and Airport Engineering
Credit: 4	L-T-P: 3-1-0
Pre-requisite course:	

Syllabus

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

Books

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

UG	Department: Civil Engineering
Course Code: CET 322	Course Name: Design of Steel Structures
Credit: 4	L-T-P: 3-1-0
Pre-requisite course:	
Syllabus <p>Structural steel and properties ,Introduction to stability and buckling concepts, Working stress and plastic design methods , Bolted and Welded connections, , Design of tension, compression and flexural members (including built up members):Column bases, Plate Girder and Roof trusses using latest IS codes.</p>	
Text Books <ol style="list-style-type: none"> 1. Plastic Analysis & Design Of Steel Structures : Wong 2. Design of Steel Structures: N Subramanium 3. Limit State Design of Steel Structures: S.K.Duggal 4. Design of Steel Structures: P Dayaratnam. 	

UG	Department: Civil Engineering
Course Code: CET 323	Course Name: Design Of Foundations And Earth Structures
Credit: 4	L-T-P: 3-1-0
Pre-requisite course: Soil Mechanics	

Syllabus

Stability of infinite and finite slopes, Swedish slip circle method, Bishop's method, Stability of slopes of earth dam, Earth pressures theories; Stability analysis of retaining structures; Shallow foundations, Bearing capacity and settlement analysis, contact stress beneath foundations, Plate load test, Standard penetration test, Dynamic and static cone penetration test; Allowable bearing pressure on soils and rocks, Raft foundation, Soil Exploration and sampling: Site investigation report. Pile foundation: Classification; Bearing capacity of piles, Pile load test, Group capacity of vertical piles; IS code provisions, Well foundation and caissons; Depth of well, Bearing capacity and settlement of well, Lateral stability of well foundations, Sinking of wells, Tilts and shifts, Machine foundations, Dynamic soil properties, Laboratory techniques, Resonant column test to obtain Young's modulus, Shear modulus and damping characteristics of soils, Cyclic simple shear test, Cyclic triaxial compression test, Field tests: Vertical and horizontal block resonance test, Cyclic plate load test, Reinforced earth.

Books

1. T. William Lambe, Robert V. Whitman, "Soil Mechanics", John Wiley and Sons, New York.
2. John N. Cernica, "Geotechnical Engineering: Soil Mechanics", John Wiley and Sons, New York.
3. Rodrigo Salgado, "The Engineering of Foundations", Tata McGraw Hill Education Limited, New Delhi.

UG	Department: Civil Engineering
Course Code: CET 324	Course Name: Design of RC Systems
Credit:4	L-T-P:3-1-0
Version:	Approved on:
Pre-requisite course: Design of RC Structures	
<p>Syllabus</p> <p>Design of Flat slab & grid Slab; Design of retaining walls; Design of beams curved in plan; Design of domes for axisymmetric loading, uniformly distributed load, ring load and concentrated load at the crown; Design of water tanks, Intze tank; Yield line theory for slabs: basic concepts, location of yield lines, yield line analysis-equilibrium method and virtual work method, analysis and design of rectangular slabs with different support conditions, Yield line pattern in building frames; Prestressed concrete: advantages and disadvantages, methods of prestressing, losses in prestress, analysis and design of prestressed concrete beam; IRC Loading & Slab Bridge</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Design of RCC Structures by Jain & Jaykrishana 2. Design of RCC Structures by Krishnaraju 3. Design of RCC Structures by Menon & Pillai 	

UG	Department: Civil Engineering
Course Code: CET 325	Course Name: Design of Masonry Structures
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Building Technology	
<p>Syllabus</p> <p>Behaviour of Masonry Structures During Past Earthquakes: Common modes of failure, effect of unit shapes and mortar type, effect of roof and floor systems; Common deficiencies.</p> <p>Masonry Under Compression: Prism strength, Failure mechanism, types of construction and bonds; Eccentric loading; Slenderness – effective length and effective height, effect of openings; Code provisions.</p> <p>Masonry Under Lateral Loads: In-plane and out-of-plane loads, bending parallel and perpendicular to bed joints; Shear and flexure behaviour of piers.</p> <p>Earthquake Resistant Measures: Analysis for earthquake forces, role of floor and roof diaphragm; Concept and design of bands, bandages, splints and ties; Reinforced masonry; Code provisions.</p> <p>Masonry Infills: Effect of masonry infills on seismic behaviour of framed buildings; Failure modes; simulation of infills – FEM and equivalent strut; Safety of infills in in-plane action – shear, compression and buckling; Code provisions.</p> <p>Retrofitting of Masonry Building: Techniques of repair and retrofitting of masonry buildings; IS: 13935 (1993) provision for retrofitting.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Drysdale, R. G., Hamid, A. H. and Baker, L. R., "Masonry Structure: Behaviour and Design", Prentice Hall, Englewood Cliffs. 2. Paulay, T. and Priestley, M. J. N., "Seismic Design of Reinforced Concrete and masonry Buildings", John Wiley & Sons. 3. Amrhein, J. E., "Reinforced Masonry Engineering Handbook," Masonry Institute of America, CRC Press. 4. Donald Anderson and Svetlana Brzev, "Seismic Design Guide for Masonry Buildings," Canadian Concrete Masonry Producers Association. 5. "Prestandard and Commentary For The Seismic Rehabilitation of Buildings," FEMA 356, Federal Emergency Management Agency, Washington, D.C. 	

UG	Department: Civil Engineering
Course Code: CET 326	Course Name: Water Resource Engineering
Credit : 4	L-T-P: 3-1-0
Version:	Approved on:
Pre-requisite course:	
 Syllabus	
Introduction, need for harnessing water resources; Water resources projects and their planning; Irrigation practices; Irrigation-its importance and impact on environmental, assessment of water requirements for crops; Irrigation water Quality, Methods of irrigation; canal and well irrigation; canal irrigation; canal alignment; Design principles of irrigation canal, Silt theories, management of canal irrigation; Water logging and Drainage, Seepage theories for design of hydraulic structures; Surface and sub-surface considerations including energy dissipation; salient features of diversion head works; Falls; Regulators; River meandering and river training works, Breif introduction of water conservation and water harvesting technologies; Hydropower; General features and components of a hydropower station.	
Books	
<ol style="list-style-type: none"> 1. Water Resources Engineering by Linsley & Franzini 2. Irrigation Engineering by G.L. Asawa 3. Water Resources & Water Power Engg. By P.N. Modi 	

UG	Department: Civil Engineering
Course Code: CEP 327	Course Name: Structural Design and Drawing
Credit:2	L-T-P: 0-0-2
Version:	Approved on:
Pre-requisite course:	
<p>Detailed syllabus:</p> <p>Design and detailed drawings Flat slab & grid Slab, retaining walls, curved beams, domes, water tanks with foundation, pile & pile foundations, pile caps, ductile detailing of RC Structural systems, building frames, prestressed concrete beams, slab bridge.</p> <p>Design and Drawings of Bolted and Welded connections.</p> <p>Design and Drawings of Beam Column Connections.</p> <p>Design and Drawing of tension, compression and flexural members. (including built up members).</p> <p>Design and Drawing of Column bases.</p> <p>Design and Drawing of Plate Girder.</p> <p>Design and Drawing of Roof trusses.</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. Design of RCC Structures by Jain & Jaykrishna 2. Design of RCC Structures by Krishnaraju 3. Design of RCC Structures by Menon & Pillai 4. Plastic Analysis & Design Of Steel Structures : Wong 5. Design of Steel Structures: N Subramanium 6. Limit State Design of Steel Structures: S.K.Duggal 7. Design of Steel Structures: P Dayaratnam 	

UG	Department: Civil Engineering
Course Code: CEP 328	Course Name: Geotechnical Engineering Laboratory
Credit: 1	L-T-P: 0-0-2

Pre-requisite course: Soil Mechanics, Design of Foundations and Earth Structures

List of Experiments

1. Determination shear strength parameters using Triaxial test.
2. Determination shear strength parameters using Vane shear test.
3. Swelling pressure determination.
4. Determination of differential free swell.
5. Determination of pH value of soils.
6. Determination of total soluble sulphates.
7. Determination of total soluble solids by Gravimetric method.
8. Determination of organic matter.
9. Determination of allowable bearing pressure using Standard Penetration Test, Dynamic cone Penetration test.
10. Demonstration of Static Cone Penetration Test (SCPT).
11. Determination of allowable bearing pressure and settlement using Plate Load Test on soils.
12. Determination of unconfined compressive strength of rock materials.
13. Determination of point load strength index of rocks.
14. Determination of strength of rock materials in triaxial compression.
15. Determination of water content, porosity, density and related properties of rock materials.
16. Field Determination of Dynamic soil properties Vertical and horizontal block resonance test.
17. Determination of Dynamic soil properties by Cyclic triaxial compression test.

Books

1. Head, K.H, "Manual of Soil Laboratory Testing", John Wiley and Sons, New York.
2. T. William Lambe, "Soil Testing for Engineers", Wiley Eastern Limited, New Delhi.
3. Joseph E. Bowles, "Engineering Properties of Soil and their Measurement", McGraw Hill Inc., New York.
4. Shamsher Prakash and P.K. Jain, "Engineering Soil Testing", Nem Chand & Bros. Roorkee.
5. Leonard Obert and Wilbur I. Duvall, "Rock mechanics and design of structures in rock", John Wiley and Sons, Inc., New York.
6. Swami Saran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt. Limited, New Delhi.

UG/PG : UG	Department: Civil Engineering
Course Code: CEP 329	Course Name: Environmental System Design
Credit: 2	L-T-P: 0-2-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Analysis of waste water quality: COD, BOD, TOC, SS, VSS. Systems Lab: Design of water distribution system; analysis of Hardy Cross Method ; design of sewerage system; design of water & sewage treatment system including software applications.</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Water Works Engineering: Planning Design and Operation : Qasim, Motley and Zhu 2. CPHEEO Manual on Water Supply and Treatment 3. Waste water Treatment Plant: Design and Operation: Qasim 4. Wastewater Engineering: Treatment and Reuse by Metcalf & Eddy, TMH. 5. Manual of Sewage treatment by CPHEEO, Ministry of Urban Dev., GOI 6. APHA (1995): Standard methods for the examination of water and wastewater. 17th edition APHA, Washington DC. 	

B. Tech Civil 7th Semester

S. No.	Course Code	Course Name	Category	Type	Credit	L	T	P
1		Training Seminar	PC	Theory				
2		Management*	PC	Theory				
3			OE	Theory				
4			OE	Theory				
5			PE	Theory				
6			PE	Theory				

List of Programme Electives (PE), 03 Credits		
S.NO.	COURSE	COURSE CODE
1	Concrete Technology	CET 401
2	Design of Hydraulic Structures	CET 402
3	Ground Improvement Techniques	CET 403
4	Air & Noise Pollution	CET 404
5	System Analysis	CET 405
6	Industrial Waste Treatment	CET 406
7	Prestressed Concrete	CET 407
8	Urban Water Conveyance System Design	CET 408
9	Traffic Engineering and Traffic Planning	CET 409
10	Sustainable Building Project Delivery	CET 410
11	Construction Project Management	CET 411
12	Solid Waste Management	CET 412

List of Advanced Elective Courses (AEC), 03 Credits		
S.NO.	COURSE	COURSE CODE
1	Introduction of Spatial Data Collection and Analysis	CET 420
2	Construction Information System	CET 421
3	Structural Dynamics	CET 422
4	Finite Element Method	CET 423
5	Advanced Foundation Design	CET 424
6	Design of Steel Structural Systems	CET 425

List of Open Elective Courses (OE) for students of other departments.		COURSE CODE
S.NO.	COURSE	
1	Introduction to Remote Sensing & GIS	CET 431
2	Numerical Methods	CET 432
3	Earthquake Disaster Mitigation	CET 433
4	Water Conservation Techniques	CET 434

PROGRAMME ELECTIVES (PE)

UG	Department: Civil Engineering
Course Code:CET 401	Course Name: Concrete Technology
Credit:4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Building Technology	

Syllabus

Review of constituent materials and mix design, admixtures, Properties of concrete in fresh and hardened state, Special concretes, Durability of concrete subjected to extreme environment, Deterioration mechanisms, assessment and control of corrosion in concrete structures, In-situ assessment of concrete structures, Various NDT techniques and their applications, Repair of concrete structures.

Text Books

1. Concrete technology by A. M. Neville, Pearson education India.
2. Concrete Technology by Krishnaraju
3. Concrete Technology by Gambhir

UG	Department: Civil Engineering
Course Code: CET 402	Course Name: Design of Hydraulic Structures
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Water Resources Engineering, Hydrology	

Syllabus

Introduction; type of hydraulic structures and their function; consideration for their selection.

Dams; Design principles of gravity and earth dams; spillway; types of spillway: Ogee, chute, shaft, side channel and siphon spillway; spillway aerators; spillways; Design of ogee spillway.

Diversion headworks; Components of diversion head work and their design.

Channel transitions; Design of channel transitions for sub critical and super critical flows; cross and distributory head regulators; energy dissipation downstream of falls; Cross drainage structures: Super passage, aqueducts, design of cross drainage structures, Design of outlets.

Books:

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

UG/PG: UG	Department: Civil Engineering
Course Code: CET 403	Course Name: Ground Improvement Techniques
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Soil Mechanics and Design of Foundations	
<h3>Syllabus</h3> <p>Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement, Shallow and deep compaction requirements, Principles and methods of soil compaction. Shallow compaction and methods, properties of compacted soil and compaction control, deep compaction and vibratory methods, dynamic compaction. Ground Improvement by drainage, Dewatering methods, Design of dewatering systems, Preloading, Vertical drains, vacuum consolidation, Electro-kinetic dewatering, design and construction methods. Cement stabilization and cement columns, Lime stabilization and lime columns, Stabilization using bitumen and emulsions, Stabilization using industrial wastes. Construction techniques and applications, Permeation grouting, compaction grouting, jet grouting, different varieties of grout materials, grouting under difficult conditions, Soil nailing, rock anchoring, micro-piles, design methods, construction techniques, Case studies of ground improvement projects. Soil Reinforcement and Geosynthetics, design principles and influencing factors, Use of geosynthetics for filtration, drainage, roads, and landfills.</p>	
<h3>Books</h3> <ol style="list-style-type: none"> 1. Ground Improvement Techniques by Dr. P. Purushottam, Laxmi Publications, New Delhi 2. Construction and Geotechnical methods in foundation engineering, by Koerner, MGH 3. Engineering with Geo-synthetics, by GV Rao & GVSS Raju, Tata McGraw Hill, New Delhi. 4. G. Venkatappa Rao, "Geosynthetics an Introduction", Sai Master Geoenvironmental Pvt Ltd. 5. Nainan P. Kurian, "An Introduction to Modern Techniques in Geotechnical and Foundation Engineering", Narosa Publishing House, New Delhi. 6. G.L. Sivakumar Babu, "An Introduction to Soil Reinforcement and Geosynthetics", Universities Press (India) Pvt Ltd, Hyderabad, A.P, India. 	

UG	Department: Civil Engineering
Course Code: CET 404	Course Name: Air and Noise Pollution
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

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

Books:

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

UG	Department: Civil Engineering
Course Code: CET 405	Course Name: System Analysis
Credit: 4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Definitions; synthesis and control; linear time variant systems; transfer function; impulse response; state transition matrix; system synthesis; objectives of a design, direct and indirect method of optimization; optimality conditions for unconstrained problem; linear programming; dual sensitivity; gradient method; steepest descent method. Dynamic programming; single degree of difficult problems; examples from Civil Engineering design; stochastic processes; decision process in engineering; decision making under uncertainty and under risk.</p> <p>Books:</p> <ol style="list-style-type: none"> 1. Optimisation by S.S. Rao 2. Optimisation by Wagner 	

UG	Department: Civil Engineering
Course Code: CET 406	Course Name: Industrial Waste Treatment
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course: Sanitary Engineering	
<p>Syllabus</p> <p>Sources and characteristics, Effects of Discharges of Industrial Waste on receiving bodies of water, land and Sewer. Effluent and stream standards. Specific Industrial treatment Processes: Neutralization, Equalization and proportioning, Volume and strength Reduction. Raw Materials, water Requirement, Flow Sheet and treatment of Industrial Wastewater Generated from: Textile Tannery, Pulp and Paper, Dairy, Distillery, Dying and Printing, and electro-plating Industry. Provisions of various Indian standards for above Industries.</p> <p>Potentials for Wastewater recycle and reuse in industries, Concept of Common effluent treatment plants.</p> <p>Books:</p> <ol style="list-style-type: none"> 1. Industrial Wastewater by Nelson L Nemerow 2. Industrial water pollution control, William Wesley Eckenfelder 3. Industrial Wastewater Treatment by Rao & Dutta 	

UG	Department: Civil Engineering
Course Code: CET 407	Course Name: Prestressed Concrete
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course: Design of RC Structures	
<p>Syllabus</p> <p>Basic philosophy of prestressing; various techniques of prestressing; different systems of prestressing; Prestressing of concrete structures; losses in prestress; deflection of prestressed concrete members; analysis and design of prestress beams; camber; deflection; cable layouts; stretching in stages, ultimate strength in flexure and shear. Design of end blocks; Statically indeterminate structures; concordant cables; linear transformation, Analysis and design of continuous beams. Tension members; circular prestressing-prestressed tanks and prestressed pipes. Compression members; piles. Partial prestressing; composite construction, analysis of composite beams, prestress slabs; Introduction to pre-cast prestressed elements like poles, railway sleepers, beams, slabs and wall panels etc. planning and economical aspects of prestressed structures, construction of prestressed concrete structures-techniques, materials and management</p>	
<p>Books:</p> <ol style="list-style-type: none"> 1. Prestressed Concrete Structures by T.Y. Lin 2. Prestressed Concrete Structures by Krishnaraju 3. Prestressed Concrete Structures by G.S. Pandit & S.P. Gupta. 	

UG/PG : UG/PG	Department: Civil Engineering
Course Code: CET 408	Course Name: Urban Water Conveyance System Design
Credit: 4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Pipe and Channel Hydraulics	

Syllabus

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

Text Books

1. Hall, M.J., Urban Hydrology, Elsevier, 1984.
2. Optimal Design of Water Distribution Networks, P. R. Bhave, Narosa Publishing House, 2003.
3. Butler, D. & Davies, J.W. Urban Drainage, Spon Press, 2nd Edn., 20004.

Reference Books

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

UG/PG: UG	Department: Civil Engineering
Course Code: CET 409	Course Name: Traffic Engineering and Transport Planning
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course:	Highway Engineering

Syllabus

Traffic Engineering: Volumetric traffic studies, Traffic-volume study, traffic-speed study, Origin and Destination studies, Parking studies and accident study, their objectives, methods, analysis and interpretation. Roadway capacity and level of service concept. Geometric improvement of intersections. Street lighting. Impact of traffic on environment. Traffic flow characteristics; Traffic Control & Parking Studies: Traffic & parking problems, requirements & design standards for on street parking, off-street parking . Importance of traffic signs, general principles & types of traffic signs, advantages & disadvantages of traffic signals, signal phases, number and location of signal phases. Transport Planning: Various transportation systems, their classification, suitability, merits & demerits. Methodologies of planning transport systems, transport surveys. Trip-generation & distribution. Traffic assignment and model split. Mass transit systems, planning, design and operation.

Books

1. Transport Engineering and Transport Planning By L.R.Khadyal
2. Highway Engineering By S.K.Khanna and C.E.G Justo
3. IRC 93,
4. Transportation Engineering by James H Banks

UG/PG: UG	Department: Civil Engineering
Course Code: CET 410	Course Name: Sustainable Building Project Delivery
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to sustainable development; Energy and environmental issues in built environment; Concept of eco friendly materials and designs, Reuse-reduce and recycling of material, waste utilization in construction materials; Professionals associated in a sustainable building project, roles and responsibilities of engineers and managers, integrated project management, certified professionals for sustainable projects, project delivery and documentation for certification of sustainable buildings; Introduction to green movement and sustainable buildings, sustainable building economics, concepts of life cycle costing ; Introduction to sustainable building design and rating systems, Requirements and submittals, national and international certification processes (LEED, LEED India, GRIHA-TERI, etc), exposure to related standards and organizations, associated tools and terminology, continual improvement, case studies.</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. Sustainable construction, design and delivery by Charles Kibert 2. LEED Green building rating System 3. GRIHA Building rating system 	

UG	Department: Civil Engineering
Course Code: CET 411	Course Name: Construction Project Management
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus

Project management concepts, construction firms- management hierarchy, Architect-Engineers-Contractors/Managers relationships, Roles of construction managers; Construction contracts, project delivery methods; Project proposal, project feasibility, request for proposal, project drawings, estimation and bidding, job site layout, contracting the project, sub contractors procurement, resources procurement; Fundamental concepts of equipment economics and equipment management, equipment selection ; Construction plans, work study, work breakdown structure (WBS), construction job-site layout, construction procurements, Time estimates, PERT, CPM, linear scheduling, project scheduling, monitoring, updating, cost functions, time –cost trade off, resource planning leveling and allocation, resource based networks, project cost and schedule of values, change orders, cost budgeting ; Concepts of Risk management, safety management, and quality management; Project monitoring and reporting; Construction claims, Arbitration, project closeout ; Concept of lean construction. Introduction to BIM.

Text Books:

1. Construction Management and Planning by Sengupta and Guha TMH Publications
2. Construction project management by Kumar Neeraj Jha Pearson Publications
3. Construction planning equipment and methods by Peurifoy TMH publications

Reference Material:

1. Construction management fundamentals Knutson MGH publications
2. IS 15883 : 2009 Construction Project Management

UG	Department: Civil Engineering
Course Code: CET 412	Course Name: Solid Waste Management
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Problems associated with solid waste disposal; generation of solid wastes; Classification of solid; characteristics of solid waste; analysis of solid waste; Onsite handling, storage and processing of solid waste; Solid waste collection systems; options for transfer and transport systems; processing and disposal methods; Recovery of resources, conversion products and energy generation from solid waste, Biomedical waste definition; Biomedical Handling Rules; Waste Category; waste minimization; Handling and Disposal; Biomedical waste treatment; Electronic waste and its management.</p>	
<p>Books:</p> <ol style="list-style-type: none"> 1. Integrated Solid Waste Management: Tchobanoglous, Theisen and Vigil 2. Hazardous Waste Management: Wentz 3. Environmental Engineering, Howard Peavy, D. Rowe. 	

ADVANCED ELECTIVE COURSES

UG/PG : UG (Advance Elective Course)	Department: Civil Engineering
Course Code: CET 420	Course Name: Introduction to spatial data collection & analysis
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course: Surveying	

Syllabus

Remote Sensing: Basic concepts, Remote Sensing Platforms & Sensors; Remote sensing data products; Geometric & Radiometric corrections; Visual interpretation and digital image processing; Image Classification, Accuracy Assessment; Image Processing Software.

Overview of GNSS techniques, Introduction to the GNSS functions, Components and operation of GNSS; Surveying and data collection using GNSS; Overview of 3D Terrestrial Scanners and Ground Penetrating Radar.

Geographic al Information System; Basic concepts and components of GIS; Digital representation of geographic data, Database creation, Raster and Vector based GIS data and analysis, Database management; Operations and analysis in GIS; Introduction of GIS software.

Application case studies of spatial data collection and analysis techniques.

Basic Textbooks

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

Reference Books

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

UG/PG: UG	Department: Civil Engineering
Course Code: CET 421	Course Name: Construction Information systems
Credit: 3	L-T-P: 2-0-2
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to IT in construction, ERP in construction, use of IT in improving productivity and communication in construction, Management information systems in construction industry, computerized project management systems, internet technology, web applications and e- business in construction; Building Information modelling concepts, software(s) used for BIM, REVIT working platform, Detailed project work based on REVIT Arch and MEP, Integration of REVIT with other project management software e.g. AUTO CAD, and NavisWorks, introduction to green building software</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Understanding IT in construction by Ming sun 2. BIM Handbook by Chuck Eastman 3. REVIT Tool Manuals by Autodesk 	

UG/PG: UG	Department: Civil Engineering
Course Code: CET 422	Course Name: Structural Dynamics
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Structural Analysis	

Syllabus

Systems with one degree of freedom; undamped system free and forced vibrations, dynamic load factor, different load pulses, damped systems, free and forced vibration response to a pulsating force of damped and damped system. Vibration of multi-degree freedom systems numerical techniques for finding natural frequencies and mode shapes; orthogonal relationship of principle modes; Rayleigh's principle and its application for determination of fundamental frequency. Evaluation of dynamic response by mode superposition method. Application of structural dynamics to civil engineering problems.

Text Books

1. Structural Dynamics by A.K. Chopra.
2. Structural Dynamics by Mario Paz.

UG/PG: UG	Department: Civil Engineering
Course Code: CET 423	Course Name: Finite Element Method
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Structural Analysis-I & Structural Analysis-II	

Syllabus

Introduction, Variational principle, Principle of virtual work, Theory of minimum potential energy, Ritz Method, Interpolation & Representation of curves, elements of elasticity, finite element formulation, Various types of elements, solution procedures, convergence criterion, Isoparametric formulation, Lagrange & Serendipity elements, One dimensional and two dimensional elements

Books:

1. Matrix & Finite element displacement analysis of structures by D. J. Dave
2. Concepts & applications of Finite Element Method by R. D. Cook
3. Finite Element procedures in Engineering Analysis by K. J. Bathe
4. Finite Element Method vs Classical Methods by H.S. Govindarao
5. The Finite Element Method in Engineering by S. S. Rao

UG/PG: UG	Department: Civil Engineering
Course Code: CET 424	Course Name: Advanced Foundation Design
Credit: 4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Soil Mechanics, Design of Foundations and Earth Structures.	

Syllabus

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

Books

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

UG	Department: Civil Engineering
Course Code: CET 425	Course Name: Design of Steel Structural Systems
Credit:4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Design of Steel Structures	

Syllabus

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

References

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

OPEN ELECTIVES

UG/PG : UG	Department: CIVIL ENGINEERING
Course Code: CET 431	Course Name: Introduction of remote sensing & GIS
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Remote Sensing: Basic concepts, Multi-Concepts in Remote Sensing, Advantages of Remote Sensing data, Applications of Remote Sensing; Remote Sensing Platforms & Sensors; Remote sensing data products; Referencing scheme, Digital data Format and characteristics;, High Resolution Images, Image Processing Software; Geometric & Radiometric corrections, Visual Image Interpretation Methods, Digital Image Enhancement, Digital Image Classification Methods, Accuracy Assessment; Geographical Information System; Basic concepts of GIS, Digital representation of geographic data, Digitization of features, Database creation, Raster and Vector based GIS data, Overlay analysis, Buffering, Query, Spatial analysis- 3-D Analysis, Introduction of GIS software, Applications of GIS, National Map policy, National Spatial Data Infrastructure in India.

Text Books:

1. Remote Sensing & DIP: by Lillesand & Keifer, John Wiley & Sons, Inc.
1. Principles of Geographical Information Systems, by Burrough, P. A. / Burrough, P. A., Oxford University Press.

Reference Books:

1. Principles of Remote Sensing: by Curran, P. J.
2. Introduction of Digital Image Processing: by J. R. Johnson, John Wiley & Sons, Inc.
3. Fundamentals of Geographical Information System, by DeMers, Michael N, John Wiley & Sons, Inc.
4. The GIS Book, 5th Edition, by Korte, George, Thomson Learning.

UG/PG : UG	Department: Civil Engineering
Course Code: CET 432	Course Name: Numerical Method
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: NO & Open Elective for ALL branches VII/VIII semester (Final year) only	

Syllabus

Interpolation And Approximation: Laplace, Poisson's, Bi-harmonic and Taylors equations; Solution of equation; Fixed point iteration: $x=g(x)$ method; Newton's method; Solution of linear system by Gaussian elimination and Gauss-Jordon method; Iterative method-Gauss Seidel method, Inverse of a matrix by Gauss Jordon method; Eigen value of matrix by power method and by Jacobi method for symmetric matrix.

Numerical Differentiation And Integration: Pascal triangle for one and two dimensions, Lagrangian Polynomials; Divided differences; Interpolating with a cubic spline; Newton's forward and backward difference formulas. Differentiation using interpolation formulae; Numerical integration by trapezoidal and Simpson's rules; Romberg's method.

Integration Methods For Ode's: Describe the Adams-Bashforth, Adams-Moulton, and Backwards Differentiation families of multi-step methods; Describe the form of the Runge-Kutta family of multi-stage methods; and Explain the relative computational costs of multi-step versus multi-stage methods.

Explain the concept of stiffness of a system of equations, and describe how it impacts the choice of numerical method for solving the equations.

Explain the differences and relative advantages between explicit and implicit methods to integrate systems of ordinary differential equations; and for nonlinear systems of equations, explain how a Newton-Raphson can be used in the solution of an implicit method.

Define a convergent method; Define a consistent method; Explain what (zero) stability is; and Demonstrate an understanding of the Dahlquist Equivalence Theorem by describing the relationship between a convergent method, consistency, and stability.

Determine if a multi-step method is stable and consistent.

Define global and local order of accuracy for an ODE integration method, Describe the relationship between global and local order of accuracy, and

Calculate the local order of accuracy for a given method using a Taylor series analysis.

Define eigenvalue stability, and determine the stability boundary for a multi-step or multi-stage method applied to a linear system of ODE's.

Recommend an appropriate ODE integration method based on the features of the problem being solved.

Implement multi-step and multi-stage methods to solve a representative system of ODE's from an engineering application.

Finite Difference And Finite Volume Methods For Ode's/ Pde's: Define the physical domain of dependence for a problem, Define and determine the numerical domain of dependence for a discretization, and Explain the CFL condition and determine the time step constraints resulting from the CFL conditions.

Determine the local truncation error for a finite difference approximation of a ODE using a Taylor series analysis.

Explain the difference between a centered and a one-sided (e.g. upwind) discretization.

Describe the Godunov finite volume discretization of one/two-dimensional convection on an unstructured mesh.

Perform an eigenvalue stability analysis of a finite difference approximation of a ODE using either Von Neumann analysis or a semi-discrete (method of lines) analysis.

Implement a finite difference or finite volume discretization to solve a representative PDE (or set of ODE's) from an engineering application.

Explain how Dirichlet and Neumann boundary conditions are implemented for Laplace's equation discretized by FDM.

Describe how the FDM discretization results in a system of discrete equations and, for linear problems band describe the meaning of the entries (rows and columns) of the stiffness matrix and of the right-hand side vector for linear problems.

Incremental Nonlinear Analysis: Nonlinear ordinary differential equations & partial differential equations. Nonlinear optimization. FFTs and wavelet analysis.

The IEEE floating point standard, sparse and structured matrices and linear algebra software.

List of Matlab(R) practical problems:

Laplace equation, Poisson equation, harmonic equation, bi-harmonic equation, Symbolic nonlinear ordinary differential equations, Symbolic nonlinear partial differential equations; Nonlinear optimization, FEM problems in 1 and 2D, toolboxes for PDE, curve fitting, Taylor series, and wavelet analysis.

Books

1. F B Hildebrand, Introduction to Numerical Analysis, Dover publications, Newyork.
2. RJ Schilling & Sandra L Harris, Applied Numerical Methods for Engineering using Matlab and C.
3. Erwin Kreyszig, Advanced Engineering Mathematics
4. William H Press at al., Numerical Recipes in FORTRAN, the Art of the Scient. Comp.
5. Cornahn B., Et al, Applied Numerical Methods, John Wiley.
6. Bau III, David, and Lloyd N. Trefethen. Numerical Linear Algebra. Philadelphia, PA: Society for Industrial and Applied Mathematics, 1997. ISBN: 9780898713619.
7. V. RajaRaman, Computer Oriented Numerical Methods
8. S.D. Conte, & Cari De Boor, Elementary Numerical Analysis, Mc Graw Hill.
9. R.L. Burden and T.D. Faires, 'Numerical Analysis', Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
10. Chapra, S. C and Canale, R. P., "Numerical Methods for Engineers", 5th Edition, TataMcGraw-Hill, New Delhi, 2007.
11. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education, Asia, New Delhi, 2006.
12. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
13. Bai, et al. Templates for the Solution of Algebraic Eigenvalue Problems: a Practical Guide. Philadelphia, PA: Society for Industrial and Applied Mathematics, 2000.

UG	Department: Civil Engineering
Course Code: CET 433	Course Name: Earthquake Disaster Mitigation
Credit:3	L-T-P:2-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to Earthquake Hazard: Seismic hazard and seismic risk definitions, Hazard estimation, Effect of site conditions on structures</p> <p>Seismic Vulnerability: Seismic Evaluation, Building Types, Micro & Macro methods, Intensity Scales, Damage probability matrix, Vulnerability functions</p> <p>Earthquake Disaster: Direct and indirect damages, Ground failures in the past earthquake, Damage to structures, Associated damage due to fire and flooding, failure of embankments, dams and bridges, tsunamis.</p> <p>Disaster Mitigation: Earthquake warning and evacuation, Lesson learnt, Do's and don't about earthquakes, Short term and long term mitigation, post earthquake disaster surveys, Survey proformas, Maximum credible earthquake and Design basis earthquakes, Seismic evaluation of existing buildings and structures, rapid visual screening (RVS), methods of seismic retrofitting</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Richter, C. F. (1958), "Elementary Seismology, Eurasia Publishing House (Pvt.) Ltd., New Delhi. 2. Agrawal, P. N. (1992), "Engineering Seismology", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. 3. Aki, K. and Richard, P. G. (1980), "Quantitative Seismology, Theory And Methods", Vol. I and II, W. H. Freeman & Co. 4. Reiter, L (2001)., "Earthquake Hazard Analysis, Issues and Insights", Columbia University Press. 5. "Prestandard and Commentary for The Seismic Rehabilitation of Buildings," FEMA 356 (2000), Federal Emergency Management Agency, Washington, D.C. 	

UG	Department: Civil Engineering
Course Code: CET 434	Course Name: Water Conservation Technology
Credit: 3	L-T-P:3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to water conservation and assessment. Importance of conservation for urban and rural conditions. Soil, Plant, Atmosphere Continuum (SPAC); resource assessment (hydrology cycle, surface flow assessment, groundwater recharge assessment).</p> <p>Water stress: principles and indicators for assessing water stress, Water quality assessment; Water resources conservation and management measures.</p> <p>Irrigation: types, scheduling, efficiency. Arid, semi arid and humid ecosystems; Water recycling and reuse leading to water conservation; Institutional mechanisms for water management: collective action and decentralization, river basin organizations, WUAs, multiple stakeholder platforms, programmes and policies for integrated water management</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Land and Water Management Principles: R. Suresh 2. Advances in Irrigation: Daniel A. Hillel. 3. Soil and Water Conservation: Schwaab, Frevert. 	

B. Tech Civil 8th Semester

S. No.	Course Code	Course Name	Category	Type	Credit	L	T	P
1		Management*	PC	Theory				
2		Major Project	Project	Theory				
3			AEC	Theory				
4			AEC	Theory				
5			OE	Theory				
6			OE	Theory				

List of Programme Electives (PE), 03 Credits		
S.NO.	COURSE	COURSE CODE
1	Concrete Technology	CET 401
2	Design of Hydraulic Structures	CET 402
3	Ground Improvement Techniques	CET 403
4	Air & Noise Pollution	CET 404
5	System Analysis	CET 405
6	Industrial Waste Treatment	CET 406
7	Prestressed Concrete	CET 407
8	Urban Water Conveyance System Design	CET 408
9	Traffic Engineering and Traffic Planning	CET 409
10	Sustainable Building Project Delivery	CET 410
11	Construction Project Management	CET 411
12	Solid Waste Management	CET 412

List of Advanced Elective Courses (AEC), 03 Credits		
S.NO.	COURSE	COURSE CODE
1	Introduction of Spatial Data Collection and Analysis	CET 420
2	Construction Information System	CET 421
3	Structural Dynamics	CET 422
4	Finite Element Method	CET 423
5	Advanced Foundation Design	CET 424
6	Design of Steel Structural Systems	CET 425

List of Open Elective Courses (OE) for students of other departments.		COURSE CODE
S.NO.	COURSE	
1	Introduction to Remote Sensing & GIS	CET 431
2	Numerical Methods	CET 432
3	Earthquake Disaster Mitigation	CET 433
4	Water Conservation Techniques	CET 434

PROGRAMME ELECTIVES (PE)

UG	Department: Civil Engineering
Course Code:CET 401	Course Name: Concrete Technology
Credit:4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Building Technology	

Syllabus

Review of constituent materials and mix design, admixtures, Properties of concrete in fresh and hardened state, Special concretes, Durability of concrete subjected to extreme environment, Deterioration mechanisms, assessment and control of corrosion in concrete structures, In-situ assessment of concrete structures, Various NDT techniques and their applications, Repair of concrete structures.

Text Books

1. Concrete technology by A. M. Neville, Pearson education India.
2. Concrete Technology by Krishnaraju
3. Concrete Technology by Gambhir

UG	Department: Civil Engineering
Course Code: CET 402	Course Name: Design of Hydraulic Structures
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Water Resources Engineering, Hydrology	

Syllabus

Introduction; type of hydraulic structures and their function; consideration for their selection.

Dams; Design principles of gravity and earth dams; spillway; types of spillway: Ogee, chute, shaft, side channel and siphon spillway; spillway aerators; spillways; Design of ogee spillway.

Diversion headworks; Components of diversion head work and their design.

Channel transitions; Design of channel transitions for sub critical and super critical flows; cross and distributory head regulators; energy dissipation downstream of falls; Cross drainage structures: Super passage, aqueducts, design of cross drainage structures, Design of outlets.

Books:

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

UG/PG: UG	Department: Civil Engineering
Course Code: CET 403	Course Name: Ground Improvement Techniques
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Soil Mechanics and Design of Foundations	
<h3>Syllabus</h3> <p>Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement, Shallow and deep compaction requirements, Principles and methods of soil compaction. Shallow compaction and methods, properties of compacted soil and compaction control, deep compaction and vibratory methods, dynamic compaction. Ground Improvement by drainage, Dewatering methods, Design of dewatering systems, Preloading, Vertical drains, vacuum consolidation, Electro-kinetic dewatering, design and construction methods. Cement stabilization and cement columns, Lime stabilization and lime columns, Stabilization using bitumen and emulsions, Stabilization using industrial wastes. Construction techniques and applications, Permeation grouting, compaction grouting, jet grouting, different varieties of grout materials, grouting under difficult conditions, Soil nailing, rock anchoring, micro-piles, design methods, construction techniques, Case studies of ground improvement projects. Soil Reinforcement and Geosynthetics, design principles and influencing factors, Use of geosynthetics for filtration, drainage, roads, and landfills.</p>	
<h3>Books</h3> <ol style="list-style-type: none"> 1. Ground Improvement Techniques by Dr. P. Purushottam, Laxmi Publications, New Delhi 2. Construction and Geotechnical methods in foundation engineering, by Koerner, MGH 3. Engineering with Geo-synthetics, by GV Rao & GVSS Raju, Tata McGraw Hill, New Delhi. 4. G. Venkatappa Rao, "Geosynthetics an Introduction", Sai Master Geoenvironmental Pvt Ltd. 5. Nainan P. Kurian, "An Introduction to Modern Techniques in Geotechnical and Foundation Engineering", Narosa Publishing House, New Delhi. 6. G.L. Sivakumar Babu, "An Introduction to Soil Reinforcement and Geosynthetics", Universities Press (India) Pvt Ltd, Hyderabad, A.P, India. 	

UG	Department: Civil Engineering
Course Code: CET 404	Course Name: Air and Noise Pollution
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Sources of air pollution; Classification of aerosols, Gases vapors, natural pollutants; Properties of air pollutants; Standards of air quality. Emission inventories & Emission factor; Meteorological factors influencing dispersion of air pollutants; Gaussian plume model for dispersion of air pollutants and its applications; Effects on man, material, vegetation, art treasure; Air pollution disasters; Economic Effects of air pollution; Global Effects of Air pollution; Air pollution Due to Automobiles and emission control; General concept of transport planning for prevention of air pollution; Control technology for particulate and gaseous pollutants. Basics of noise Pollution; Measurement of noise; permissible noise levels in different zones; effects of noise, Control of Noise Pollution.</p>	
<p>Books:</p> <ol style="list-style-type: none"> 1. Air Pollution: Its Origin & Control: Wark, Warner & Davis 2. Air Pollution: Perkins. 3. Noise Pollution and Control: S P. Singhal 4. Air pollution and control, KVSG Muralikrishna, Kaushal and Co., ND. 	

UG	Department: Civil Engineering
Course Code: CET 405	Course Name: System Analysis
Credit: 4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Definitions; synthesis and control; linear time variant systems; transfer function; impulse response; state transition matrix; system synthesis; objectives of a design, direct and indirect method of optimization; optimality conditions for unconstrained problem; linear programming; dual sensitivity; gradient method; steepest descent method. Dynamic programming; single degree of difficult problems; examples from Civil Engineering design; stochastic processes; decision process in engineering; decision making under uncertainty and under risk.</p> <p>Books:</p> <ol style="list-style-type: none"> 1. Optimisation by S.S. Rao 2. Optimisation by Wagner 	

UG	Department: Civil Engineering
Course Code: CET 406	Course Name: Industrial Waste Treatment
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course: Sanitary Engineering	
<p>Syllabus</p> <p>Sources and characteristics, Effects of Discharges of Industrial Waste on receiving bodies of water, land and Sewer. Effluent and stream standards. Specific Industrial treatment Processes: Neutralization, Equalization and proportioning, Volume and strength Reduction. Raw Materials, water Requirement, Flow Sheet and treatment of Industrial Wastewater Generated from: Textile Tannery, Pulp and Paper, Dairy, Distillery, Dying and Printing, and electro-plating Industry. Provisions of various Indian standards for above Industries.</p> <p>Potentials for Wastewater recycle and reuse in industries, Concept of Common effluent treatment plants.</p> <p>Books:</p> <ol style="list-style-type: none"> 1. Industrial Wastewater by Nelson L Nemerow 2. Industrial water pollution control, William Wesley Eckenfelder 3. Industrial Wastewater Treatment by Rao & Dutta 	

UG	Department: Civil Engineering
Course Code: CET 407	Course Name: Prestressed Concrete
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course: Design of RC Structures	
<p>Syllabus</p> <p>Basic philosophy of prestressing; various techniques of prestressing; different systems of prestressing; Prestressing of concrete structures; losses in prestress; deflection of prestressed concrete members; analysis and design of prestress beams; camber; deflection; cable layouts; stretching in stages, ultimate strength in flexure and shear. Design of end blocks; Statically indeterminate structures; concordant cables; linear transformation, Analysis and design of continuous beams. Tension members; circular prestressing-prestressed tanks and prestressed pipes. Compression members; piles. Partial prestressing; composite construction, analysis of composite beams, prestress slabs; Introduction to pre-cast prestressed elements like poles, railway sleepers, beams, slabs and wall panels etc. planning and economical aspects of prestressed structures, construction of prestressed concrete structures-techniques, materials and management</p>	
<p>Books:</p> <ol style="list-style-type: none"> 1. Prestressed Concrete Structures by T.Y. Lin 2. Prestressed Concrete Structures by Krishnaraju 3. Prestressed Concrete Structures by G.S. Pandit & S.P. Gupta. 	

UG/PG : UG/PG	Department: Civil Engineering
Course Code: CET 408	Course Name: Urban Water Conveyance System Design
Credit: 4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Pipe and Channel Hydraulics	

Syllabus

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

Text Books

1. Hall, M.J., Urban Hydrology, Elsevier, 1984.
2. Optimal Design of Water Distribution Networks, P. R. Bhave, Narosa Publishing House, 2003.
3. Butler, D. & Davies, J.W. Urban Drainage, Spon Press, 2nd Edn., 20004.

Reference Books

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

UG/PG: UG	Department: Civil Engineering
Course Code: CET 409	Course Name: Traffic Engineering and Transport Planning
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course:	Highway Engineering

Syllabus

Traffic Engineering: Volumetric traffic studies, Traffic-volume study, traffic-speed study, Origin and Destination studies, Parking studies and accident study, their objectives, methods, analysis and interpretation. Roadway capacity and level of service concept. Geometric improvement of intersections. Street lighting. Impact of traffic on environment. Traffic flow characteristics; Traffic Control & Parking Studies: Traffic & parking problems, requirements & design standards for on street parking, off-street parking . Importance of traffic signs, general principles & types of traffic signs, advantages & disadvantages of traffic signals, signal phases, number and location of signal phases. Transport Planning: Various transportation systems, their classification, suitability, merits & demerits. Methodologies of planning transport systems, transport surveys. Trip-generation & distribution. Traffic assignment and model split. Mass transit systems, planning, design and operation.

Books

1. Transport Engineering and Transport Planning By L.R.Khadyal
2. Highway Engineering By S.K.Khanna and C.E.G Justo
3. IRC 93,
4. Transportation Engineering by James H Banks

UG/PG: UG	Department: Civil Engineering
Course Code: CET 410	Course Name: Sustainable Building Project Delivery
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to sustainable development; Energy and environmental issues in built environment; Concept of eco friendly materials and designs, Reuse-reduce and recycling of material, waste utilization in construction materials; Professionals associated in a sustainable building project, roles and responsibilities of engineers and managers, integrated project management, certified professionals for sustainable projects, project delivery and documentation for certification of sustainable buildings; Introduction to green movement and sustainable buildings, sustainable building economics, concepts of life cycle costing ; Introduction to sustainable building design and rating systems, Requirements and submittals, national and international certification processes (LEED, LEED India, GRIHA-TERI, etc), exposure to related standards and organizations, associated tools and terminology, continual improvement, case studies.</p>	
<p>Text Books</p> <ol style="list-style-type: none"> 1. Sustainable construction, design and delivery by Charles Kibert 2. LEED Green building rating System 3. GRIHA Building rating system 	

UG	Department: Civil Engineering
Course Code: CET 411	Course Name: Construction Project Management
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus

Project management concepts, construction firms- management hierarchy, Architect-Engineers-Contractors/Managers relationships, Roles of construction managers; Construction contracts, project delivery methods; Project proposal, project feasibility, request for proposal, project drawings, estimation and bidding, job site layout, contracting the project, sub contractors procurement, resources procurement; Fundamental concepts of equipment economics and equipment management, equipment selection ; Construction plans, work study, work breakdown structure (WBS), construction job-site layout, construction procurements, Time estimates, PERT, CPM, linear scheduling, project scheduling, monitoring, updating, cost functions, time –cost trade off, resource planning leveling and allocation, resource based networks, project cost and schedule of values, change orders, cost budgeting ; Concepts of Risk management, safety management, and quality management; Project monitoring and reporting; Construction claims, Arbitration, project closeout ; Concept of lean construction. Introduction to BIM.

Text Books:

1. Construction Management and Planning by Sengupta and Guha TMH Publications
2. Construction project management by Kumar Neeraj Jha Pearson Publications
3. Construction planning equipment and methods by Peurifoy TMH publications

Reference Material:

1. Construction management fundamentals Knutson MGH publications
2. IS 15883 : 2009 Construction Project Management

UG	Department: Civil Engineering
Course Code: CET 412	Course Name: Solid Waste Management
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Problems associated with solid waste disposal; generation of solid wastes; Classification of solid; characteristics of solid waste; analysis of solid waste; Onsite handling, storage and processing of solid waste; Solid waste collection systems; options for transfer and transport systems; processing and disposal methods; Recovery of resources, conversion products and energy generation from solid waste, Biomedical waste definition; Biomedical Handling Rules; Waste Category; waste minimization; Handling and Disposal; Biomedical waste treatment; Electronic waste and its management.</p>	
<p>Books:</p> <ol style="list-style-type: none"> 1. Integrated Solid Waste Management: Tchobanoglous, Theisen and Vigil 2. Hazardous Waste Management: Wentz 3. Environmental Engineering, Howard Peavy, D. Rowe. 	

ADVANCED ELECTIVE COURSES

UG/PG : UG (Advance Elective Course)	Department: Civil Engineering
Course Code: CET 420	Course Name: Introduction to spatial data collection & analysis
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course: Surveying	

Syllabus

Remote Sensing: Basic concepts, Remote Sensing Platforms & Sensors; Remote sensing data products; Geometric & Radiometric corrections; Visual interpretation and digital image processing; Image Classification, Accuracy Assessment; Image Processing Software.

Overview of GNSS techniques, Introduction to the GNSS functions, Components and operation of GNSS; Surveying and data collection using GNSS; Overview of 3D Terrestrial Scanners and Ground Penetrating Radar.

Geographic al Information System; Basic concepts and components of GIS; Digital representation of geographic data, Database creation, Raster and Vector based GIS data and analysis, Database management; Operations and analysis in GIS; Introduction of GIS software.

Application case studies of spatial data collection and analysis techniques.

Basic Textbooks

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

Reference Books

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

UG/PG: UG	Department: Civil Engineering
Course Code: CET 421	Course Name: Construction Information systems
Credit: 3	L-T-P: 2-0-2
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to IT in construction, ERP in construction, use of IT in improving productivity and communication in construction, Management information systems in construction industry, computerized project management systems, internet technology, web applications and e- business in construction; Building Information modelling concepts, software(s) used for BIM, REVIT working platform, Detailed project work based on REVIT Arch and MEP, Integration of REVIT with other project management software e.g. AUTO CAD, and NavisWorks, introduction to green building software</p>	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Understanding IT in construction by Ming sun 2. BIM Handbook by Chuck Eastman 3. REVIT Tool Manuals by Autodesk 	

UG/PG: UG	Department: Civil Engineering
Course Code: CET 422	Course Name: Structural Dynamics
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Structural Analysis	

Syllabus

Systems with one degree of freedom; undamped system free and forced vibrations, dynamic load factor, different load pulses, damped systems, free and forced vibration response to a pulsating force of damped and damped system. Vibration of multi-degree freedom systems numerical techniques for finding natural frequencies and mode shapes; orthogonal relationship of principle modes; Rayleigh's principle and its application for determination of fundamental frequency. Evaluation of dynamic response by mode superposition method. Application of structural dynamics to civil engineering problems.

Text Books

1. Structural Dynamics by A.K. Chopra.
2. Structural Dynamics by Mario Paz.

UG/PG: UG	Department: Civil Engineering
Course Code: CET 423	Course Name: Finite Element Method
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Structural Analysis-I & Structural Analysis-II	

Syllabus

Introduction, Variational principle, Principle of virtual work, Theory of minimum potential energy, Ritz Method, Interpolation & Representation of curves, elements of elasticity, finite element formulation, Various types of elements, solution procedures, convergence criterion, Isoparametric formulation, Lagrange & Serendipity elements, One dimensional and two dimensional elements

Books:

1. Matrix & Finite element displacement analysis of structures by D. J. Dave
2. Concepts & applications of Finite Element Method by R. D. Cook
3. Finite Element procedures in Engineering Analysis by K. J. Bathe
4. Finite Element Method vs Classical Methods by H.S. Govindarao
5. The Finite Element Method in Engineering by S. S. Rao

UG/PG: UG	Department: Civil Engineering
Course Code: CET 424	Course Name: Advanced Foundation Design
Credit: 4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Soil Mechanics, Design of Foundations and Earth Structures.	

Syllabus

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

Books

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

UG	Department: Civil Engineering
Course Code: CET 425	Course Name: Design of Steel Structural Systems
Credit:4	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: Design of Steel Structures	

Syllabus

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

References

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

OPEN ELECTIVES

UG/PG : UG	Department: CIVIL ENGINEERING
Course Code: CET 431	Course Name: Introduction of remote sensing & GIS
Credit: 3	L-T-P: 3-0-0
Version:	Approved on:
Pre-requisite course:	

Syllabus

Remote Sensing: Basic concepts, Multi-Concepts in Remote Sensing, Advantages of Remote Sensing data, Applications of Remote Sensing; Remote Sensing Platforms & Sensors; Remote sensing data products; Referencing scheme, Digital data Format and characteristics;, High Resolution Images, Image Processing Software; Geometric & Radiometric corrections, Visual Image Interpretation Methods, Digital Image Enhancement, Digital Image Classification Methods, Accuracy Assessment; Geographical Information System; Basic concepts of GIS, Digital representation of geographic data, Digitization of features, Database creation, Raster and Vector based GIS data, Overlay analysis, Buffering, Query, Spatial analysis- 3-D Analysis, Introduction of GIS software, Applications of GIS, National Map policy, National Spatial Data Infrastructure in India.

Text Books:

1. Remote Sensing & DIP: by Lillesand & Keifer, John Wiley & Sons, Inc.
1. Principles of Geographical Information Systems, by Burrough, P. A. / Burrough, P. A., Oxford University Press.

Reference Books:

1. Principles of Remote Sensing: by Curran, P. J.
2. Introduction of Digital Image Processing: by J. R. Johnson, John Wiley & Sons, Inc.
3. Fundamentals of Geographical Information System, by DeMers, Michael N, John Wiley & Sons, Inc.
4. The GIS Book, 5th Edition, by Korte, George, Thomson Learning.

UG/PG : UG	Department: Civil Engineering
Course Code: CET 432	Course Name: Numerical Method
Credit: 3	L-T-P: 2-1-0
Version:	Approved on:
Pre-requisite course: NO & Open Elective for ALL branches VII/VIII semester (Final year) only	

Syllabus

Interpolation And Approximation: Laplace, Poisson's, Bi-harmonic and Taylors equations; Solution of equation; Fixed point iteration: $x=g(x)$ method; Newton's method; Solution of linear system by Gaussian elimination and Gauss-Jordon method; Iterative method-Gauss Seidel method, Inverse of a matrix by Gauss Jordon method; Eigen value of matrix by power method and by Jacobi method for symmetric matrix.

Numerical Differentiation And Integration: Pascal triangle for one and two dimensions, Lagrangian Polynomials; Divided differences; Interpolating with a cubic spline; Newton's forward and backward difference formulas. Differentiation using interpolation formulae; Numerical integration by trapezoidal and Simpson's rules; Romberg's method.

Integration Methods For Ode's: Describe the Adams-Bashforth, Adams-Moulton, and Backwards Differentiation families of multi-step methods; Describe the form of the Runge-Kutta family of multi-stage methods; and Explain the relative computational costs of multi-step versus multi-stage methods.

Explain the concept of stiffness of a system of equations, and describe how it impacts the choice of numerical method for solving the equations.

Explain the differences and relative advantages between explicit and implicit methods to integrate systems of ordinary differential equations; and for nonlinear systems of equations, explain how a Newton-Raphson can be used in the solution of an implicit method.

Define a convergent method; Define a consistent method; Explain what (zero) stability is; and Demonstrate an understanding of the Dahlquist Equivalence Theorem by describing the relationship between a convergent method, consistency, and stability.

Determine if a multi-step method is stable and consistent.

Define global and local order of accuracy for an ODE integration method, Describe the relationship between global and local order of accuracy, and

Calculate the local order of accuracy for a given method using a Taylor series analysis.

Define eigenvalue stability, and determine the stability boundary for a multi-step or multi-stage method applied to a linear system of ODE's.

Recommend an appropriate ODE integration method based on the features of the problem being solved.

Implement multi-step and multi-stage methods to solve a representative system of ODE's from an engineering application.

Finite Difference And Finite Volume Methods For Ode's/ Pde's: Define the physical domain of dependence for a problem, Define and determine the numerical domain of dependence for a discretization, and Explain the CFL condition and determine the time step constraints resulting from the CFL conditions.

Determine the local truncation error for a finite difference approximation of a ODE using a Taylor series analysis.

Explain the difference between a centered and a one-sided (e.g. upwind) discretization.

Describe the Godunov finite volume discretization of one/two-dimensional convection on an unstructured mesh.

Perform an eigenvalue stability analysis of a finite difference approximation of a ODE using either Von Neumann analysis or a semi-discrete (method of lines) analysis.

Implement a finite difference or finite volume discretization to solve a representative PDE (or set of ODE's) from an engineering application.

Explain how Dirichlet and Neumann boundary conditions are implemented for Laplace's equation discretized by FDM.

Describe how the FDM discretization results in a system of discrete equations and, for linear problems band describe the meaning of the entries (rows and columns) of the stiffness matrix and of the right-hand side vector for linear problems.

Incremental Nonlinear Analysis: Nonlinear ordinary differential equations & partial differential equations. Nonlinear optimization. FFTs and wavelet analysis.

The IEEE floating point standard, sparse and structured matrices and linear algebra software.

List of Matlab(R) practical problems:

Laplace equation, Poisson equation, harmonic equation, bi-harmonic equation, Symbolic nonlinear ordinary differential equations, Symbolic nonlinear partial differential equations; Nonlinear optimization, FEM problems in 1 and 2D, toolboxes for PDE, curve fitting, Taylor series, and wavelet analysis.

Books

1. F B Hildebrand, Introduction to Numerical Analysis, Dover publications, Newyork.
2. RJ Schilling & Sandra L Harris, Applied Numerical Methods for Engineering using Matlab and C.
3. Erwin Kreyszig, Advanced Engineering Mathematics
4. William H Press at al., Numerical Recipes in FORTRAN, the Art of the Scient. Comp.
5. Cornahn B., Et al, Applied Numerical Methods, John Wiley.
6. Bau III, David, and Lloyd N. Trefethen. Numerical Linear Algebra. Philadelphia, PA: Society for Industrial and Applied Mathematics, 1997. ISBN: 9780898713619.
7. V. RajaRaman, Computer Oriented Numerical Methods
8. S.D. Conte, & Cari De Boor, Elementary Numerical Analysis, Mc Graw Hill.
9. R.L. Burden and T.D. Faires, 'Numerical Analysis', Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
10. Chapra, S. C and Canale, R. P., "Numerical Methods for Engineers", 5th Edition, TataMcGraw-Hill, New Delhi, 2007.
11. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education, Asia, New Delhi, 2006.
12. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
13. Bai, et al. Templates for the Solution of Algebraic Eigenvalue Problems: a Practical Guide. Philadelphia, PA: Society for Industrial and Applied Mathematics, 2000.

UG	Department: Civil Engineering
Course Code: CET 433	Course Name: Earthquake Disaster Mitigation
Credit:3	L-T-P:2-1-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to Earthquake Hazard: Seismic hazard and seismic risk definitions, Hazard estimation, Effect of site conditions on structures</p> <p>Seismic Vulnerability: Seismic Evaluation, Building Types, Micro & Macro methods, Intensity Scales, Damage probability matrix, Vulnerability functions</p> <p>Earthquake Disaster: Direct and indirect damages, Ground failures in the past earthquake, Damage to structures, Associated damage due to fire and flooding, failure of embankments, dams and bridges, tsunamis.</p> <p>Disaster Mitigation: Earthquake warning and evacuation, Lesson learnt, Do's and don't about earthquakes, Short term and long term mitigation, post earthquake disaster surveys, Survey proformas, Maximum credible earthquake and Design basis earthquakes, Seismic evaluation of existing buildings and structures, rapid visual screening (RVS), methods of seismic retrofitting</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Richter, C. F. (1958), "Elementary Seismology, Eurasia Publishing House (Pvt.) Ltd., New Delhi. 2. Agrawal, P. N. (1992), "Engineering Seismology", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. 3. Aki, K. and Richard, P. G. (1980), "Quantitative Seismology, Theory And Methods", Vol. I and II, W. H. Freeman & Co. 4. Reiter, L (2001)., "Earthquake Hazard Analysis, Issues and Insights", Columbia University Press. 5. "Prestandard and Commentary for The Seismic Rehabilitation of Buildings," FEMA 356 (2000), Federal Emergency Management Agency, Washington, D.C. 	

UG	Department: Civil Engineering
Course Code: CET 434	Course Name: Water Conservation Technology
Credit: 3	L-T-P:3-0-0
Version:	Approved on:
Pre-requisite course:	
<p>Syllabus</p> <p>Introduction to water conservation and assessment. Importance of conservation for urban and rural conditions. Soil, Plant, Atmosphere Continuum (SPAC); resource assessment (hydrology cycle, surface flow assessment, groundwater recharge assessment).</p> <p>Water stress: principles and indicators for assessing water stress, Water quality assessment; Water resources conservation and management measures.</p> <p>Irrigation: types, scheduling, efficiency. Arid, semi arid and humid ecosystems; Water recycling and reuse leading to water conservation; Institutional mechanisms for water management: collective action and decentralization, river basin organizations, WUAs, multiple stakeholder platforms, programmes and policies for integrated water management</p>	
<p>Books</p> <ol style="list-style-type: none"> 1. Land and Water Management Principles: R. Suresh 2. Advances in Irrigation: Daniel A. Hillel. 3. Soil and Water Conservation: Schwaab, Frevert. 	