KAMARAJ
COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)
S.P.G.Chidambara Nadar - C.Nagammal Campus
S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

B.E. CIVIL ENGINEERING
REGULATIONS – 2021
AUTONOMOUS SYLLABUS
CHOICE BASED CREDIT SYSTEM
III TO IV SEMESTER CURRICULUM AND SYLLABI

VISION:

To make the Department of Civil Engineering, unique of its kind to promote education and research in the various fields of construction industry.

MISSION:

To impart highly innovative and technical knowledge in the field of Civil Engineering to the urban and rural student folks through “Total Quality Education”.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1: Graduates of the program will be creative, able to apply scientific knowledge and computer aided design tools for technical problems in the field of Civil Engineering.

PEO 2: Graduates of the program will be a professional Civil Engineer and/or will pursue higher education in various domains of Civil Engineering by taking competitive examinations.

PEO 3: Graduates of the program will passionately perform as a competent team member, team leader and/or entrepreneur in the development of a sustainable environment.

PROGRAM OUTCOMES:

After going through the four years of study, the Civil Engineering graduates will have the ability to

POs	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/Development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and

		demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 : Graduating students will be able to deal complex problems in the field of Civil Engineering to achieve design solutions with modern technological approach and application software.

PSO2 : Graduating students will be able to understand the professional Civil Engineering practice and apply contextual knowledge with the appropriate consideration of the society and environment.

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REGULATIONS - 2021

CHOICE BASED CREDIT SYSTEM

B.E. CIVIL ENGINEERING

CURRICULUM AND SYLLABI FOR SEMESTER III TO IV

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA2202	Transforms and Numerical Solution of Equations	BS	4	3	1	0	4
2	CE2201	Construction Materials	PC	3	3	0	0	3
3	CE2202	Fluid Mechanics	PC	3	3	0	0	3
4	CE2203	Mechanics of Solids	PC	3	3	0	0	3
5	CE2204	Surveying	PC	3	3	0	0	3
6	GE2201	Design Thinking	EM	3	3	0	0	3
7		Audit Course	AU	3	3	0	0	0
PRACTICALS								
8	CE2205	Computer Aided Building Drawing Laboratory	PC	4	0	0	4	2
9	CE2206	Surveying Laboratory	PC	4	0	0	4	2
10	EM2202	Interpersonal Skills - Listening and Speaking	EM	2	0	0	2	1
			TOTAL	**32**	**21**	**1**	**10**	**24**

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA2254	Probability, Statistics and Numerical Methods	BS	4	3	1	0	4
2	CE2251	Applied Hydraulic Engineering	PC	3	3	0	0	3
3	CE2252	Concrete Technology	PC	3	3	0	0	3
4	CE2253	Environmental Engineering	PC	3	3	0	0	3
5	CE2254	Geotechnical Engineering – I	PC	3	3	0	0	3
6	CE2255	Strength of Materials	PC	4	3	1	0	4
7	GE2251	Quantitative Aptitude	EM	1	1	0	0	1
8	AUD110	Tamils and Technology	AU	1	1	0	0	0
PRACTICALS								
9	CE2256	Geotechnical Laboratory	PC	3	0	0	3	1
10	CE2257	Strength of Materials Laboratory	PC	3	0	0	3	1
11	EM2252	An Introduction to Advanced Reading and Writing	EM	2	0	0	2	1
			TOTAL	**30**	**20**	**2**	**8**	**24**

Course Code	Course Name	L	T	P	C
MA2202	TRANSFORMS AND NUMERICAL SOLUTION OF EQUATIONS	3	1	0	4

Category: Foundation Course (Engineering Science)

a. Preamble

Fourier analysis allows modelling periodic phenomena which appears frequently in engineering, alternating electric currents or the motion of planets. The idea of Fourier analysis is to represent complicated functions in terms of simple periodic functions,namely cosines and sines. This course aims to developing the ability to formulate an engineering problem in a mathematical form by appropriate numerical approach.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Construct the Fourier series for periodic functions and for function with discrete data.	K3
CO2	Classify and solve the initial and boundary value problems such as wave and heat flow equation.	K3
CO3	Compute the Fourier transforms of standard functions and learn its properties.	K3
CO4	Apply the techniques of Z - transform to get the solutions of difference equations.	K3
CO5	Compute numerical solution of algebraic, transcendental equations and system of linear equations.	K3

c. Course Syllabus **Total : 60 Periods**

FOURIER SERIES **12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Classification of partial differential equations – Method of separation of variables – Solutions of one-dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in cartesian coordinates.

FOURIER TRANSFORM **12**

Fourier integral theorem – Fourier transform pair – Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

Z-TRANSFORM **12**

Z-transform – Elementary properties – Initial and final value theorems – Inverse Z–transform – Convolution theorem – Formation of difference equation – Solution of difference equation using Z - transform.

NUMERICAL SOLUTION OF EQUATIONS **12**

Solution of Algebraic and Transcendental equations: Bisection Method – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations: Gauss elimination method – pivoting – Gauss Jordan method – Iterative methods: Gauss Jacobi – Gauss Seidel.

d. Activities

Students shall be exposed to MATLAB programming to find the Fourier transform of the given functions.

e. Learning Resources

Text Books

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, Tenth Edition, New Delhi, 2015.
2. Grewal, B. S, *Higher Engineering Mathematics*, Khanna Publishers, Forty Fourth Edition, New Delhi, 2017.
3 Sastry, S. S, *Introductory Methods of Numerical Analysis*, PHI Learning,Fifth Edition, 2015.

Reference Books

1. Bali, N, Goyal, M, & Watkins, C, *Advanced Engineering Mathematics*, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), Seventh Edition,New Delhi, 2009.
2. Peter, V, O'Neil, *Advanced Engineering Mathematics* , Cengage Learning India Pvt., Ltd., Seventh Edition, New Delhi, 2012.
3 Ramana, B.V, *Higher Engineering Mathematics*, Tata McGraw Hill Co.Ltd., New Delhi, Eleventh Reprint, 2010.

Course Code	Course Name	L	T	P	C
CE2201	CONSTRUCTION MATERIALS	3	0	0	3

Category: Professional Core Course

a. Preamble

To understand the geological knowledge about the origin of materials and its properties, and various properties of materials commonly used in civil engineering construction and their properties.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Develop an understanding about the formation of geological features, plate tectonics and categorize minerals base on appearance and composition.	K3
CO2	Relate the traits that delineate the various types of rocks, structural form of rocks and its implications on its mechanical properties	K2
CO3	Outline the production of bricks, concrete and also the method of placing and making of concrete elements.	K2
CO4	Summarize the typical and potential applications of lime, cement and timbers.	K2
CO5	Illustrate the applications of other materials in civil Engineering.	K2

c. Course Syllabus **Total : 45 Periods**

GEOLOGICAL ORIGIN OF MATERIALS **9**

Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks – scale of weathering – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India. Physical properties of minerals – Quartz group, Feldspar group Gypsum and Clay minerals.

PETROLOGY AND STRUCTURAL GEOLOGY **9**

Classification of rocks, distinction between Igneous Sedimentary and Metamorphic rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations

STONES – BRICKS – CONCRETE BLOCKS **9**

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Concrete blocks – Lightweight concrete blocks – Flyash Bricks.

LIME – CEMENT – TIMBER **9**

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades fine aggregates – river sand – crushed stone sand – properties – Grading-Bulking of fine aggregate – M-Sand. Timber – Market forms – Industrial timber– Plywood – Veneer – Thermocol – Panels of laminates.

OTHER MATERIALS **9**

Steel – Aluminum and Other Metallic Materials – Composition – Aluminum composite panel – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumen. Glass – Ceramics Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles– Geomembranes and Geotextiles for earth reinforcement.- Green material, Sustainable material, Nano materials, Construction chemicals.

d. Activities

Activities to improve the experimental learning:

- Test on cement - Experiment Demo in virtual lab

e. Learning Resources

Text Books

1. Parbin Singh. A ,2009,*Textbook of Engineering and General Geology*, Katson publishing house, Ludhiana.
2. Varghese, P.C.,2012, *Engineering Geology for Civil Engineering*, Prentice Hall of India Learning Private Limited, New Delhi.
3. Varghese.P.C, 2015, *Building Materials*, PHI Learning Pvt. Ltd, New Delhi.
4. Rajput. R.K., 2008, *Engineering Materials*, S. Chand and Company Ltd.
5. Duggal.S.K., 2008, *Building Materials*, 4th Edition, New Age International.

Reference Books

1. Bell .F.G., 2011, *Fundamentals of Engineering Geology*, B.S. Publications. Hyderabad.
2. Dobrin, M.B, 1988, *An introduction to geophysical prospecting*, McGraw Hill, New Delhi,.
3. Jagadish.K.S, 2007, *Alternative Building Materials Technology*, New Age International.
4. Ambhir. M.L., &Neha Jamwal 2012, *Building Materials, products, properties and systems*, Tata McGraw Hill Educations Pvt. Ltd, New Delhi,.
5. IS456 - 2000: *Indian Standard specification for plain and reinforced concrete*, 2011.
6. IS383 - 1970: *Indian Standard specification for coarse and fine aggregate from natural Sources for concrete*, 2011. S1542-1992: Indian standard specification for sand for plaster, 2009.

Course Code	Course Name	L	T	P	C
CE2202	FLUID MECHANICS	3	0	0	3

Category: Professional Core Course

a. Preamble

To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyze and appreciate the complexities involved in solving the fluid flow problems.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.	K2
CO2	Understand and solve the problems related to equation of motion.	K2
CO3	Gain knowledge about dimensional and model analysis.	K3
CO4	Learn types of flow and losses of flow in pipes.	K3
CO5	Understand and solve the boundary layer problems.	K2

c. Course Syllabus **Total : 45 Periods**

FLUID PROPERTIES AND FLUID STATICS **9**

Fluid – definition, distinction between solid and fluid - Units and dimensions Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

FLUID KINEMATICS AND DYNAMICS **9**

Fluid Kinematics – Classification and types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- stream line-streak line-path line- stream function - velocity potential function - flow net. Fluid dynamics - equations of motion ---Euler's equation along streamline - Bernoulli‟s equation – applications Venturimeter, orifice meter and Pitot tube- linear momentum equation and its application to pipe bend.

DIMENSIONAL ANALYSIS AND MODEL STUDIES **9**

Fundamental dimensions - dimensional homogeneity - Rayleigh‟s method and Buckingham Pi- theorem - dimensionless parameters - similitude and model studies distorted models.

FLOW THROUGH PIPES **9**

Reynold‟s experiment - laminar flow through circular pipe (Hagen poiseulle's) -- hydraulic and energy gradient – flow through pipes - Darcy - Weisbach's equation - pipe roughness - friction factor- Moody's diagram- major and minor losses of flow in pipes pipes in series and in parallel – Equivalent pipe.

BOUNDARY LAYER **9**

Boundary layer – definition- boundary layer on a flat plate – laminar and turbulent boundary layer- displacement, energy and momentum thickness – Momentum integral equation- Boundary layer separation and control – drag on flat plate.

d. Activities

Activities to improve the experimental learning:

Students will learn about the major loss and minor loss in the pipe by conducting experiment in the laboratory.

e. Learning Resources

Text Books

1. Modi P.N and Seth., 2009, *Hydraulics and Fluid Mechanics including Hydraulic Machines*, Standard Book House New Delhi.
2. Jain.A.K..,2016,*Fluid Mechanics" (Including Hydraulic Machines)*, Khanna Publishers, Twelfth Edition.
3. Subramanya.K., 2010,*Fluid Mechanics and Hydraulic Machines*, Tata McGraw Hill Education Private Limited, New Delhi.
4. Rajput.R.K., 2008,*Fluid Mechanics*, S.Chand and Co, New Delhi.

Reference Books

1. Streeter, V.L., and Wylie, E.B., 2010,*Fluid Mechanics*, McGraw Hill.
2. Fox W.R. and McDonald A.T., 2013,*Introduction to Fluid Mechanics*, John-Wiley and Sons, Singapore.

3. White, F.M., 2017, *Fluid Mechanics*, Tata McGraw Hill, 5th Edition, New Delhi.

4. Mohd. Kaleem Khan., 2015, *Fluid Mechanics and Machinery*, Oxford University Press, New Delhi.

5. Bansal.R.K., 2013,*Fluid Mechanics and Hydraulic Machines*, Laxmi Publications Pvt. Ltd., New Delhi.

Course Code	Course Name	L	T	P	C
CE2203	MECHANICS OF SOLIDS	3	0	0	3

Category: Professional Core Course

a. Preamble

To develop capacity to predict the effect of force in the course of carrying out the design functions of engineering.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Understand the basic engineering principles such as laws of mechanics and vector calculus for solving problems related to particles at rest	K2
CO2	Examine the various reactive forces and couples for equilibrium of rigid bodies using free body diagram	K3
CO3	Determine the various section properties (Centroid, Moment of Inertia, Product Moment of Inertia and Mass moment of Inertia) for simple and composite sections.	K3
CO4	Understand the fundamental concepts of stress, strain of solids and the stresses in two Dimensions.	K2
CO5	Apply the analytical techniques for computing deflection of members subjected to bending.	K3

c. Course Syllabus **Total : 45 Periods**

BASICS AND STATICS OF PARTICLES **9**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces - rectangular components -Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces. Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance.

EQUILIBRIUM OF RIGID BODIES **9**

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Varignon's

theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions

PROPERTIES OF SURFACES AND SOLIDS **9**

Centroid and Moment of Inertia – Centroid of lines and areas – Parallel axis theorem and perpendicular axis theorem for Second moment of Plane area - First and Second moment of plane area , Principal Moment of Inertia for T section- I section, - Angle section, Hollow section by using standard formula. Mass moment of Inertia for prismatic, cylindrical and spherical solids - Relation to area moments of inertia.

STRESS, STRAIN AND DEFORMATION OF SOLIDS **9**

Simple Stresses and strains – Elastic constants -- Relationship between elastic constants – Stress Strain Diagram – Ultimate Stress – Yield Stress – Deformation of axially loaded member - Composite Bars Thermal Stresses – State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress -- Mohr's circle method.

STATE OF STRESS IN THREE DIMENSIONS **9**

Stress tensor at a point – Stress invariants Determination of principal stresses and principal planes Volumetric strain. Theories of failure: Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Total Strain energy theory – Maximum distortion energy theory – Application problems.

d. Activities

Activities to improve the experimental learning:

Students will learn determination of young’s modulus of material by conducting experiment in the laboratory.

e. Learning Resources

Text Books

1. Beer, F.P and Johnston Jr. E.R., (2004), *Vector Mechanics for Engineers (In SI Units): Statics and Dynamics*, 8th ed, Tata McGraw-Hill Publishing company,
2. Vela Murali, 2010, *Engineering Mechanics*, Oxford University Press
3. Rajput.R.K., 2015,*Strength of Materials*,S.Chand and Co, New Delhi.
4. Bansal. R.K.,2010, *Strength of Materials*,Laxmi Publications Pvt. Ltd., New Delhi.

Reference Books

1. Bhavikatti, S.S and Rajashekarappa, K.G, 1998, *Engineering Mechanics*, New Age International (P) Limited Publishers.
2. Hibbeller, R.C and Ashok Gupta, 2010, *Engineering Mechanics: Statics and Dynamics*, 11th Edition, Pearson Education.
3. Rajasekaran S and Sankarasubramanian G., 2005, *Engineering Mechanics Statics and Dynamics*, 3rd ed, Vikas Publishing House Pvt. Ltd.
4. Timoshenko.S.B. and Gere.J.M.,1999, *Mechanics of Materials*, Van NosReinbhold, New Delhi.

Course Code	Course Name	L	T	P	C
CE2204	SURVEYING	3	0	0	3

Category: Professional Core Course

a. Preamble

This course introduces the various methods of surveying to solve the field problems and to illustrate the basics of Modern Surveying and advanced concepts of surveying.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Understand the rudiments of various surveying and its principles	K2
CO2	Infer the concepts of Theodolite and Tacheometric Surveying	K2
CO3	Narrate the procedure for establishing horizontal and vertical control and its adjustment procedure	K2
CO4	Describe the basics of Modern Surveying methods and its applications	K2
CO5	Outline the knowledge in Route surveying, Hydrographic surveying and Field Astronomical surveying	K2

c. Course Syllabus **Total : 45 Periods**

FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING **9**

Classifications and basic principles of surveying -- Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Types of Compass Basic Principles- Bearing – Types - True Bearing - Magnetic Bearing- Levelling- Principles and theory of Levelling – Datum -- Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling- Booking – Reduction - Sources of errors in Levelling Curvature and refraction.

THEODOLITE AND TACHEOMETRIC SURVEYING **9**

Horizontal and vertical angle measurements - Temporary and permanent adjustments Heights and distances - Tacheometer - Stadia Constants - Analytic Lens -- Tangential and Stadia Tacheometry surveying - Contour – Contouring – Characteristics of contours – Methods of contouring – Tacheometric contouring Contour gradient – Uses of contour plan and map

CONTROL SURVEYING AND ADJUSTMENT **9**

Horizontal and vertical control- Methods – Triangulation - Traversing – Trigonometric Levelling – Gale's table - Trilateration - Concepts of measurements and errors – error propagation and linearization – adjustment methods – least square methods – adjustment of simple triangulation networks.

MODERN SURVEYING **9**

Total Station - Digital Theodolite, EDM, Electronic field book - Advantages – Parts and accessories - working principle – Observables – Errors COGO functions – Field procedure and applications. GPS: Advantages System components – Signal structure – Selective availability and antispoofing – receiver components and antenna – Planning and data acquisition – Data processing Errors in GPS – Field procedure and applications.

ADVANCED TOPICS IN SURVEYING **9**

Route Surveying - Reconnaissance - Route surveys for highways, railways and waterways - Simple curves – Compound and reverse curves – Transition curves - Setting out different methods of simple curve - Vertical curves - Hydrographic surveying – Tides - MSL Sounding methods - - Astronomical terms and definitions Celestial coordinate systems – different time systems Field observations and determination of azimuth by altitude and hour angle method.

d. Activities

Activities to improve the experimental learning:

Students will learn about the measurement of Reduced level by conducting Fly Leveling experiment in the laboratory.

e. Learning Resources

Text Books

1. Venkatramaiah, 2014, *Text book of Surveying*, University press, New Delhi,
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, 2005, *Surveying Vol.I& II*, Lakshmi Publications Pvt Ltd, New Delhi.
3. S.K.Duggal, *Surveying Volume I & II*, Tata McGraw Hill Publishers

Reference Books

1. R. Subramanian, 2012, *Surveying and Levelling*, Oxford University Press, Second Edition.

2. Bannister and S. Raymond, 2004, *Surveying*, Seventh Edition, Longman
3. S.K. Roy, 2004, *Fundamentals of Surveying*, Second Edition, Prentice,, Hall of India.
4. K.R. Arora, 2013, *Surveying Vol I & II*, Standard Book house , Twelfth Edition.

Course Code	Course Name	L	T	P	C
GE2201	DESIGN THINKING	3	0	0	3

Category: Employability Enhancement Course

a. Preamble

This course introduces the various principles of design thinking to achieve an effective design and to examine the implementation of the model or process for its successful operation.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Describe the basic principles of design and various stages of design thinking for better conceiving of idea and refinement	K2
CO2	Elucidate the concepts of idea generation and refinement	K3
CO3	Apply various prototype models for solving complex problems	K3
CO4	Analyze real-time problems for effective design, implementation and operation	K3
CO5	Device idea/solution towards development of a prototype for a chosen problem of interest	K4

c. Course Syllabus **Total : 45 Periods**

INTRODUCTION TO DESIGN THINKING **9**

Introduction - Product life cycle – Design Ethics – Design Process – Stages in design thinking: Immersion, Analysis and synthesis, Ideation, Prototyping.

IDEA GENERATION AND REFINEMENT **9**

Basic design - directions - Themes of thinking - Inspiration and references - Brainstorming - Value - Inclusion – Sketching - Presenting ideas - Thinking in images - Thinking in signs - Appropriation - Personification - Visual metaphors - Modification - Thinking in words – Words and language - Thinking in shapes - Thinking in proportions - Thinking in color - Outside the Box.

PROTOTYPING **9**

Developing designs - Types of prototype - Prototyping for Designing Complex Systems – The Efficacy of Prototyping under Time Constraints.

IMPLEMENTATION **9**

Format - Materials - Finishing - Media - Scale - Series/Continuity - Emerging Landscapes of Design - Real-Time Design Interaction Capture and Analysis - Enabling Efficient Collaboration in Digital Design - Spaces Across Time and Distance - Software used in Developing in Virtual Environments.

DESIGN THINKING IN VARIOUS SECTORS **9**

. Design & Development of Prototypes for Wall Plastering, Rubber shredding, Separation of Corn seeds, Electric vehicles, Smart gates, Burglar alarm, Tyre pressure monitor, Development of Online Voting System, Online Proctoring System, Online Health Monitoring System, IoT based Home Automation and any other problem of interest in your domain.

d. Activities

Following activities shall be implemented to enhance the knowledge of design thinking in various streams of Engineering

- Brainstorming
- Themes of Thinking
- Seminar
- Protype Making

e. Learning Resources

Text Books

1. Binder, T., De Michelis, G., Ehn, P., Jacucci, G., Linde, P., and Wagner, I., 2011. *Design things*, MIT press
2. Ambrose, G., and Harris, P., 2009. *Basics Design: Design thinking*, Bloomsbury Publishing

Reference Books

1. Meinel, C., and Leifer, L. (Eds.)., 2011. *Understanding Innovation*, Springer.
2. Plattner, H., Meinel, C., and Leifer, L. (Eds.)., 2010. *Design thinking: understand–improve–apply*, Springer Science & Business Media
3. Moran, T. P., and Carroll, J. M., 1996. *Design Rationale: Concepts, Techniques, and Use*, L. Erlbaum Associates Inc.
4. Cross, N., 1984. *Developments in Design Methodology*, Chichester: Wiley.

WEB RESOURCES:

1. https://www.designsociety.org/download publication/39626/Design+prototyping+of+systems
2. https://www.interaction-design.org/literature/article/5-stages-in-the-design- thinking-process

VIDEO LECTURES :(NPTEL OR ANY OTHER VIDEO LECTURES)

1. https://nptel.ac.in/courses/110/106/110106124/#

Course Code	Course Name	L	T	P	C
CE2205	COMPUTER AIDED BUILDING DRAWING LABORATORY	0	0	4	2

Category: Professional Core Course

a. Preamble

This course introduces the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Draft Paneled and Glazed Doors and Windows.	K2
CO2	Sketch front, top & side views of Buildings with load bearing walls.	K2
CO3	Sketch Buildings with sloping roof.	K2
CO4	Sketch R.C.C. framed structures.	K2
CO5	Draft Industrial buildings – North light roof structures.	K2

c. Course Syllabus **Total : 60 Periods**

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows).
2. Buildings with load bearing walls.
3. Buildings with sloping roof.
4. R.C.C. framed structures.
5. Industrial buildings – North light roof structures.

d. Activities

Students shall be exposed to do the 3D building modelling to visualize the drafting skills. For 3D modelling can be done by any one of the simple software tools like 3D Home Architect Design Suite Deluxe 8 / Sketchup/ Revit Architecture.

e. Learning Resources

Text Books

1. Sikka V.B., 2015, *A Course in Civil Engineering Drawing*, 4th Edition, S.K.Katariaand Sons.
2. George Omura, 2008, *Mastering in Autocad 2005 and Autocad LT 2005* BPB Publications,

Reference Books

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, 2011, *BIM Handbook:A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors*, John Wiley and Sons.Inc.
2. Marimuthu.V.M., Murugesan. R and Padmini. S., 2008, *Civil Engineering Drawing-I*, Pratheeba Publishers.
3. Shah.M.G., Kale. C.M. and Patki.S.Y., 2007,*Building Drawing with an Integrated Approach to Built Environment*, Tata McGraw Hill Publishers Limited.
4. Verma.B.P., 2010, *Civil Engineering Drawing and House Planning*, Khanna Publishers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl. No.	Description of Equipment	Quantity
1.	Computer system of Pentium IV or equivalent	1 for each student
2.	AUTOCAD	1 copy for a set of 3 students

Course Code	Course Name	L	T	P	C
CE2206	SURVEYING LABORATORY	0	0	4	2

Category: Professional Core Course

a. Preamble

At the end of the course the student will possess knowledge about Survey field techniques

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Make use of chain for measuring distance in field	K3
CO2	Examine the area of traverse and detect local attraction using compass surveying & Plane table Surveying.	K4
CO3	Examine the elevation of various points and carryout longitudinal and cross sectioning using level	K4
CO4	Examine the heights and distances using Theodolite and systems of tachometry.	K3
CO5	Make use of total station for measuring distance in field	K3

c. Course Syllabus **Total : 60 Periods**

LIST OF EXPERIMENTS:

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room

Compass Survey and Plan table Survey

3. Compass Traversing – Measuring Bearings & arriving included angles
4. Plan table Surveying – Measuring areas & Distance between inaccessible points

Levelling - Study of levels and levelling staff

5. Fly levelling using Dumpy level &Tilting level
6. Check leveling.

Theodolite - Study of Theodolite

7. Measurements of horizontal angles by reiteration and repetition and vertical angles.
8. Determination of elevation of an object using single plane method when base is accessible/inaccessible.

Tacheometry – Tangential system – Stadia system

9. Determination of Tacheometric Constants
10. Heights and distances by stadia Tacheometry
11. Heights and distances by Tangential Tacheometry

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

12. Traverse using Total station and Area of Traverse
13. Determination of distance and difference in elevation between two inaccessible points using Total station

d. Activities

Activities to improve the experimental learning:

Students will learn about the profile leveling concept and its application in alignment of Drainage, Roadwork etc. . .

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No	Description of Equipment	Quantity
1.	Total Station	3 Nos.
2.	Theodolites	At least 1 for every 5 students
3.	Dumpy level / Filling level	At least 1 for every 5 students
4.	Pocket stereoscope	1
5.	Ranging rods	1 for a set of 5 students
6.	Levelling staff	
7.	Cross staff	
8.	Chains	
9.	Tapes	
10.	Arrows	

11.	Prismatic Compass	10 nos
12.	Surveyor Compass	2 nos
13.	Survey grade or Hand held GPS	3 nos

Course Code	Course Name	L	T	P	C
EM2202	INTERPERSONAL SKILLS - LISTENING AND SPEAKING	0	0	2	1

Category: Employment Enhancement

a. Preamble

The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Develop their communicative competence in English with specific reference to listening	
CO2	Prepare conversation with reasonable accuracy	
CO3	Apply lexical Chunking for accuracy in speaking	
CO4	Demonstrate their ability to communicate effectively in GDs	
CO5	Explain directions and instructions in academic and business contexts	

c. Course Syllabus **Total : 30 Periods**

LISTENING AS A KEY SKILL **6**

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk

LISTEN TO A PROCESS INFORMATION **6**

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate acomplete idea as opposed to producing fragmented utterances - compare andcontrast information and ideas from multiple sources- converse with reasonable accuracy overa wide range of everyday topics.

LEXICAL CHUNKING **6**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minuteinformal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

GROUP DISCUSSION **6**

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

GROUP & PAIR PRESENTATIONS **6**

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

d. Activities

Students shall be taken to the Language lab for enhancing their listening and speaking skills.

e. Learning Resources

Text Books

1. Brooks,Margret,2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press,Oxford.
2. Richards, C, Jack and David Bholke,2010, *Speak Now Level 3,*Oxford University Press, Oxford.

Reference Books

1. Bhatnagar, Nitin and MamtaBhatnagar,2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn and Josephine Moate,2014, *Practical English Classroom,* Oxford University Press, Oxford.

3. Vargo, Mari,2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack,2006,*Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter,2014, *Role Play*. Oxford University Press, Oxford.

Web resources:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

Course Code	Course Name	L	T	P	C
MA2254	PROBABILITY, STATISTICS AND NUMERICAL METHODS	3	1	0	4

Category: Foundation Course (Engineering Science)

a. Preamble

This course introduces the basic concepts and techniques of Random variables, Probability distributions, Testing of Hypothesis, Design of Experiments and Numerical Methods and highlights their applications in various fields such as Engineering and Technology.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Apply the concepts of probability distributions to solve engineering problems.	K3
CO2	Apply the concept of testing of hypothesis for small and large samples in real life problems.	K3
CO3	Apply the basic concepts of classifications of design of experiments in Engineering.	K3
CO4	Compute intermediate values of unknown function using interpolation.	K3
CO5	Apply the numerical techniques of integration for engineering problems.	K3

c. Course Syllabus

Total : 60 Periods

PROBABILITY AND RANDOM VARIABLES **12**

Probability – Conditional Probability – Baye's Theorem – Random variables – Mathematical Expectations – Moments – Moment generating functions – Distributions: Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

TESTING OF HYPOTHESIS **12**

Sampling distributions – Statistical Hypothesis – Type I and Type II errors – Tests for single mean and difference of means of large samples (Z – test) and small samples (t – test) – F – test for variance – Chi-square test for goodness of fit – Independence of attributes.

DESIGN OF EXPERIMENTS **12**

Basic Principles of Experimental Design - Completely randomized design - Randomized block design – Latin square design – 2^2 factorial design.

INTERPOLATION AND APPROXIMATION **12**

Difference operators and relations – Interpolation with equal intervals: Newton's forward and backward difference formulae – Cubic Splines – Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference interpolation.

NUMERICAL INTEGRATION AND INITIAL VALUE PROBLEMS **12**

Numerical Integration: Trapezoidal – Simpson's 1/3rd rule and 3/8th rule (double integration excluded) – Two point and three point Gaussian quadrature formulae - Single step methods: Euler's method – Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations.

d. Activities

Students shall be exposed to Microsoft Excel for Design of Experiments and MATLAB programming to solve ordinary differential equations with initial condition.

e. Learning Resources

Text Books

1. Grewal, B.S, *Numerical Methods in Engineering and Science*, Eighth Edition Reprint, Khanna Publishers, New Delhi, India, 2018.
2. Johnson, R.A, Miller, I., & Freund, J.E, Miller & Freund's *Probability and Statistics for Engineers*, Eighth Edition, Pearson Education, Asia, 2015.

Reference Books

1. Gerald, C.F, Wheatley, P.O, *Applied Numerical Analysis*, Seventh Edition, Pearson Education, Asia, New Delhi, 2007.
2. Walpole, R.E, Myers, R.H, Myers, S.L, & Ye, K, *Probability and Statistics for Engineers and Scientists*, Ninth Edition, Pearson Education, Asia, 2012.
3. Kandasamy, P, Thilagavathy, K, & Gunavathy, K, *Numerical Methods*, Third Edition Reprint, S. Chand & Co. Ltd., New Delhi, 2014.
4. Gupta, S.C, & Kapoor, V.K, *Fundamentals of Mathematical Statistics*, Twelth Edition Reprint, Sultan Chand & Sons, 2020.
5. Veerarajan, T, *Probability, Statistics and Random Processes*, Fourth Edition, Tata McGraw Hill Education, New Delhi, 2014.

Course Code	Course Name	L	T	P	C
CE2251	APPLIED HYDRAULIC ENGINEERING	3	0	0	3

Category: Professional Core Course

a. Preamble

- To introduce the students to various hydraulic engineering problems like open channel· flows and hydraulic machines.
- At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Identify channel type and possible flow profiles.	K3
CO2	Compute and draw gradually varied flow profiles for prismatic and non-prismatic channels.	K3
CO3	Analyze rapidly varied flow including depth, length and energy loss.	K3
CO4	Arrive at the turbine capacity required to produce the specified power.	K3
CO5	Suggest suitable pump and its capacity to lift water to the required height.	K3

c. Course Syllabus **Total : 45 Periods**

UNIFORM FLOW **9**

Definition and differences between pipe flow and open channel flow - Types of Flow Properties of open channel - Velocity distribution in open channel Steady uniform flow: Chezy‟s equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow.

GRADUALLY VARIED FLOW **9**

Dynamic equations of gradually varied flows – Types of flow profiles---Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation.

RAPIDLY VARIED FLOW **9**

Application of the momentum equation for RVF - Hydraulic jumps - Types Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)

TURBINES **9**

Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine Specific speed – Characteristic Curves of Turbines Draft tube and cavitation.

PUMPS **9**

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels Savings in work done.

d. Activities

Activities to improve the experimental learning:

Students will learn about the determination of efficiency of Reciprocating pump and centrifugal pump by conducting experiment in the laboratory.

e. Learning Resources

Text Books

1. Subramanya.K .2000,*Flow in open channels*, Tata McGraw Hill, New Delhi.
2. Modi P.N and Seth.S.M .,2009,*Hydraulics and Fluid Mechanics including Hydraulic Machines*, Standard Book House New Delhi.
3. Chandramouli P.N. 2017,*Applied Hydraulic Engineering*, Yes Dee Publishing Pvt. Ltd.

Reference Books

1. VenTe Chow, 2009, *Open Channel Hydraulics*, McGraw Hill, New York.
2. HanifChaudhry.M., 2007, *Open Channel Flow*, Second Edition, Springer.
3. Rajesh Srivastava,2008, *Flow through open channels*, Oxford University Press, New Delhi.
4. Jain.A.K.,2016 , *Fluid Mechanics (Including Hydraulic Machines)*, Khanna Publishers, Twelfth Edition.

5. Subramanya.K.,2010, *Fluid Mechanics and Hydraulic Machines*, Tata McGraw Hill Education Private Limited, New Delhi.

Course Code	Course Name	L	T	P	C
CE2252	CONCRETE TECHNOLOGY	3	0	0	3

Category: Professional Core Course

a. Preamble

This course enables the students to understand the importance of the properties of all the materials used in concrete. This course focuses on concept of the different kinds of admixtures in concrete. This course promotes the students to understand the basic concept of testing of materials and its properties in concrete. This course introduces the basis of special concretes and concreting methods.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Summarize the various requirements of cement, aggregates and water for making concrete	K2
CO2	Outline the effect of admixtures on properties of concrete	K3
CO3	Experiment with concept and procedure of mix design as per IS method	K3
CO4	Relate the properties of fresh and hardened concrete	K2
CO5	Illustrate the importance and application of special concretes	K3

c. Course Syllabus **Total : 45 Periods**

CONSTITUENT MATERIALS **9**

Cement - Different types - Chemical composition and Properties – Hydration of cement Tests on cement - IS Specifications - Aggregates – Classification Mechanical properties and tests as per BIS - Grading requirements - Water Quality of water for use in concrete.

CHEMICAL AND MINERAL ADMIXTURES **9**

Accelerators - Retarders - Plasticizers - Super plasticizers - Water proofers – Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline - Effects on concrete properties. Case study on Effects of chemical and mineral admixtures on mortar/concrete.

PROPORTIONING OF CONCRETE MIX **9**

Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS Method of Mix Design Mix Design Examples.

FRESH AND HARDENED PROPERTIES OF CONCRETE **9**

Workability - Tests for workability of concrete - Segregation and Bleeding Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength - Flexural strength - Stress-strain curve for concrete Modulus of elasticity - durability of concrete - water absorption - permeability - corrosion test - acid resistance.

SPECIAL CONCRETES **9**

Light weight concretes - foam concrete- self compacting concrete - vacuum concrete High strength concrete - Fibre reinforced concrete - Ferro cement - Ready mix concrete – SIFCON Shotcrete - Polymer concrete - High performance concrete - Geopolymer Concrete - Bacterial ductal concrete.

d. Activities

Activities to improve the experimental learning:

Activities to find the material properties of concrete ingradients and mix design procedure to different grades of concrete.

e. Learning Resources

Text Books

1. Gupta.B.L., Amit Gupta, 2010, *Concrete Technology*, Jain Book Agency Shetty, M.S, *Concrete Technology*, 2003,S Chand and Company Ltd, New Delhi.
2. Bhavikatti.S.S, 2015 *Concrete Technology*, I.K.International Publishing House Pvt. Ltd., New Delhi.
3. Santhakumar. A.R.,2006, *Concrete Technology*, Oxford University Press India.

Reference Books

1. Neville, A.M;1995, *Properties of Concrete*, Pitman Publishing Limited, London.
2. Gambhir, M.L;2007, *Concrete Technology*, 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi.

3. IS10262-2009, 1998, *Recommended Guidelines for Concrete Mix Design*, Bureau of Indian Standards, New Delhi.
4. Job Thomas,2015, *Concrete Technology*, Cengage Learning India Pvt. Ltd., Delhi.
5. Kumar P Mehta., Paulo J M Monterio., *Concrete - Microstructure, Properties and Materials*, 2016, McGraw Hill Education (India) Private Limited, New Delhi.

Course Code	Course Name	L	T	P	C
CE2253	ENVIRONMENTAL ENGINEERING	3	0	0	3

Category: Professional Core Course

a. Preamble

This course is to introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment, disposal and sewerage system.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Understand the various components of water supply scheme, intake structure and design of conveyance system for water transmission	K2
CO2	Understand the process of conventional treatment and design of water process and knowledge about the recent advances in water treatment	K2
CO3	Design and evaluate water distribution system and water supply in buildings.	K3
CO4	Estimate sewage generation and design sewer system including sewage pumping stations.	K3
CO5	Understand the self-purification of streams and sludge and sewage disposal methods, selection of treatment process and design of wastewater treatment system	K2

c. Course Syllabus **Total : 45 Periods**

SOURCE AND CONVEYANCE OF WATER SUPPLY SYSTEMS 9

Planning - Objectives - Population forecasting - Design period - Water demand - Sources and characteristics of water - Source selection - Water quality parameters & significance - Standards – Intake structures - Conveyance - Pipes - Mains design - Pumps - Pump selection.

WATER TREATMENT 9

Objectives - Unit operations and processes - Principles, functions of Chemical feeding, flash mixers, flocculators - Design of sedimentation tanks and sand filters - Disinfection -

Construction, operation and maintenance aspects of water treatment plants - Aeration - Iron and manganese removal, defluoridation and demineralization - Water softening - Desalination - Membrane Systems.

WATER STORAGE AND DISTRIBUTION **9**

Requirements of water distribution - Components - Service reservoirs - Network design - Leak detection methods - Principles of design of water supply in buildings - House service connection - Fixtures and fittings.

PLANNING AND DESIGN OF SEWERAGE SYSTEM **9**

Sources of waste water - Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage- Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control – Sewage pumping-drainage in buildings - Plumbing systems for drainage

SEWAGE TREATMENT AND DISPOSAL **9**

Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB – Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage – Recent Advances in Sewage Treatment - Discharge standards-sludge treatment - Disposal of sludge

d. Activities

Visit to wastewater treatment plant to know about the realtime working of treatment facility.

e.Learning Resources

Text Books

1. Garg, S.K, 2015, *Environmental Engineering, Vol.I & Vol.II* Khanna Publishers, New Delhi.
2. Modi, P.N., 2016, *Water Supply Engineering, Vol.I & Vol II* Standard Book House, New Delhi.
3. Duggal K.N., 2014, *Elements of Environmental Engineering* S. Chand and Co. Ltd., New Delhi.
4. Punmia, B.C., Jain, A.K., and Jain.A.K.., *Environmental Engineering, Vol I & Vol.II*, Laxmi

Reference Books

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Syed R. Qasimand Edward M. Motley Guang Zhu, 2009, *Water Works Engineering Planning, Design and Operation*, Prentice Hall of India Learning Private Limited, New Delhi.
3. Metcalf and Eddy, 2010, *Waste water Engineering – Treatment and Reuse*, Tata Mc. Graw – Hill Company, New Delhi.
4. Syed R.Qasim, 2010, *Waste water Treatment Plants*, CRCPress, WashingtonD.C.

Course Code	Course Name	L	T	P	C
CE2254	GEOTECHNICAL ENGINEERING – I	3	0	0	3

Category: Professional Core Course

a. Preamble

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
- To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.
- To impart knowledge of design of both finite and infinite slopes.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Summarize the classification of soil and soil properties	K2
CO2	Describe the stress distribution and permeability of soil	K3
CO3	Outline compaction and consolidation of soil	K3
CO4	Explain about shear strength of soil	K3
CO5	Narrate the slope stability in soil and slope protection measures	K2

c. Course Syllabus **Total : 45 Periods**

SOIL CLASSIFICATION AND COMPACTION **9**

History – formation and types of soil – composition - phase relationship- Index properties – Grain size distribution - Atterberg limits - Classification – BIS AASHTO – Unified classification system.

PERMEABILITY AND STRESS DISTRIBUTION **9**

Introduction - Permeability - Darcy's law - Laboratory methods - Quick sand condition - Seepage - Laplace equation - Flow nets - Properties and applications - Effective stress concepts - Vertical stress in soil using Boussinesq equation, Newmarks influence chart and

Westergaards equation.

COMPACTION AND CONSOLIDATION **9**

Introduction to compaction - Influencing factors - Laboratory and field methods - Settlement - Components - Terzaghi's one dimensional consolidation theory - Laboratory consolidation test - Field consolidation curve - Normally Consolidated and Over Consolidated clays - Final and time rate of consolidation.

SHEAR STRENGTH **9**

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Factors influencing shear strength of soil.

SLOPE STABILITY **9**

Infinite slopes and finite slopes — Friction circle method – Use of stability number – Guidelines for location of critical slope surface in cohesive and c - soil – Slope protection measures.

d. Activities

Hands on experience to find the types of soil characteristics and permeability aspects of soil.

e. Learning Resources

Text Books

1. Murthy, V.N.S., 2014 Text book of *Soil Mechanics and Foundation Engineering*, CBS Publishers Distribution Ltd., New Delhi.
2. Arora, K.R., 7th Edition, 2017(Reprint). *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, New Delhi,
3. GopalRanjan, A S R Rao, 2016. *Basic and Applied Soil Mechanics* New Age International Publication, 3rd Edition,
4. Punmia, B.C., 2017 *Soil Mechanics and Foundations*, Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition.

Reference Books

1. McCarthy, D.F., 2006. *Essentials of Soil Mechanics and Foundations: Basic Geotechnics*. Prentice-Hall.

2. Coduto, D.P., 2010 *Geotechnical Engineering – Principles and Practices*, Prentice Hall of India Pvt. Ltd. New Delhi.

3. Braja M Das, 2014 *Principles of Geotechnical Engineering*, Cengage Learning India Private Limited, 8th Edition.

4. Palanikumar.M., 2013 *Soil Mechanics*, Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi.

5. Craig.R.F., 2012. *Soil Mechanics*, E & FN Spon, London and New York,

6. Purushothama Raj. P., 2013 *Soil Mechanics and Foundations Engineering*, 2nd Edition, Pearson Education,.

7. Venkatramaiah.C., 2017 *Geotechnical Engineering*, New Age International Pvt. Ltd., New Delhi,

Course Code	Course Name	L	T	P	C
CE2255	STRENGTH OF MATERIALS	3	1	0	4

Category: Professional Core Course

a. Preamble

To know the method of finding slope and deflection of beams using energy theorems and to estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Construct shear force and bending moment diagram for determinate beams and understand the concept of simple bending.	K2
CO2	Analyze indeterminate structures using theorem of three moments	K3
CO3	Apply the analytical techniques for computing deflection of members subjected to bending.	K2
CO4	Compare column behavior based on loading and geometry and infer its importance in economic design.	K3
CO5	Solve analytical problems on shafts subjected to torsion and helical springs	K2

c. Course Syllabus **Total : 60 Periods**

TRANSFER OF LOADS AND STRESSES IN BEAMS **12**

Types of loads, supports, beams – concept of shearing force and bending moment - Relationship between intensity of load, Shear Force and Bending moment Shear Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force.

INDETERMINATE BEAMS **12**

Concept of Analysis - Propped cantilever and fixed beams - fixed end moments and reactions – sinking and rotation of supports - Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

DEFLECTION OF BEAMS **12**

Elastic curve – Governing differential equation - Double integration method Macaulay's method - Area moment method --conjugate beam method for computation of slope and deflection of determinant beams.

COLUMNS AND CYLINDERS **12**

Euler‟s column theory – critical load for prismatic columns with different end conditions – Effective length – limitations - Rankine-Gordon formula Eccentrically loaded columns – middle third rule core of a section – Thin cylindrical and spherical shells – stresses and change in dimensions Thick cylinders – Compound cylinders – shrinking on stresses.

ADVANCED TOPICS **12**

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel , Leaf Springs – Unsymmetrical bending of beams of symmetrical and unsymmetrical sections Shear Centre curved beams – Winkler Bach formula – stresses in hooks.

d. Activities

Activities to improve the experimental learning:

Students will learn about properties of mild steel by conduction Tension test experiment in the laboratory.

e. Learning Resources

Text Books

1. Rajput R.K., 2015, *Strength of Materials (Mechanics of Solids)*, S.Chand& company Ltd., New Delhi,.
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain.,2015 *SMTS–I Strength of materials*, Laxmi publications. New Delhi,
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain., 2017, *Theory of Structures*

(SMTS) Vol - II, Laxmi Publishing Pvt Ltd, New Delhi.

4. Bansal. R.K.,2010, *Strength of Materials*, Laxmi Publications Pvt. Ltd., New Delhi.

Reference Books

1. Timoshenko.S.B. and Gere.J.M.,1999, *Mechanics of Materials*, Van NosReinbhold, New Delhi.
2. Kazimi S.M.A,, 2003, *Solid Mechanics*, Tata McGraw-Hill Publishing Co., New Delhi,
3. William A .Nash., 2007, *Theory and Problems of Strength of Materials,Schaum''s Outline Series*, Tata McGraw Hill Publishing company,.
4. Singh. D.K., 2016, *Strength of Materials*,Ane Books Pvt. Ltd., New Delhi,
5. Egor P Popov., 2012, *Engineering Mechanics of Solids*, 2nd edition, PHI Learning Pvt. Ltd., New Delhi,
6. Vazirani.V.N and Ratwani.M.M,,1995, *Analysis of Structures,Vol I* Khanna Publishers, New Delhi,.
7. Junnarkar.S.B. and Shah.H.J.,2016, *Mechanics of Structures, Vol I*, Charotar Publishing House,New Delhi.

Course Code	Course Name	L	T	P	C
GE2251	QUANTITATIVE APTITUDE	1	0	0	1

Category: Employability Enhancement Course

a. Preamble

To develop the thinking ability and problem solving skills of students to compete themselves in placement and competitive examinations.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Apply the concept of profit in real life problems	K3
CO2	Solve the problems by using proportion	K3
CO3	Compute accurate speed, time and distance	K3
CO4	Apply the concept of Time & Speed	K3
CO5	Calculate the work done based on various methods	K3

c. Course Syllabus **Total : 15 Periods**

PROFIT AND LOSS **3**

Profit and Loss - Cost Price, Selling Price, Profit and Loss %, Marked Price, Discount.

RATIO AND PROPORTION **3**

Ratio and Proportion - Ratio, Proportion, Comparison of Ratios, Duplicate, Triplcate Ratio.

TIME, SPEED AND DISTANCE **3**

Time, Speed and Distance - Concept of time, speed and distance, Conversion of units and proportionality, Avearge speed concept.

APPLICATIONS ON TIME, SPEED AND DISTANCE **3**

Problems on trains - Relative speed concept and application. Boats and Streams - Upstream speed, Downstream speed, Speed of stream, Speed of boat.

TIME AND WORK **3**

Time & work - Problems based on time and work, Formulae, Computation of work together, Wages based work problems. Pipes & Cisterns - Inlet-outlet, Part of tank filled, Time based problems.

d. Learning Resources

Text Book

1. Dinesh Khattar, *Quantitative Aptitude for Competitive Examinations*, Pearson India Education services Pvt Ltd, Fourth Edition, Uttar Pradesh, 2019.

Reference Books

1. TCY online, *Reasoning ability and Quantitative Aptitude,* Wiley India Pvt. Ltd, First Edition, New Delhi, 2016.
2. Agarwal.R.S, *Quantitative Aptitude for Competitive Examinations,* S.Chand Limited, 2011.
3. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations,* Tata McGraw Hill, 3rd Edition, 2011

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Course Code	Course Name	L	T	P	C
CE2256	GEOTECHNICAL LABORATORY	0	0	3	1

Category: Professional Core Course

a. Preamble

To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties**.**

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Identify the soil based on its properties	K3
CO2	Make use of compaction characteristics of soil	K3
CO3	Make use of Seepage analysis	K3
CO4	Identify the shear strength of soil	K3
CO5	Interpret the settlement behavior of the soil	K2

c. Course Syllabus **Total : 45 Periods**

LIST OF EXPERIMENTS:

DETERMINATION OF INDEX PROPERTIES

1. Specific gravity of soil solids
2. Grain size distribution – Sieve analysis
3. Grain size distribution - Hydrometer analysis
4. Liquid limit and Plastic limit tests
5. Shrinkage limit and Differential free swell tests

DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

6. Field density Test (Sand replacement method and core cutter method)
7. Determination of moisture – density relationship using standard Proctor compaction test.

8. Determination of relative density (Demonstration only)

DETERMINATION OF ENGINEERING PROPERTIES

9. Permeability determination (constant head and falling head methods)
10. One dimensional consolidation test (Determination of Co-efficient of consolidation only) Direct shear test in cohesionless soil
11. Unconfined compression test in cohesive soil Laboratory
12. vane shear test in cohesive soil Laboratory
13. Tri-axial compression test in cohesionless soil (Demonstration only) California Bearing Ratio Test

d. Activities

Students(Group of students) can bring their own soil sample and check the suitability for construction (Gradation, Atterberg limits, optimum moisture content and dry density)

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment's	Quantity
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and Plastic limit apparatus	2 sets
4.	Shrinkage limit apparatus	3 sets
5.	Proctor Compaction apparatus	2 sets
6.	UTM of minimum of 20kN capacity	1
7.	Direct Shear apparatus	1
8.	Thermometer	2
9.	Sand replacement method accessories and core cutter method Accessories	2 sets (each)
10.	Tri-axial Shear apparatus	1
11.	Three Gang Consolidation test device	1
12.	Relative Density apparatus	1

13.	Van Shear apparatus	1
14.	Weighing machine – 20kg capacity	1 No.
15.	Weighing machine – 1 kg capacity	3 No.

Course Code	Course Name	L	T	P	C
CE2257	STRENGTH OF MATERIALS LABORATORY	0	0	3	1

Category: Professional Core Course

a. Preamble

This course exposes the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Experiment with universal testing machine to determine the maximum strength of the various materials.	K3
CO2	Make use of torsion testing machine to determine the Stiffness for member subjected to Torsion	K3
CO3	Infer the characteristics of ductile materials by using hardness, Impact test.	K3
CO4	Demonstrate the Bending of metal beams and Infer the types of springs and their load carrying capacity.	K3
CO5	Ability to conduct various basic test on Cement, Bricks and Execute result for any one model .	K3

c. Course Syllabus **Total : 45 Periods**

LIST OF EXPERIMENTS:

1. Tension test on mild steel rod
2. Test on wood (Compression test)
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Test on Cement (Specific gravity, Fineness, Standard consistency, Initial & final setting)
10. Test on Bricks (Compression, Water absorption- clay brick, Fly ash bricks)
11. Modeling cum testing of any material (Beam modeling, Mortar cube, Concrete cubes, Composite materials)

d. Activities

Activities to improve the experimental learning:

Students will learn the properties of different blocks (Paver block,Light weight concrete blocks) by conducting different test in the laboratory.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

SI.No	Description of Equipment's	Quantity
1	UTM of minimum 400 kN capacity	1
2	Torsion testing machine for steel rods	1
3	Izod impact testing machine	1
4	Hardness testing machine(Brinell,Rockwell,Vickers-any 2)	1each
5	Beam deflection test apparatus	1
6	Extensometer	1
7	Compressometer	1
8	Dial gauges	Few
9	Le Chatelier‟s apparatus	2
10	Vicat‟s apparatus	2
11	Mortar cube moulds	10
12	Specific gravity Bottles (cement)	2
13	Modeling cum testing of any material (Beam modeling, Mortar cube, Concrete cubes, Composite materials)	Any 2

Course Code	Course Name	L	T	P	C
EM2252	AN INTRODUCTION TO ADVANCED READING AND WRITING	0	0	2	1

Category: Employment Enhancement

a. Preamble

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

b. Course Outcome

After successful completion of the course, the students will be able to

CO. No.	Course Outcome	Knowledge Level
CO1	Understand how the text positions the reader	K3
CO2	Develop critical thinking while reading a text	K3
CO3	Develop a descriptive paragraph	K3
CO4	Make use of sentence structures effectively when creating an essay.	K3
CO5	Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals	K3

c. Course Syllabus **Total : 45 Periods**

EFFECTIVE READING **6**

Reading - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension - Read and recognize different text types - Predicting content using photos and title. Reading - Read for details - Use of graphic organizers to review and aid comprehension.

CRITICAL READING **6**

Reading - Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading - Genre and Organization of Ideas- Reading - Critical reading and thinking- understanding how the text positions the reader.

PARAGRAPH WRITING **6**

Writing-Plan before writing - Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing - Write a paragraph with reasons and examples - Write an opinion paragraph

ESSAY WRITING **6**

Writing - Elements of a good essay - Types of essays - descriptive-narrative- issue-based-argumentative-analytical.

EFFECTIVE WRITING **6**

Writing - Email writing- visumes - Job application- Report Writing - Project writing-Writing convincing proposals

d.Activities

Students shall be exposed to various passages for reading and trained to write in different forms.

f. Learning Resources

Text Books

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* ,Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

Reference Books

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills*, Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing, Routledge*: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.