KALASALINGAM
ACADEMY OF RESEARCH AND EDUCATION
(DEEMED TO BE UNIVERSITY)
Under sec. 3 of UGC Act 1956. Accredited by NAAC with "A" Grade
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SCHOOL OF MECHANICAL, AERO, AUTO AND CIVIL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

B.Tech. Civil Engineering

CURRICULUM and SYLLABUS

(Regulation-2021)

INSTITUTE VISION

- To be a Centre of Excellence of International repute in education and research

INSTITUTE MISSION

- To produce technically competent, socially committed technocrats and administrators through quality education and research

DEPARTMENT VISION

- To be a Centre of Excellence in Civil Engineering through Quality Education and Research

DEPARTMENT MISSION

- To make the students excel in core civil engineering principles, develop professional leadership qualities, and
- To encourage need-based research with an emphasis on societal considerations.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO-1: Successful careers

Graduates would have embarked on successful careers as Civil Engineers in consulting or constructing firms, government organizations and academia.

PEO-2: Higher studies

Graduates would have pursued or been pursuing higher studies and research program.

PEO-3: Leaders

Graduates would be entrepreneurs and leaders facing market challenges, and lifelong learners for their professional advancement.

PROGRAM OUTCOMES

PO1 -- Engineering Knowledge: Apply the knowledge of Mathematics, Science, Engineering Fundamentals, and an Engineering Specialization to the solution of complex engineering problems.

PO2 -- Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of Mathematics, Natural Sciences, and Engineering Sciences.

PO3 -- 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.

PO4 -- 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.

PO5 -- 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.

PO6 -- 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.

PO7 -- 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.

PO8 -- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 -- Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 -- 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.

PO11 -- 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.

PO12 -- 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:

PSO1 -- Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of Civil Engineering infrastructure.

PSO2 -- Graduates shall have a broad understanding of environment, health and safety factors involved in infrastructural development and using modern tools.

PSO3 -- Graduates will be motivated for continuous self-learning in professional practice, pursue research in advanced areas of Civil Engineering, and involve to offer engineering service to the society, ethically and responsibly

Credit Structure

Foundation Core Courses

S.No.	Course Code	Course Name	Credits
1	211ENG1301	English for Engineers	3
2	211PHY1301	Physics	4
3	211CHY1301	Chemistry	4
4	211MAT1301	Linear Algebra and Calculus	4
5	211MAT1303	Multiple Integration, ODE and complex variable	4
6	211MAT1304	Statistics for Engineers	4
7	211MEC1201	Introduction to Engineering Visualisation	2
8	211MEC1401	Sustainable Design and Manufacturing	3
9	211CSE1402	Python Programming	3
10	211CSE1401	Problem Solving using computer Programming	3
11	211BIT1101	Biology for Engineers	3
12	211EEE1301	Basic Electrical and Electronics Engineering	4
13	211ECE1400	IoT sensors and devices	2
			44

Program Core Courses

S.No.	Course Code	Course Name	Credits
1	212CIV1101	Building Planning and Drawing	3
2	212CIV1102	Mechanics of solids I	3
3	212CIV1103	Geomatics Engineering	3
4	212CIV1304	Fluid Mechanics and Channel hydraulics	4
5	212CIV1305	Soil Mechanics and Geology	4
6	212CIV1106	Transportation Engineering	3
7	212CIV1107	Construction Engineering and Management	3
8	212CIV1308	Water and Waste Water Engineering	4
9	212CIV2309	Mechanics of Solids II	4
10	212CIV2110	Construction Materials	4
11	212CIV2111	Concrete Structures	3
12	212CIV2112	Foundation Engineering	3
13	212CIV2113	Structural Analysis	3
14	212CIV2114	Steel Structures	3
15	212CIV2115	Professional Ethics and Practice	2
16	212CIV3116	Estimation and Costing	3
			52

Experiential Core Course

S.No.	Course Code	Course Name	Credits
1	215CIV4219	Design Project - I	3
2	215CIV4220	Design Project - II	3
3	215CIV4221	Capstone Project	10
			16

Experiential Elective Course

S.No.	Course Code	Course Name	Credits
1	216CIV4222	Survey Camp	2
2	216CIV4223	Community Service	2
3	216CIV4224	Internship	2
4	216CIV4225	UG Research	2
			8

Program Elective Course – 24 Credits

University Elective Course – 16 Credits

212CIV1101	BUILDING PLANNING AND DRAWING	L	T	P	C
		3	0	0	3

Course Outcome(s):

CO1: Illustrate the orientation of buildings and its components
CO2: Apply the knowledge and idea in planning residential buildings as per specifications
CO3: Apply the knowledge and idea in planning public buildings as per specifications
CO4: Understand the minimum building bye laws in planning the buildings
CO5: Able to prepare the site specification and documentation records

Site and Building Planning

Building and its basic terminologies - Site selection of building plot and its factors –- Climatic and its influence on building planning – Orientation of buildings – Orientation criteria for Indian conditions - Principles of planning and practical considerations – Components of building

Planning of Residential Buildings

Basic elements of planning residential buildings – Minimum sizes – Guidelines for the location and sizes of doors and windows - Specification of different building items – Vastu shastra for residential building - Preparing a line plan – Conversion of line plan into solid plan – Projection of elevation and sectional views – Detailed drawing of various residential building.

Planning of Public Buildings

Basic elements of planning public buildings – Difference between residential and official buildings – Provisions in public buildings – bank, clinic, office and small factories and industries – Vastu Shastra for office, industry, shops / showrooms and commercial complex – Detailed drawing of various public buildings.

Building Bye-laws

Building bye-laws – Objectives and principles of bye-laws – Minimum plot size and building frontage – open spaces – Minimum standard dimensions on building elements – Provisions for lighting, ventilation, drainage and sanitation – Requirements for off street parking – Requirements for green belt and landscaping – Sizes of the structural elements – Applicability of bye-laws.

Site specifications & documentation

Construction specification – Importance and types of specification – Construction specification standards - Writing specifications for construction activities - Construction documents - Types and contents of construction documents – documents and checklist for residential and industrial building plan approval, clearance and completion.

Text Book(s):

1. S.S. Bhavikatti, Building Drawing and Planning with Auto CAD commands, IK Publishers, Edition 2, 2018.
2. N. Kumaraswamy, A.K.Rao, Building Planning and Drawing, Charotar Publishing House Pvt. Ltd, Edition 9, 2019.

212CIV1102	MECHANICS OF SOILDS - I	L	T	P	C
		3	0	0	3

Course Outcome(s):

CO1: Explain the vectorial and scalar representation of forces and moments of particles and rigid bodies both in two dimensions and in three dimensions.
CO2: Apply the knowledge of trusses in frames, beams and machine components.
CO3: Contrast the effect of friction on equilibrium.
CO4: Illustrate the importance of properties of surfaces and solids.
CO5: Demonstrate the dynamic equilibrium equation.

Statics of Particles and Rigid Bodies

Six Fundamental principles and concepts - vector algebra - Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D - System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant - Equations of Equilibrium of Coplanar Systems and Spatial Systems. Rigid Body equilibrium in 2-D & 3-D - Moment of Forces and its Application - Couples and Resultant of Force System - Equilibrium of System of Forces, Free body diagrams - Equations of Equilibrium of Coplanar Systems and Spatial Systems.

Analysis of Trusses

Basic Structural Analysis- Equilibrium in three dimensions - Method of Sections- Method of Joints- How to determine if a member is in tension or compression- Simple Trusses- Zero force members- Beams & types of beams- Frames &Machines.

Bending Moment (BM) and Shear Force (SF) Diagrams

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

Stresses and Strains

Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity. Types of stresses and strains, Hooke's law–stress–strain diagram for mild steel – Working stress - Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy–Resilience–Gradual, sudden, impact and shock loadings –simple applications.

Properties of Surfaces and Solids

Centroid of simple figures from first principle, centroid of composite sections - Centre of Gravity and its implications - Area moment of inertia - Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections (T section and I section) - Mass moment inertia of circular plate, Cylinder,

Cone, Sphere- Principal moment of inertia.

Text Book(s):

1. Beer, F.P., and Johnson, E.R., Vector Mechanics for Engineers – Statics and Dynamics, McGraw Hill, Tenth Edition in SI units

Reference(s):

1. Merriam, J.L., Engineering Mechanics, Volume I – Statics, and Volume – II, Dynamics 2/e, Wiley International, Seventh Edition.
2. Irving, H., Shames, Engineering Mechanics, Statics and Dynamics, Prentice Hall of India Ltd., Fourth Edition

212CIV1103	GEOMATICS ENGINEERING	L	T	P	C
		3	0	0	3

Course outcomes

After completion of this course the student will able to

CO 1: Apply the knowledge about the conventional methods of surveying like chain, compass and plane table surveying

CO 2: Demonstrate skills in performing measurement of levelling to find elevation of objects and in preparing various contour maps.

CO 3: Develop skills to carry out elevation and angular measurement using theodolite, triangulation methods and curve setting.

CO 4: Expand the knowledge about the basic principles of Electronic Distance Measurement, Global Positioning System and its applications in the field works.

CO 5: Develop basic skills on Photogrammetric and its application and the principles of remote sensing.

Basic Surveying

Principles of surveying, working from whole to part, types of surveying, Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement

Leveling

Leveling and Trigonometric leveling – Determination of elevation (single and double plane method) – problems, Theodolite survey: Instruments- Measurement of horizontal and vertical angle- methods -triangulation- network Trilateration-advantages and disadvantages

Curves

Introduction - Elements of simple and compound curves – Method of setting out simple circular curve– Linear and Angular Method (Rankine's method), - Transition curve and Vertical curve (concepts only).

Modern Field Survey Systems

Principle of Electronic Distance Measurement, Types of EDM instruments, Total Station

Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, Global Positioning Systems (GPS) - Surveying with GPS.

Photogrammetric Surveying and Remote Sensing

Photogrammetric Surveying: Introduction, Basic concepts, Scale - geometry of aerial photograph (parallax and relief displacement only) flying height – ground control - aerial triangulation, radial triangulation, Remote Sensing: Introduction, Basics of remote sensing and GIS – Field data collection through remote sensing - elements of visual image interpretation.

Text Books:

1. P.C.Punmia, surveying vol.I, Laxmi publications,2016.
2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2018.

Reference Books:

1. Madhu, N, Sathiskumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India,2016.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2018
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International,2015

212CIV1304	FLUID MECHANICS AND CHANNEL HYDRAULICS	L	T	P	C
		3	0	2	4

Course Outcomes

CO1: Apply static and kinematic properties of fluids in practical problems

CO2: Apply dynamic conditions in fluid flow problems

CO3: Apply Dimensional analysis in fluild flow and understand concept of Hydraulic machines

CO4: Apply the specific energy concept in solving channel transition problems and apply the design principles in ciritical flow conditions

CO5: Analyze the characteristics of uniform and gradually varied flow

Fluid Statics

Properties of fluids- specific gravity, viscosity, measurement of pressures, hydrostatic forces, buoyancy and floatation, continuity, momentum and energy equations and their applications.

Flow Through Pipes and boundary layers

Flow in conduits, shear stress distribution across a pipe section, criterion for laminar and turbulent flow in a pipe, Moody’s diagram, major and minor losses, pipes in series, parallel, equivalent pipe, fundamentals of distribution network, concept of boundary layer and its growth; Concept of lift and drag.

Dimensional analysis and Hydraulic machines
Dimensional analysis and hydraulic similitude, introduction to pumps and turbines, series and parallel pumps.

Channel flow
Flow measurement in channels, Types and regimes of flow – velocity distribution – specific energy concept – critical flow computations – application.

Uniform Flow and Gradually Varied Flow
Manning's and Chezy's equation – computation of normal depths – most economical section – Velocity measurement. Dynamic equation for GVF – Classification of flow profiles – Computation of GVF profiles – Direct Step Method and Standard Step Method (only concept).

Textbooks

1. Cengel,Y.A.andCimbala,J.M., Fluid Mechanics: Fundamentals and Applications (SIUnits),3/e in SI units, McGraw Hill,2010.
2. Ojha, C.S.P., Berndtsson, R., and Chandramouli, P.N., Fluid Mechanics and Machinery, Oxford University Press,2010.
3. Subramanya,K.,FlowinOpenChannels,4/e, Mc Graw Hill(India),2015.

Reference Books

1. Munson, B.R., Young, D.F., Okiishi, T.H., and Huebech, W.W., Fundamentals of Fluid Mechanics, 6/e, Wiley India,2012.
2. Subramanya, K., Fluid Mechanics and Hydraulic Machines, McGraw Hill (India),2011
3. White, F.M., Fluid Mechanics, 8/e in SI units, McGraw-Hill, 2017
4. Chaudhry, M.H., Open-Channel Flow, 2/e, Springer,2008.
5. Chow, V.T., Open Channel Hydraulics, McGraw Hill,1988.

Laboratory experiments

1. Determination of co-efficient of discharge for orifice meter
2. Determination of co-efficient of discharge for venturi meter
3. Study of friction losses in pipes
4. Study of minor losses in pipes
5. To verify bernoullis theorem
6. Flow through triangular notch
7. Flow through rectangular notch
8. Study of hydraulic jump
9. Study on performance characteristics of Reciprocating pump
10. Study on performance characteristics of Pelton turbine.

212CIV1305	SOIL MECHANICSAND ENGINEERING GEOLOGY	L	T	P	Credit
		3	0	2	4

Course Outcome

CO1: The student will be able to understand the various properties of soils and application of geology in the field of civil engineering.

CO2: The student will be able to evaluate the effective stresses and permeability of the soil and their effects in engineering properties.

CO3: Student will be able to understand the concepts of stress distribution under varying load conditions using Boussinesq's and Westergaard's theories.

CO4: Student will be able to apply the principles of terzaghi's theory to determine the consolidation of the soil.

CO5: Student will have an understanding of shear stress and shear strength properties of the soils.

INTRODUCTION TO SOIL AND GEOLOGY

Nature of Soil – Properties of soils - phase relation – Index properties - classification of soils– Unified and BIS Classification system – Soil compaction - factors affecting compaction – field compaction methods and monitoring – Geology in Civil Engineering – Earthquake belts in India – Classification of rocks – Study of structures – Folds, Faults and Maps – Seismic and Electrical methods for Civil Engineering investigations

SOIL WATER AND WATER FLOW

Soil water – Capillary rise – Effective stress concepts in soil – Total, neutral and effective stress distribution in soil – Effect of water table - Permeability – Darcy's Law- Permeability measurement in the laboratory – quick sand condition – Seepage-uplift pressure, piping, Introduction to flow net.

STRESS DISTRIBUTION

Stress distribution in soil media – Boussinesq's Equation – stress due to point load, uniformly distributed load, line load, circular, annular and rectangular loaded area - approximate methods - use of influence charts –pressure bulb

COMPRESSIBILITY AND SETTLEMENT

Components and types of settlement - Terzaghi's one dimensional consolidation theory –pressure void ratio relationship- laboratory consolidation test – Time rate of consolidation - coefficient of consolidation, consolidation settlement.

SHEAR STRENGTH

Shear Strength, Mohr's circle - Mohr Coulomb failure theory – Strength parameters - Measurement of shear strength, Direct shear, Triaxial compression, UCC and Vane shear tests – Different drainage conditions of soil– Stress-Strain characteristics of clays and sand; Stress paths.

TEXT BOOKS

1. Gopal Ranjan and Rao, A.S.R., Basic and Applied soil mechanics, New Age International Publishers, New Delhi, 2nd Edition, 2nd Reprint, 2006.

2. Murthy, V.N.S., Soil Mechanics and Foundation Engineering, UBS Publishers Distribution Ltd, New Delhi, 1999.
3. Punmia B C, Ashok Kumar Jain and Arun Kumar Jain, Basic Applied Soil Mechanics and Foundations, Lakshmi Publications Pvt. Ltd., New Delhi, 16th Edition, 2005.

REFERENCES

1. Dr.K.R. Arora, Soil mechanics and Foundation Engineering, Standard Publishers distributors New Delhi.
2. Das, B.M., Principles of Foundation Engineering (Fifth edition), Thomson Books, 2003.
3. Bowles, J.E., Foundation analysis and design, McGraw-Hill, New Delhi, 1994.

212CIV1106	TRANSPORTATION ENGINEERING	L	T	P	Credit
		3	0	0	3

Course Outcomes

Upon successful completion of this course, student can

CO1: Carry out surveys involved in planning and highway alignment.
CO2: Design the geometric elements of highways and expressways.
CO3: Carry out traffic studies and implement traffic regulation and control measures and intersection design.
CO4: Characterize pavement materials and analyze its properties.
CO5: Design flexible and rigid pavements as per IRC.

Highway development and planning:
Classification of roads, road development in India, Macadams method, Jayakar committee, Cross-sectional elements Current road projects in India; highway alignment ~~and~~ Classification of roads Urban and Rural

Geometric design of highways:
Introduction; highway cross section elements; of sight distance, design horizontal alignment; design of vertical alignment; design intersections, problems

Traffic engineering & control:
Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

Pavement materials:
Desirable properties and tests; Soils, aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete Desirable properties of bituminous paving mixes for different types of pavements. Construction practice for WBM road, bituminous road and cement concrete road.

Design of pavements:
Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and

functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; Design of joints, problems.

Textbooks

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017

Reference books

1. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
2. Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning,
3. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
4. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
5. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

212CIV1107	CONSTRUCTION ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course outcome(s):

CO1: To explain role and challenges in construction Industry.
CO2: To clarify the different network techniques.
CO3: To estimate the expected time for construction activities.
CO4: To compare and contrast CPM and PERT for construction planning.
CO5: To estimate the quantities required for building works using the drawings.

Project planning

Construction as industry and its challenges, Role of construction management, Methods of construction managements, Project reports, tendering, contracts, measurements, payment, disputes, compensation Arbitration, Resource Scheduling.

Network Techniques in Construction Planning

Defining activities and their interdependence, planning of network construction, network diagram, classification of networks, choice of type of network

Program Evaluation and Review Techniques

Introduction, time estimates shape of probability distribution curve, mean variance and standard deviation, expected time for activities, earlier expected and latest allowable occurrence time, critical path

Critical Path Method

Introduction, CPM and PERT, CPM application, earliest and latest time event calculation, activities time, Float, critical path

Cost Estimates of Building

Estimate – Types of Estimates – Units of measurements – Estimate of single and two room

buildings – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C, PCC Doors, Windows, Flooring, White Washing, colour washing and painting Nourishing for load bearing structures and framed structures

Textbook(s):

1. Chitkara. K.K(1998) "Construction Project Management: Planning Scheduling and Control", Tata mcgraw Hill Publishing Company, NewDelhi
2. Dr. Neeraj Kumar Construction Project Management, Jha PearsonPublications
3. Chris Hendrickson and Tung Au(2000), "Project Management for Construction Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall Pittsburgh
4. B.L Gupta "Construction Management and Machinery", Standard publishers, NewDelhi.

Reference(s):

1. Moder.J., C.Phillips and Davis, Project Management with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition,1983.
2. Willis., E.M., Scheduling Construction Projects , John Wiley and Sons, New Delhi 1986.
3. Halpin,D.W., Financial and Cost Concepts for Construction Management, John Wiley and Sons, New York,1985.
4. Cliff Schexnayder, Construction Management Fundamentals, Tata McGraw-Hill, New Delhi,2006
5. Donald S.Barrie& Boyd C.Paulson, Professional Construction Management, Tata McGraw-Hill, New Delhi, Third Edition,2006

212CIV1308	WATER AND WASTE WATER QUALITY ENGINEERING	L	T	P	C
		3	0	2	4

Course Outcomes:

CO1: Estimate water demandfor the particular region based upon population forecast.
CO2: Design various units of water treatment plant to meet IS water quality andrequirement.
CO3: Analyze flow distribution in pipe network system.
CO4: Study various source of wastewater generation and its characteristics.
CO5: To design various units of wastewater treatment plant to meet disposal standards.

WATER SUPPLY SYSTEMS Water Supply Scheme - Objectives - Design period- Population forecasting Water demand characteristics - Sources of water-Conveyance

WATER TREATMENT Water quality parameters and significance -Standards - Water treatment objectives -Unit operations and processes- screening, sedimentation, filtration, disinfection, water quality index.

DISTRIBUTION Requirements - Components -Layout of distribution system- Analysis of distribution network - Hardy Cross method -Equivalent Pipe method-Design of balancing reservoir.

SEWERAGE TRANSPORT Sources of wastewater - quantity of sanitary sewage -storm runoff estimation - design of sewers-wastewater characteristics and significance.

WASTEWATER TREATMENT Primary and secondary treatment- Screen chamber, grit chamber, design of primary sedimentation tanks, numerical problems on activated sludge process, trickling filter, Effluent discharge standards, Reuse of treated water for different applications, sludge- treatment and disposal.

Laboratory Experiments:

1. Determination of pH, conductivity, and turbidity
2. Determination of Hardness
3. Determination of Chlorides
4. Determination of Available Chlorine in Bleaching powder
5. Determination of dissolved oxygen
6. Determination of Total, suspended, dissolved solids
7. Determination of Optimum Coagulant Dosage.
8. Determination of residual chlorine
9. Determination of Fluoride
10. Determination of Sulphate
11. Biochemical Oxygen Demand
12. Chemical Oxygen Demand

TEXT BOOKS

1. Garg, S.K., Environmental Engineering I & II, Khanna Publishers, New Delhi, 2015
2. Modi, P.N., Environmental Engineering I & II, Standard Book House, New Delhi, 2000.
3. Birdie, G.S., Birdic JS, Water Supply and Sanitary Engineering, Dhanpat Rai Publishers, 9th Edition, 2011

REFERENCES

1. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.
2. Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993.
3. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987.
4. Metcalf and Eddy, M.C., Wastewater Engineering – Treatment & Reuse, Tata McGraw-Hill Publications, New Delhi, 2003.

212CIV2309	MECHANICS OF SOLIDS I	L	T	P	C
		4	0	0	4

Course Outcomes

Upon successful completion of this course, student can

CO1: Determine the strength parameters of the materials

CO2:.Determine shear force, bending moment of a beam

CO3: Determine the bending stress and shear stress distribution

CO4: Analyze members subjected to torsion

CO5: Evaluate the buckling load on columns and struts

Stresses and Strains

Types of stresses and strains, Hooke's law–stress–strain diagram for mild steel Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy–Resilience–Gradual, sudden, impact and shock loadings –simple applications.

Shear Force and Bending Moment Diagrams

BM and SF diagrams for cantilevers, simply supported, over hanging beams and Continuous beams. Calculation of maximum BM and SF, point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Flexural and Shear Stresses

Theory of simple bending – Assumptions – Derivation of bending equation: M/I=f/y=E/R- Neutral axis Determination of bending stresses Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections. Shear Stresses – Shear centre and shear stress distribution across various beam sections

Torsion, Thin Cylinders and Spheres

Derivation of torsion equation and its assumptions - Applications of the equation of the hollow and solid circular shafts, tensional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close coiled & helical springs. Stress in a cylinder and sphere subjected to internal pressures.

Columns and Struts

Columns – Behavior of axially loaded short, medium and long column members – Buckling load - Euler's theory – Different end conditions – Empirical formulae – Rankine's formula – Straight line formula – Secant formula for columns subjected to eccentric loading.

LISTOFEXPERIMENTS

1. Tension test on mild steel rod
2. Compression test on wood
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. Deflection test on carriage spring

Textbooks

1. Timoshenko, S. and Young, D. H., Elements of Strength of Materials, DVNC, New York, USA.
2. Kazmi, S. M. A., Solid Mechanics, Tata McGraw Hill,India.
3. Hibbeler, R. C., Mechanics of Materials. 6th ed., Pearson Prentice Hall,2004

Reference Books:

1. Laboratory Manual of Testing Materials - William KendrickHall
2. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.
3. Strength of Materials by R. Subramanian, Oxford University Press, NewDelhi.

212CIV2110	CONSTRUCTION MATERIALS	L	T	P	C
		3	0	2	4

COURSE OUTCOMES:

CO1. Identify the materials used to make concrete; including their sources, production and properties
CO2. Describe and carry out tests relevant to the use of fresh and hardened concrete
CO3. To design concrete mixtures with and without admixtures
CO4. Classify the different types of concrete based on their applications
CO5. To identify the various concreting methods to place the concrete on site

CONCRETE CONSTITUENTS

Aggregates classifications, IS Specifications, properties, grading, methods of combining aggregates, specified gradings, testing of aggregates, fibers – Cement - grade of cement, chemical composition, testing of cement, hydration of cement, structure of hydrated cements, special cements – water - chemical admixtures, mineral admixtures.

PROPERTIES OF CONCRETE

Properties of fresh and hardened concrete – strength, elastic properties, creep and shrinkage, variability of concrete strength quality control (transferred from Mix Design) – permeability, volume changes, thermal properties, fire resistance, sulphate attack – durability of concrete in sea water –action of sewage – resistance to freezing and thawing – corrosion mechanism – effects of cover thickness – cracking – various causes and effects.

MIX DESIGN

Principles of concrete mix design, methods of concrete mix design - testing of concrete – High Strength Concrete Mix Design – Super Plasticizers - Principles involved for high performance concrete with fly ash or GGBS replacements.

SPECIAL CONCRETES

Light weight concrete, fiber reinforced concrete, polymer concrete, super plasticised concrete - epoxy resins and screeds for rehabilitation – properties and applications – high performance concrete – Ready mix Concrete

STEEL STRUCTURES
Structural Steel – Composition, material properties and behaviour;

LISTOFEXPERIMENTS

1.	**TESTS ON CONCRETE MAKING MATERIALS**
2.	**TESTS ON FRESH CONCRETE**
a.	Slump cone test
b.	Flow table
c.	Compaction factor
d.	Vee bee test.
3.	**TESTS ON HARDENED CONCRETE**
a.	Compressive strength - Cube & Cylinder
b.	Flexure test
c.	Modulus of Elasticity

TEXT BOOK
1. Shetty, M.S., Concrete Technology, S. Chand & Company Ltd., Delhi, 2000.
2. Gambhir. M.L.Reinforced Concrete Structures, Prentice Hall India, 2009.

212CIV2111	CONCRETE STRUCTURES	L	T	P	Credit
		3	0	0	3

Course Outcomes
Upon successful completion of this course, student can
CO1:Analyze the design philosophies of Reinforced concrete structures
CO2:Design of RC Slabs by Limit state Method against Flexure
CO3: Design of RC Beams by Limit state Method against bond and Anchorage
CO4: Design of RC Columns against axial, uniaxial and biaxial bending
CO5: Design of various types of RC footings

METHODS OF DESIGN OF CONCRETE STRUCTURES
Working stress, Limit state and ultimate load design concepts; Classification of structures – function, material and shape-different structural systems – Basic structural requirements – stability, strength and stiffness - Advantages of Limit State Method over other methods

LIMIT STATE DESIGN FOR FLEXURE
Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.

LIMIT STATE DESIGN FOR BOND, ANCHORAGE SHEAR & TORSION

Behaviour of RC members in bond and Anchorage - Design requirements as per current code Behaviourof RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.

LIMIT STATE DESIGN OF COLUMNS

Types of columns – Braced and unbraced columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

LIMIT STATE DESIGN OF FOOTING

Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

Textbooks

1. Krishna Raju.N, "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi2010.
2. VargheseP.C, "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd, New Delhi 2010.

Reference Books:

1. Ashok Kumar Jain, "Reinforced Concrete Limit State Design", Nem Chand Brothers, 2015.

212CIV2112	FOUNDATION ENGINEERING	L	T	P	C
		3	0	0	3

Course outcomes

CO 1: The students will be able to understand various methods of soil exploration for the collection of soil samples.
CO 2: The students will be able to apply the terzaghi's and meyerhoff's theories to evaluate the effect of water table and settlement analysis in shallow foundation.
CO 3: The students will be able to evaluate the load carrying capacity of the piles and analyze the settlement in the pile groups.
CO 4: The students will be able to understand the earth pressure in the retaining walls through theories and graphical methods.
CO 5: The students will be able to understand the slope failure mechanism in cohesive soils by various methods.

SOIL EXPLORATION

Scope and objectives – Methods of exploration–Depth of boring – Spacing of bore hole - Sampling – Representative and undisturbed sampling – Sampling techniques plate load test, standard penetration and cone penetration tests –Bore log report

SHALLOW FOUNDATION

Introduction –bearing capacity of shallow foundation on homogeneous deposits –Terzaghi's and Meyerhoff's bearing capacity theories - effect of water table on shallow foundations –Combined footing and raft foundation - Contact pressure - Settlement analysis in sands and clays.

PILE FOUNDATIONS

Static formula - dynamic formulae, Pile under lateral loading, Axial load capacity of piles in sands and clays, Negative skin friction – uplift capacity – Group capacity by different methods (Feld's rule, Converse Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test – Forces on pile caps – under reamed piles

RETAINING WALLS

Particle equilibrium in soils – active and passive states – rankine's theory – cohesion less and cohesive soil – coulomb's wedge theory – condition for critical failure plane – earth pressure on retaining walls of simple configurations – Graphical methods (Rebhann and Culmann) pressure on the wall due to line load – stability of retaining walls.

SLOPE STABILITY

Slope failure mechanisms - Modes - Infinite slopes - Finite slopes – Total and effective stress analysis - Stability analysis for purely cohesive and C-ϕ soils - Method of slices – Modified Bishop's method - Friction circle method - stability number – problems – Slope protection measures.

TEXT BOOKS

1. Murthy, V.N.S., Soil Mechanics and Foundation Engineering, UBS Publishers Distribution Ltd, New Delhi, 1999.
2. Gopal Ranjan and Rao, A.S.R., Basic and Applied soil mechanics, New Age International Publishers, New Delhi, 2nd Edition, 2nd Reprint, 2006.
3. Punmia B C, Ashok Kumar Jain and Arun Kumar Jain, Basic Applied Soil Mechanics and Foundations, Lakshmi Publications Pvt. Ltd., New Delhi, 16th Edition, 2005.

REFERENCES

1. Dr.K.R. Arora, Soil mechanics and Foundation Engineering, Standard Publishers distributors New Delhi.2011
2. Das, B.M., Principles of Foundation Engineering (Fifth edition), Thomson Books, 2003.
3. Bowles, J.E., Foundation analysis and design, McGraw-Hill, New Delhi, 1994.
4. Coduto, D.P., Foundation Engineering Principles and practices, Prentice Hall of India Pvt, Ltd, New Delhi, 2002
5. Terzaghi, K., Peck, R. B. and Mesri. G. (1996). Soil Mechanics in Engineering Practice, Jon, Wiley and sons, New York.
6. Venkatramaiah C "Geotechnical Engineering" New age international publishers, New Delhi.
7. P.C.Verghess, Foundation Engineering, PHI Learning Pvt. Ltd., New Delhi, 2012

212CIV2113	Structural Analysis	L	T	P	Credit
		3	0	0	3

Course outcomes:

Upon successful completion of this course, student can

CO1: Analyze the determinate structure by using virtual work method and strain energy method.

CO2: To help develop analytical skills required to determine support reactions, internal forces, and displacements of arches and cables
CO3: Analyze the continuous beams and rigid frames (indeterminate structures) by slope deflection method
CO4: Analyze the continuous beams and rigid frames (indeterminate structures) by moment distribution method
CO5: Explain the basic concepts of matrix method

ANALYSIS OF STATICALLY DETERMINATE STRUCTURES:
Equilibrium, Stability and Determinacy of structures - Concept of Free Body Diagram- Method of superposition- Analysis of statically determinate structures, Displacement response in statically determinate structures, basic energy methods, and determination of deflections of statically determinate beams -pin-joined trusses and rigid frames, principle of virtual work- Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment.

ARCHES AND CABLES:
Arches – Types of arches – Analysis of three hinged, two hinged and fixed arches – Parabolic and circular arches- Equilibrium of cable – length of cable – anchorage of suspension cables – stiffening girders – cables with three hinged stiffening girders.

SLOPE DEFLECTION METHOD:
Application of slope deflection method - Analysis of continuous beams with and without settlement - Rigid jointed plane frame with and without sway

MOMENT DISTRIBUTION METHOD:
Application of moment distribution methods - Analysis of continuous beams with and without settlement – Rigid jointed plane frames with and without sway

MATRIX METHOD:
Equilibrium and compatibility – Determinate vs. Indeterminate structures – Indeterminacy - Primary structure – Compatibility conditions - Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Generation of stiffness and flexible matrix

Text book, title, author, and year:

1. Vaidyanadhan, R and Perumal, P, –"Structural Analysis Vol 1&Vol 2 Laxmi Publications Pvt. Ltd, New Delhi, 2015.
2. BhavaiKatti, S.S, "Structural Analysis –Vol. 1 & Vol. 2", Vikas Publishing Pvt Ltd., New Delhi, 2015
3. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, " Theory of structures", Laxmi Publications Pvt. Ltd., New Delhi, 2016
4. Reddy. C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

212CIV2114	STEEL STRUCTURES	L	T	P	C
		3	0	0	3

Course Outcome

CO1: Apply the basics of structural mechanics to determine appropriate methods of structural design for the Steel structures.

CO2: Analyze the load capacity of steel connections and design based on the loading requirements.

CO3: Analyze the load capacity of tension members and design based on the loading requirements.

CO4: Analyze the load capacity of compression members and design based on the loading requirements.

CO5: Analyze the flexural capacity of steel members and design suitable cross section for beams

Basics of structural design

Structural Steel- Classification of structures – function, material and shape – Different structural systems – Basic structural requirements – stability, strength and stiffness, Loadings and load combinations on structures - Factors of safety and load factors. Design philosophies: Working stress and Limit state design concepts.

Design of Connections

Types of joints and connections - Design of bolted and welded joints - simple and eccentric, Design concept of riveted connection

Design of tension members

Behavior of Tension members – Factors affecting the strength of Tension members - Design of Tension Members – For yielding, net section rupture and Block shear.

Design of Compression members

Local buckling and sectional classifications– Concept of Effective Lengths – Design of compression member – Column Bases – Design concept of Laced and Battened Columns

Design of flexural member

Beam types – Design of beams and beam- columns, Design concept of girders and trusses; Concept of plastic analysis - beams and frames.

Text Books

1.Subramanian N., Design of Steel Structures, Oxford University Press, New Delhi, 2018

2.Ramachandra, Design of steel structures, Vol. 1, Standard Book House, New Delhi,2009.

3.Punmia, B.C., Ashok Kumar Jain & Arunkumar Jain, Comprehensive Design of Steel Structures, Laxmi Publications, New Delhi,2nd Edition, 2015.

References

1.SK. Duggal, Limit State Design of Steel Structures, McGraw Hill Education India, 2019

2.Arya &Ajmani, Design of Steel Structures, NEM Chand & Brothers, 2014.

212CIV2115	PROFESSIONAL PRACTICES IN CIVIL ENGINEERING	L	T	P	Credit
		3	0	0	3

Course Outcome(s):

CO1: The students will be able to setout of foundation for buildings.
CO2: The students will be able to carry out testing of construction materials
CO3: The students will be able to manage inventory on site.
CO4: The students will be able to maintain quality control on site.
CO5: To Explain the advanced legal concepts

Professional Practice

Technical, legal, and ethical considerations in civil engineering practice - examination of contract specifications and technical specification writing.

Fundamentals of Construction Engineering

Introduction to concepts required by professionals involved in the construction industry- Contracts, bidding, estimating, scheduling- Cash flow, Safety, Labor issues- Equipment ownership - Productivity.

Heavy Construction

Conventional heavy construction - equipment, methods, and practice - planning for critical operations - modeling and simulation, safety - Field studies

Value Management Process

Industry value management processes - Value engineering and LCC- individual value engineering- process simplification- function analysis concept development- design to capacity- constructability, modularization and preassembly- Design effectiveness.

Planning

Principles and applications for effective early planning of capital facilities- finance, economic decision making- risk management- team alignment - pre-project planning processes and tools.

Text Book(s)

1. Roshan H Namawathi, Professional Practice, Lakshmi publications, fifth edition, New Delhi,1998.

212CIV3116	Estimating and Costing	L	T	P	Credit
		3	0	0	3

Course Outcomes

CO1: To estimate the quantities required for building works using the drawings.
CO2: To carry out the analysis of rates**.**
CO3: To prepare the cost estimate for various buildings
CO4: To prepare the estimate of civil engineering structures other than buildings

CO5: To prepare the report on the basis of specifications and valuation of the existing buildings

Procedure Of Estimating Quantities

Introduction – Estimate – Types of Estimates – Units of measurements – Methods of building estimate – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C, PCC Doors, Windows, Flooring, White Washing, colour washing and painting Nourishing for load bearing structures and framed structures.

Rate Analysis

Data – Types of Data – Scheduled of rates – lead statement – Theoretical materials – Requirement calculations - Analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works.

Cost Estimate of Buildings

Estimation of the cost of residential buildings by load bearing structures and framed structures - Estimation of Roofs – R.C.C. slab roof, GI sheet roof, Tiled Roof, Roof Truss. Estimation of R.C.C. works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc.

Estimate of Other Structures

Estimation Of Roads – Earth Work, Pitching Of Slopes, Hill Roads - Estimation Of R.C.C. Slab Culvert, Pier, Pipe Culvert, R.C.C. T-Beam Bridge - Estimation Of Water Supply And Sanitary Works Like Septic Tank, Soak Pit, Manhole, Sewer line

Specifications and Valuation

Specifications – Objectives – Types Of Specifications – Principles Of Specification - Writing – Typical Specifications – Tenders – E-Tendering, Contracts – Types Of Contracts – Arbitration And Legal Requirements - Valuation – Market Value – Book Value – Scrap Value – Salvage Value – Annuity – Capitalized Values – Sinking Fund – Depreciation – Valuation Of A Building – Rent Fixation – Mortgage – Lease – Cash Flow And Cost Control.

Experiment: Detailed Estimation of a multi storied building (case study)
Experiment: Preparation of Rate analysis
Experiment: Case study on cost of an existing building
Experiment: Case Study On Valuation Of A Existing Project

Text book, title, author, and year:

1. Dutta, B.N., Estimating And Costing, S Dutta and Co., Lucknow 2016.
2. Rangawala,S.C., Estimating And Costing, Charotar Anand Publications, 2006.
3. Kohli, D.D.And Kohli R.C., A Text Book On Estimating, Costing And Accounts, S.Chand And Co, New Delhi, 2004