

CURRICULUM

For the Academic year 2018 – 2019

DEPARTMENT OF CIVIL ENGINEERING

V & VI Semester B. E.

RAMAIAH INSTITUTE OF TECHNOLOGY

(Autonomous Institute, Affiliated to VTU)

BANGALORE - 54

About the Institute

Ramaiah Institute of Technology (RIT) (formerly known as M. S. Ramaiah Institute of Technology) is a self financing institution established in the year 1962 by industrialist and philanthropist, Late Dr. M S Ramaiah offering Bachelor of Engineering courses. It is accredited by NBA and NAAC. Ramaiah Institute of Technology is one of the few institutions with faculty & student ratio of 1:15 with excellent performance in both academics and other curricular & co curricular activities. The institute was a participant in Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. Ramaiah Institute of Technology comprises of competent and quality faculty with postgraduates and doctorates. Some of the distinguished features of RIT are: State of the art laboratories, individual computing facility to all faculty members. Many departments are recognized research centers by Visvesvaraya Technological University, Belgaum with many research scholars pursuing research for their Ph D and faculties are involved actively in many sponsored research projects by AICTE, DST etc. More than 130 scholars are pursuing their research for PhD. The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up in campus as incubation centers training students for enhancing their innovative ideas, skill, and competence. RIT has a strong Placement and Training department with a committed team, a fully equipped Sports department, large air-conditioned library with over 80,000 & more books with subscription to more than 300 International and National Journals. The Digital Library subscribes to several online e-journals like IEEE, JET etc. RIT is a member of DELNET, and AICTE INDEST Consortium. RIT has a modern air-conditioned auditorium, several hi-tech conference halls with video conferencing facilities. It also provides excellent hostel facilities for boys and girls. RIT has a very vibrant and interactive Alumni Association maintaining contacts with all graduated from institute and also distinguished Alumni, who have occupied very high positions in India and globally also. In the year 2007, VTU, Belgaum accorded Academic Autonomy status for UG and PG programs of the institute. As per the National Institutional Ranking Framework, MHRD, Government of India, Ramaiah Institute of Technology has achieved 60th rank in 2018 among the top 100 engineering colleges across India.

About the Department

The Civil Engineering Department was started in the year 1971. Master program [M Tech] in Structural Engineering was started in the year 1984. In the year 1994, department was recognized as Research Center by affiliated university. Over four decades the department has carved its self niche in the areas of academics, research, consultancy, collaborative projects, sponsored research projects and publications. The department was awarded distinction of three years of accreditation by NBA, when it was evaluated for fourth time. Many research scholars have been awarded with PhD degree and many more are pursuing their research to obtain PhD. There is also master degree program M.Sc [by research] degree in Civil Engineering. Around 250 and more technical papers are published in reputed journals and conferences by faculties and research scholars. The Department holds a patent on utilizing pond ash as replacement to sand, "Total Replacement of Sand in Concrete by Pond Ash" (Patent No 244063). The department has been involved actively in conducting conferences, workshops, FDP's, Site Visits, Project Tours and several students related programs to provide platform for sharing and spreading the latest developments in the field of Civil Engineering.

VISION OF THE INSTITUTE

To evolve into an autonomous institution of international standing for imparting quality technical education

MISSION OF THE INSTITUTE

MSRIT shall deliver global quality technical education by nurturing a conducive learning environment for a better tomorrow through continuous improvement and customization

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To become a premier Department to impart state-of-the-art technical knowledge and professional skills through effective learning process with research ambience to produce global quality Civil Engineers to develop sustainable society.

MISSION OF THE DEPARTMENT

To transform the young minds into employable professionals by providing contemporary technical knowledge and appropriate professional skills through suitable teaching learning process.

To provide rigorous training and acquaint the students with necessary skills and leadership qualities along with ethical values to address the complex and multi-faceted Civil Engineering Problems.

To provide opportunity to develop their potential by fostering intellectual curiosity to promote them for pursuing higher studies and research through exposure to the modern engineering tools and techno innovative projects.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of engineering graduates of Civil Engineering program of M S Ramaiah Institute of Technology shall attain the following PEO's within three to four years of graduation.

PEO 1	To perform well in engineering profession as competent professionals using contemporary technical knowledge and professional skills. (THEME: Perform well in engineering profession as competent professionals)
PEO 2	To pursue higher education and show intellectual curiosity for lifelong learning. (THEME: Higher education and lifelong learning)
PEO 3	To communicate effectively to work in multi-disciplinary environments embedded with ethical values and social responsibilities. (THEME: Effective communication, leadership and ethical values)

PROGRAM OUTCOMES (POs):

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, review 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.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Apply the knowledge of basic sciences, geology and environmental science along with the conceptual knowledge of engineering sciences to illustrate the process involved in planning, analysis and design of sustainable civil engineering systems.

PSO2: Conduct laboratory experiments/field investigations, and analyze/interpret the experimental results for appropriate conclusions and recommendations to a real-world civil engineering problem with a significant perspective of economy, society and environment.

PSO3: Demonstrate professional ethics and implement the principles of project management, business and public policy to lead the project execution as per the design requirement, with the state-of-the-art technology and contemporary skills.

Curriculum Course Credits Distribution

Semester	Humanities & Social Sciences (HSS)	Basic Science s/ Lab (BS)	Engineering Sciences/ Lab (ES)	Professional Subjects - Core (Hard core, soft core, Lab) (PS-C)	Professional Subjects - Electives (PS-E)	Other Electives (OE)	Project Work (PW)	Internship/other activities (IS/EAC)	Total semester load
First	4	9	10	-	-	-	-	2	25
Second	2	9	14	-	-	-	-	-	25
Third	-	4	-	22	-	-	-	-	26
Fourth	-	-	-	25	-	-	-	-	25
Fifth	2	-	-	21	3	-	-	-	26
Sixth	-	-	-	16	3	-	6	-	25
Seventh	-	-	-	16	6	3	-	-	25
Eighth	-	-	-	-	4	-	13	6	23
Total	08	22	24	100	16	3	19	8	200

SCHEME OF TEACHING

V SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	CV 51	Structural Analysis - II	PS-C	3	1	0	0	4	56
2.	CV 52	Environmental Engineering - II	PS-C	2	0	0	1	3	42
3.	CV 53	Water Resources Engineering - I	PS-C	3	0	0	1	4	56
4.	CV 54	Intellectual Property Rights	HSS	2	0	0	0	2	28
5.	CV 55	Design of RC Elements	PS-C	3	1	0	0	4	56
6.	CVE 56	Elective - I	PS-E	3	0	0	0	3	42
7.	CVL 57	Concrete Technology Lab	PS-C	0	0	2	0	2	28
8.	CVL 58	Fluid Mechanics Laboratory	PS-C	0	0	2	0	2	28
9.	CVL 59	Environmental Engineering Lab	PS-C	0	0	2	0	2	28
Total				16	2	6	2	26	364

ELECTIVE SUBJECTS

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
I.	CVE 561	GIS and Remote Sensing	PS-E	3	0	0	0	3	42
II.	CVE 562	Design of Formwork and Scaffolding	PS-E	3	0	0	0	3	42
III.	CVE 563	Highway Geometric Design	PS-E	3	0	0	0	3	42
IV.	CVE 564	Applied Hydraulics	PS-E	3	0	0	0	3	42
V.	CVE 565	Green Building Technology	PS-E	3	0	0	0	3	42

VI SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	CV 61	Design of Structural Steel Elements	PS-C	3	1	0	0	4	56
2.	CV 62	Geotechnical Engineering - I	PS-C	3	0	0	1	4	56
3.	CV 63	Water Resources Engg - II	PS-C	3	0	0	1	4	56
4.	CV 64	Extensive Survey Camp	PW	0	0	4	1	5	70
5.	CVE 65	Elective - II	PS-E	3	0	0	0	3	42
6.	CVL 66	Highway materials Testing Lab	PS-C	0	0	2	0	2	28
7.	CVL 67	Detailing of RC and Steel Structural Elements	PS-C	0	0	2	0	2	28
Total				12	1	8	3	24	336

ELECTIVE SUBJECTS

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
I.	CVE 651	Computational Structural Mechanics	PS-E	3	0	0	0	3	42
II.	CVE 652	Solid Waste Management	PS-E	3	0	0	0	3	42
III.	CVE 653	Pavement Materials and Construction	PS-E	3	0	0	0	3	42
IV.	CVE 654	Ground Water Hydrology	PS-E	3	0	0	0	3	42
V.	CVE 655	Design of PSC Structures	PS-E	3	0	0	0	3	42
VI.	CVE 656	Design of Sub Structures	PS-E	3	0	0	0	3	42

(L= Lecture T=Tutorial P=Practical S= Self Study)

STRUCTURAL ANALYSIS-II

Course code: CV 51

Pre-requisite: Structural Analysis –I

Course Credits: 3:1:0:0

Contact Hours: 56

Course Outcomes:

Students will be able to:

1. Analyze the rotation and displacement of continuous beams and frames using slope deflection method.
2. Analyze the continuous beams and frames by Moment Distribution method.
3. Analyze beams, frames and trusses using flexibility method.
4. Analyze beams, frames and trusses using stiffness method.
5. Determine collapse loads on beams using plastic analysis.

Course Content:

UNIT - I

Slope Deflection Method: Introduction, Sign convention, Development of slope deflection equation, Analysis of continuous beams, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤ 3 .

UNIT - II

Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤ 3 .

UNIT - III

Matrix Method of Analysis (Flexibility method): Introduction, Axes and Coordinates, Flexibility matrix, Analysis of continuous beam and plane trusses using elementary approach, Analysis of simple orthogonal rigid frames using elementary approach.

UNIT - IV

Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beam and plane trusses using elementary approach, Analysis of simple orthogonal rigid frames using elementary approach.

UNIT - V

Plastic Methods of Analysis: Introduction and Basic concepts of plastic analysis, shape factors of simple sections. Equilibrium and Mechanism methods, Collapse loads for simple and continuous beams.

Text books:

1. Negi and Jahangir, "Basic Structural Analysis", Tata McGraw Hill, Publication company
2. Gupta SP, GS Pandit and R.Gupta, "Theory of Structures Vol 2", Tata McGraw Hill Publication company Ltd.

Reference Books:

1. J. Sterling Kinney, "Indeterminate structural analysis", Oxford of IBH Publishing Co.
2. Norris Wilbur JK, "Elementary structural analysis", Mcgraw Hill International Book edition.
3. Ashok K jain, "Advanced structural analysis", Nemchand of Bros, Roorkee, India.

ENVIRONMENTAL ENGINEERING - II

Course code: CV 52

Pre-requisite: Environmental Engineering –I

Course Credits: 2:0:0:1

Contract Hours: 42

Course outcomes

Students will be able to:

1. Describe sewerage and drainage system.
2. Select sewer material, design and construct sewers.
3. Demonstrate different sewer appurtenances and characterize wastewater.
4. Design and develop wastewater treatment facilities.
5. Develop house drainage plans.

Course Content:

UNIT- I

Introduction: Basic definitions. Need for wastewater collection, conveyance, treatment and disposal, Types of Sewerage Systems. Quantity of sewage. Dry weather flow and factors affecting dry weather flow, flow variations and their effects on design of sewerage system. Computation of design flow. Estimation of storm flow by Rational Method. Time of concentration and return period.

UNIT- II

Design of Sewers: Hydraulic formulae for velocity, Effects of flow variations on velocity, Self-cleansing and Non-Scouring velocities. Hydraulic Design of circular sewers. Types of sewer materials (concrete, PVC, HDPE, CI and stoneware) used, Advantages and disadvantages of materials, Suitability of sewer materials for different purpose. Laying, joining and testing of sewers.

UNIT- III

Sewer appurtenances: Street inlets, Catch basins, Manhole and Drop Manhole. Analysis of sewage - Physical, Chemical and Biological Characteristics with emphasis on BOD and COD. Concepts of Aerobic and Anaerobic activity. Sampling of wastewater. Problems on BOD. Effluent standards.

UNIT- IV

Treatment of sewage: Flow diagram of Municipal Sewage Treatment plant. Primary treatment- Screening, Grit chamber and Primary Sedimentation tank. Design circular sedimentation tank. Theory and operation of Trickling Filter and types of Trickling Filters, Design of single stage Trickling Filter. Activated Sludge Process and its modifications. Design aspects of Activated Sludge Process and design of conventional activated sludge process.

UNIT- V

Sludge Digestion, sludge drying beds, other methods of sludge disposal. Onsite treatment methods. Building Drainage - Principles of plumbing, types and location of different types of traps. Pipes and fittings. System of plumbing - one and two pipe system. Plumbing fixtures-closets and urinals. House drainage plan.

Text Books:

1. Garg. S. K., (2015), “Sewage Disposal and Air Pollution Engineering”, Khanna Publishers, New Delhi
2. Punmia. B.C. (2010) and Ashok Jain, “Environmental Engineering II”, Lakshmi Publications, New Delhi

Reference Books:

1. “Manual on sewerage and Sewage Treatment”, (2012) CPHEEO, Ministry of Urban Development, New Delhi.
2. Metcalf and Eddy Inc., (2004) “Wastewater Engineering – Treatment and Reuse”, 4th Edition, Tata McGraw Hill, India,
3. Panchdhari A.C., (2005) “Water supply and Sanitary Installations”, New Age International Publishers, New Delhi.

WATER RESOURCES ENGINEERING - I

Course code: CV 53

Prerequisite: Hydraulics and Hydraulic Machinery

Course Credits: 3:0:0:1

Contact Hours: 56

Course outcomes

Students will be able to:

1. Appraise water resources potential on earth and its data analysis in evaluating extreme hydrological events.
2. Estimate various abstractions from precipitation and thereby computing the runoff.
3. Develop stage discharge relations. Analyze hydrographs and estimate the runoff (volume) and peak flood.
4. State the importance of irrigation, types and methods of irrigation and evaluate water requirements of crops.
5. Apply silt theories and design irrigation canals.

Course Content:

UNIT - I

Precipitation and catchment: Introduction. Hydrologic cycle, World water budget. Precipitation – Forms, Types, Measurement of precipitation, Hyetograph, Rain gauge network, Mean precipitation over an area, Estimation of missing rainfall data, Double mass curve technique, Return period, Plotting positions, I.D.F. curves, PMP, Problems on frequency analysis. Catchment – definition, stream pattern, description of the basin.

UNIT - II

Abstractions and Runoff: Introduction. Abstractions – Evaporation, Factors affecting evaporation, Measurement of evaporation using evaporation pans, Methods of reduction of reservoir evaporation, Transpiration, Evapotranspiration, Estimation of evapotranspiration. Infiltration – Infiltration capacity, Infiltration rate, Measurement of infiltration, Infiltration indices. Runoff – Introduction, Types of runoff, Factors affecting runoff, Basin yield, Rainfall-runoff correlation, Estimation of runoff with empirical equations – Dicken's formula, Ryve's formula and Inglis formula.

UNIT - III

Stream flow and Hydrographs: Stream – classification of stream, stream gauging, measurement of discharge, stage-discharge relations. Introduction, Hydrograph – Definition, Factors affecting flood hydrograph, Components of a hydrograph, Base flow separation, Effective rainfall, Unit Hydrograph- Definition, Assumptions and Limitations of Unit hydrograph, Derivation of units of hydrograph, Unit hydrograph from complex storms, Unit hydrograph of different durations, S - Curve method.

UNIT – IV

Irrigation and Water Requirement of Crops: Introduction. Irrigation – Definition, Necessity and Benefits and ill-effects of irrigation, Types of irrigation systems, Various irrigation methods. Water Requirement of Crops – Classification of soil water, Soil moisture constants, Depth of water applied

and Frequency of irrigation, Crop seasons, Crop period and Base period, Duty, Delta, G.C.A., C.C.A., Intensity of irrigation, PET, Irrigation Efficiencies. Irrigation requirements of crops.

UNIT –V

Design of Irrigation Canals: Introduction. Classification of irrigation canals. Design of Canals – Silt theories, Kennedy’s theory, Design procedure by Kennedy’s theory, Lacey’s theory, Regime channels, Regime conditions, Cross-Section of regime channel, Lacey’s regime equations, Comparison between Kennedy’s and Lacey’s theory, Drawbacks in Lacey’s theory. Longitudinal section of a canal, Balancing depth, C/s of an irrigation canal, barrow pit, spoil bank, Berms

Text Books:

1. K. Subramanya, “Engineering Hydrology”, Tata McGrawHill
2. P. Jayarami Reddy, “Hydrology”, Laxmi Publications New Delhi
3. Punmia et.al., “Irrigation and Water Power Engineering”, Laxmi Publications, New Delhi

Reference Books:

1. Lingsey, Franzini, “Hydrology for Engineers” McGrawHill
2. P.N Modi, “Irrigation, “Water resources and Water Power Engineering”, Standard book house.
3. Lingsey, Franzini, “Water recourses Engineering”, McGrawHill

INTELLECTUAL PROPERTY RIGHTS

Course code: CV 54

Prerequisite: Nil

Course Credits: 2:0:0:0

Contact Hours: 28

Course outcomes:

Students will be able to:

1. Define and describe the evolution of IPR globally
2. Describe the specifications and claims with reference to patent
3. Outline the rights and obligations on industrial designs.
4. Summarize the rights and working with reference to trademark
5. Describe the contents and significance of copyrights for new inventions

Course Content:

UNIT - I

Introduction to Intellectual Property Rights: Concept of property, Nature and types of intellectual property, Constitutional aspects of IPR, Commercial exploitation of intellectual property, Intellectual property and economic development, Enforcement of rights and remedies against infringement.

UNIT - II

Patents: Meaning of patent and its purpose, Object of patent law, Evolution of patent system, Application for patent, Criteria for patentability, Non – patentable inventions, Provisional and complete specification, Publication of the application, Opposition to grant of patent, Grant of patent – priority date, date of patent, date of sealing.

UNIT - III

Rights and Obligations of Patent Holder: Rights of patent holder - monopoly, assignment, license, Working of patent and compulsory license, Obligations of patent holder, Types of patents, Industrial design - registration, rights, infringement and remedies.

UNIT - IV

Trade Marks: Features and classification, Rights conferred by registration of trade mark, Marks not registrable, Application and procedure for registration of trademarks - term and renewal, Trademark series, joint and associated trademarks, service mark, collective mark.

UNIT - V

Copy Right: Evolution of copy right law, Meaning, content and substance of copy right, Ownership, rights and period of copyright, Assignment of copyright and relinquishment, License and compulsory licenses.

Text Books:

1. N.K.Acharya, “Intellectual Property Rights”, Asia Law House, Hyderabad.
2. Wadehra B.L, “Intellectual Property Law Handbook”, Universal Law Publishing Co. Ltd., New Delhi.

Reference Books:

1. Dr.T.Ramakrishna, “Basic Principles and Acquisition of Intellectual Property Rights”, CIPRA, NLSIU, Bangalore.
2. Dr.T.Ramakrishna, “Ownership and Enforcement of Intellectual Property Rights”, CIPRA, NLSIU, Bangalore.

DESIGN OF REINFORCED CONCRETE ELEMENTS

Course code: CV 55

Prerequisite: Strength of materials

Course Credits: 3:1:0:0

Contact Hours: 56

Course outcomes:

Students will be able to:

1. Describe and apply limit state design concepts of Reinforced Concrete elements.
2. Compute and demonstrate serviceability criteria of flexural members.
3. Analyze, design and detailing of beams.
4. Analyze, design and detailing of slabs and stairs.
5. Analyze, design and detailing columns and footings.

Course Content:

UNIT - I

Introduction to limit state design: Philosophy and principle of limit state design along with the assumptions, Partial safety factors, Characteristic Load and Strength. Introduction to stress block parameters, Concept of balanced, under and over reinforced sections. Limit state of collapse in flexure of rectangular and flanged sections with examples. Limit state of collapse in shear and torsional strength of sections with examples.

UNIT - II

Serviceability limit states: Introduction to working stress method, Elastic behaviour of rectangular section, Under, Balanced and over reinforced sections. Simple Problems on Flexural strength, Deflection and cracking in beams using IS Code provisions. Deflection and cracking—codal provisions, Deflection control in design and problems, Problems on calculations of crack width.

UNIT - III

Limit state design of beams: Design of singly Reinforced Beams, Doubly Reinforced Beams and Flanged Beams T and L beams. Types of shear failures – Design for shear strength, Types and design of shear reinforcement. Analysis of Torsional moment – Torsional shear stress, Reinforcement for Torsion.

UNIT - IV

Limit state design of slabs and stairs: Introduction to one way and two way slabs, Design of one way cantilever slab, simply supported slab, continuous slab. Design of two way slabs. Introduction to stair cases and design of dog legged stair and open well stair cases, Importance of bond, anchorage, lap length etc.

UNIT - V

Limit state design of columns and footings: Design of short axially loaded RC columns with problems, RC Columns with uniaxial moment including Problems, RC Columns with biaxial moments and problems, Design concepts of footing (Limit state), Isolated footings with axial load – square type. Isolated footings with axial load – Rectangular, Isolated footings with axial load – and moment.

Note: Students have to be taken to construction sites to give the demonstrative examples of structural elements such as columns, beams, slab, staircase, etc.,

Text Books:

1. Unnikrishnan Pillai and Devadas Mennon, “Design of Reinforced Concrete Structures” –Tata McGraw Hill Publications.
2. Verghese P C, “Limit State Design Of Reinforced Concrete”, Prentice Hall of India, New Delhi

Reference Books:

1. Sinha S N, “Reinforced Concrete Design”, Tata McGraw Hill Publications
2. Karve s R & Shah V L, “Limit State Theory And Design Of Reinforced Concrete”, Vidyarthi Prakashan, Pune
3. Park and Paulay, “Reinforced Concrete”, John Wiley and Sons
4. Punmia B C, Jain A K and Jain A K, “Reinforced Concrete Design”, Lakshmi Publications, New Delhi

GIS & REMOTE SENSING

Course code: CVPE 561

Prerequisite: Nil

Course Credits: 3:0:0:0

Contact Hours: 42

Course outcomes

Students will be able to:

1. Describe principles of remote sensing over conventional methods.
2. Classify the various sensors and platforms used in remote sensing process
3. Demonstrate the concept of GIS and its applications
4. Describe data structures and data analysis
5. Illustrate how remote sensing and GIS can be used in various civil engineering applications

Course Content:

UNIT - I

Principles of Remote sensing- Interactions between matter and electro-magnetic radiation, Energy interaction in the atmosphere, Energy interactions with the earth's surface- spectral reflectance curves, Aerial Photography, Elements of photogrammetry and Visual interpretation

UNIT - II

Satellites and Data Products

Types of sensors- passive sensors and active sensors, Spectrometer, Sensor resolution- spectral, Spatial, radiometric and temporal, Photograph v/s image. Types of platforms- airborne remote sensing. Space borne remote sensing, Multispectral, Thermal and Hyperspectral remote sensing, Microwave remote sensing- SAR and SLR, Laser Altimetry. Image Classification: Supervised, unsupervised. Analysis of hyperspectral data, change detection studies

UNIT - III

Introduction to Geographic Information System

Introduction to GIS principles, Raster and Vector-based GIS and data structures, Spatial data sources, Generation of thematic maps, Georeferencing, Digitization, Data Editing, Edge Matching and Mosaicing. Linking Spatial and Non Spatial Data,

UNIT - IV

Data formats, Geo-databases, Database concepts and Database management in GIS, Data manipulations: attribute operations, area/distance calculations and overlay analyses. Map Projections, Surface mapping, Interpolation (including TIN), digital elevation model (DEM), Terrain classification- slope aspect, angle of incidence etc, Varigram and Kriging, Regression and correlation analysis

UNIT - V

Applications of Remote Sensing and GIS in Civil Engineering

Applications in Water Resources, Transportation, Environmental Engineering, Urban Landscapes, Vegetation, Soil, Minerals and Geomorphology. GPS - Distance measurement, Area Measurement, Ground truth Radiometer and Hands on experience on Commercial GISsoftware (Arc GIS and ERDAS)

Text Books:

1. Lillesand T.M., Kiefer. R.W., and Chipman. J.W., “Remote Sensing and Image Interpretation”, Wiley Publications
2. Kang-tsung-Chang “Introduction to Geographic Information Systems”, TMH Publishers

Reference Books:

1. George Joseph , “Fundamentals of Remote Sensing”.
2. J.B. Campbell , “Introduction to Remote Sensing”.
3. CP Lo Albert K W Yeung, “Concepts and Techniques of Geographic Information Systems”, 2005 Prantice Hall of India.
4. “Geographical Information Systems – Principles and Applications”, Volume I edited by David J. Maguire, Micheal F Goodchild and David W Rhind, John Wiley Sons. Inc., New York 1991.

DESIGN OF FORMWORK AND SCAFFOLDING

Course code: CVPE 562

Prerequisite: Nil

Course Credits: 3:0:0:0

Contact Hours: 42

Course Outcomes

Students will be able to:

1. Describe various types of materials and forces acting on form work.
2. Analyze and design the shores and formwork.
3. Provide detailed planning for scaffolding.
4. Analyze the deflection of form work.
5. Analyze and design of various types of shells.

COURSE CONTENTS:

UNIT – I

Form Materials and Pressures On Formwork: Lumber – Types and Finish. Sheathing boards - Working stresses & Repetitive member stress. Plywood – Types and grades, Textured surfaces and strength, Reconstituted wood. Steel & Aluminum Form lining materials. Hardware and fasteners. Nails in Plywood, Bolts lag screw and connectors. Bolt loads. Pressures on Formwork - Concrete density. Height of discharge. Temperature. Rates of Placin. Consistency of concrete – Live loads and wind pressure. Vibration Hydrostatic Adjustment for non standard condition.

UNIT – II

Shores and Form Design: Simple wood stresses. Slenderness ratio. Allowable loads. Tubular steel shores & Patented shores. Site Preparation - Size and spacing. Steel Tower Frames. Safety practices. Horizontal shoring for multi-levels. More concentrated shore loads. T-heads, Two tier wood shores, Ellis shores, Dayton sure grip, Baker Roos shores, Safway Symons shores, Beaver Advance shores, Dead shores, Raking and Flying shores. Basic simplification. Beam formulas – Allowable stresses.

UNIT - III

Planning, Site Equipment and Plant for Form Work: Overall Planning & Detailed Planning. Standard units & Corner units. Schedule for column formwork. Formwork elements. Planning at Tender stage. Development of basic system. Planning for maximum reuse. Economical form construction. Planning examples – Crane size, effective scheduling estimate, Recheck plan details & Detailing the forms. Crane arrangement. Site layout plan. Transporting plant. Formwork beams, Formwork ties, Wales, Scaffold frames, Form accessories & Vertical transport table form work.

UNIT - IV

Deflection, bending & lateral stability. Shear & Bearing – Examples in wall forms, Slab forms, Beam form – Ties, Anchors and Hangers. Column forms – Examples in each.

UNIT – V

Dome Forms, Tunnel Forms, Slipforms and Safety Practices For Scaffolds: Shells of translation and revolution – Hemispherical, Parabolic, Barrel vaults, Hypar Shells, Conoidal Shells and Folded plates. Shell form design, Building the form & Placing concrete. Strength requirements – Tunnel forming components, Curb and Invert forms, Arch and Wall forms & Telescopic forms. Concrete placement methods – Cut and Cover construction – Continuous Advancing slope method & Bulk head method . General design considerations influence of placing equipment. Tolerances. Form construction for Shafts. Slipforms – Principles , Types, Advantage & Functions of various components. Planning of Slipform operations – Desirable characteristics of concrete. Common problems faced. Safety in slip forms - Special structures built with Slipform Technique & Codal provisions. Types of scaffolds – Putlog and Independent scaffold, Single pole scaffolds, Fixing ties, Spacing of ties, Plan Bracing, Knots & Safety nets.

Reference Books:

1. Robert L. Peurifoy and Garold D. Oberlender, “Formwork for Concrete Structures”, Third Edition McGraw-Hill, 1996.
2. Hurd, M.K., “Formwork for Concrete”, Special Publication No. 4 Sixth Edition, American Concrete Institute, Detroit, 1995.
3. Michael P. Hurst, “Formwork”, Construction Press, London and New York, 1997.
4. Austin, C.K., “Formwork for Concrete”, Cleaver – Hume Press Ltd., London 1996.
5. Tudor Dinescu and ConstantinRadulescu, “Slipform Techniques”, Abacus Press, Turn Bridge Wells, Kent, 1992.
6. “Guide for Concrete Formwork”, American Concrete Institute Detroit, Michigan, 1996.
7. “Safety Requirements for Scaffolding”, American National Standards Institute, New York, 1994.

HIGHWAY GEOMETRIC DESIGN

Course code: CVPE 563

Prerequisite: Transportation Engineering-I

Course Credits: 3:0:0:0

Contact Hours: 42

Course Outcomes

Students will be able to:

1. Describe the various elements of geometric design.
2. Estimate the sight distances for various criteria.
3. Design the horizontal and vertical alignment of roadway.
4. Analyze the suitability of intersections and channelization at traffic systems.
5. Prioritize the suitability of grade separated intersection and design drainage systems

Course Contents:

Unit - I

Importance of Highway Geometric Design, Elements, Factors affecting, Pavement Surface Characteristics, Camber, Right of Way, Road Margins, Carriageway, Kerbs, Formation & Typical Highway Cross-Sections.

Unit – II

Sight Distances - Stopping Sight Distance, Overtaking Sight Distance, sight distance at Uncontrolled Intersections, Design Speed, and Super elevation

Unit – III

Curve Design-Horizontal Curves, Extra Widening, Transition Curves, Set-back Distances, Gradients and Grade Compensation, Summit Curves, salient features and geometric standards for hill roads

Unit – IV

Intersections- At Grade, manoeuvres and Conflict Areas, Traffic Islands, Intersection Forms, Rural and Urban Road Intersections, Speed change & Right-turn lanes. Channelization, Medians, Rotary Intersection & Mini Round-About Highway Lighting.

Unit – V

Grade Separated Intersections – Types of Overpasses and Underpasses, Bus Stops, Pedestrian Facilities. Highway Drainage – surface and Sub-Surface Drainage System & Drainage of Slopes. Road Construction in Water-Logged Areas.

TEXT BOOKS:

1. Principle and Practice of Highway Engineering – Kadiyali L R & Lal N B, Khanna Publications, New Delhi.
2. SK Khanna & CEG Justo, “Highway Engineering” –Nem chand & Brothers
3. Relevant IRC Codes

Reference Books:

1. Subramanyam. K.P, “Transportation Engineering”, Scitech Publications, Chennai.

2. Khanna SK and Justo CEG, "Highway Material Testing Laboratory Manual", Nemchand and Bros. Roorkee.
3. Kadiyali L.R, "Highway Engineering", Khanna Publishers, New Delhi.

APPLIED HYDRAULICS

Course code: CVPE 564

Prerequisite: Nil

Course Credits: 3:0:0:0

Contact Hours: 42

Course outcomes

Students will be able to:

1. Describe the characteristics of various types of drags and estimating drag and lift forces on different objectives of practical relevance
2. Outline the energy and momentum principles in open channel flow.
3. Apply dynamic equation and develop flow profiles at various control sections.
4. Analyze rapidly varied flow and thereby estimate the hydraulic jump for the design of spillways.
5. Apply dynamic equation of unsteady flow and evaluation of surges and channel routing.

Course Content:

UNIT - I

Boundary Layer Theory and Drag & Lift: Introduction. Laminar and Turbulent flows. Boundary Layer- Definition, Thickness of B.L, Boundary Layer along a long thin plate and its characteristics, Prandtl's Boundary layer equations, Laminar boundary layer, Turbulent boundary layer. Laminar sub-layer, Separation of boundary layer, Methods of controlling boundary layer. Flow Around Submerged Objects: Introduction. Drag and Lift - Definitions, Types of drag, Dimensional analysis of drag and lift, Drag on a sphere, cylinder, flat plate and airfoil, Lift on a circular cylinder and airfoil.

UNIT - II

Energy and Momentum Principles in Open Channel Flow: Introduction, Classification of flow in open channels, Types of channels, Velocity distribution in channel section, pressure distribution in open channel, Energy and Momentum principles, Description of specific energy curve, channel transitions, Metering flumes – Venturi flume, Standing wave flume.

UNIT - III

Gradually Varied Flow in Open Channel: Introduction. Dynamic equations of Gradually Varied Flow, Characteristics of flow profiles, Control sections, Analysis of flow profiles- Gradually Varied Flow computations, Practical applications.

UNIT - IV

Rapidly Varied Flow in Open Channels: Introduction. Hydraulic Jump - Momentum equation for the Jump, Classification of Jumps, characteristics of jump in a rectangular channel, Hydraulic jump as an energy dissipater, Location of the jump. Rapidly Varied Flow computations, Flow over spillways and weirs.

UNIT - V

Unsteady Flow in Open Channel Flow: Introduction, Dynamic equation for unsteady flow, Monoclinical rising wave, Wave propagation, Surges in open channels, Flood Routing – Channel routing, Muskingum method.

Text Books:

1. P.N. Modi & S.M.Seth, "Hydraulics and Fluid Mechanics & Hydraulic Machines", Standard Book House New Delhi
2. K. Subramanya, "Flow in Open Channel Flow", Tata McGraw-Hill Publishing Company Ltd.

Reference Books:

1. V.T.Chow, "Open Channel Hydraulics", McGraw Publishing Company Ltd. New York.

GREEN BUILDING TECHNOLOGY

Course code: CVPE 565

Prerequisite: Nil

Course Credits: 3:0:0:0

Contact Hours: 42

Course outcomes

Students will be able to:

1. Demonstrate the knowledge of green building concepts
2. Analyze different alternative building materials based on specific climate and with environmentally responsibility
3. Demonstrate different green building design techniques using passive techniques.
4. Design the building reducing energy and resource consumption.
5. Demonstrate sustainable water management techniques.

Course Contents:

UNIT - I

Introduction. Need for green building- Impact of building industry on energy resources, natural resources and environment. Green building-definition. Principles of green building. Concept of Embodied energy and calculation. Life cycle assessment. Consideration while selecting material and design for longevity.

UNIT - II

Building envelope- Conventional materials and Use of low energy materials - Base materials for RCC and Steel systems. Alternatives to structural systems, masonry, mortar, plastering, roofing, ceiling, paving, flooring, doors, windows and wood work. Smart materials. Low energy construction- low energy material, locally sourced material and recycled material

UNIT - III

Sustainable siting of building. Orientation of the building. Use of natural light, solar heat and ventilation. Fenestration and shading. Effective cooling and heating systems-solar passive techniques of heating and cooling in a building design. Methods of minimizing load on Conventional systems-Landscaping, water bodies. Building form-surface to volume ratio.

UNIT - IV

Thermal Insulation for roof and walls. Glazing and shading systems. Building finishes. Effective electrical systems - photovoltaic systems. Efficient HVAC systems. Efficient lighting system- efficient bulbs, occupancy sensor systems and light sensors. Efficient motors. Energy auditing and Certification systems-GRIHA and LEED

UNIT - V

Conserving water in building- Water efficient fixtures- flow restrictors, sensors, no water fixtures. Alternatives for secondary uses. Rain water harvesting, solar water heaters and solar cooking. Low flush toilets, grey water recycling. Onsite treatment. Eco-friendly toilets. Reducing irrigation water requirements. Vertical farming. Xeriscaping.

References Books:

1. Prof. Dr. Michael Bauer, Peter Mösle and Dr. Michael Schwarz (2010) “Green Building – Guidebook for Sustainable Architecture” Springer.
2. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison (2001) “Green Building Handbook” Volume 1-Spon Press.
3. Editor: Mili Majumdar, (2002) “Energy-efficient buildings in India” Tata Energy Research Institute.
4. TERI “Sustainable Building Design Manual- Volume I & II” Tata Energy Research Institute.

CONCRETE LABORATORY

Course code: CVL 57

Prerequisite: Concrete Technology

Course Credits: 0:0:2:0

Contact Hours: 28

Course outcomes

Students will be able to:

1. Select appropriate aggregates based on their test results.
2. Characterize cement properties by conducting various tests on cement.
3. Design concrete mixes based on properties of material and evaluate the workability of fresh concrete.
4. Describe mechanical behavior of hardened concrete.
5. Demonstrate use of Non-destructive testing methods on concrete

List of Experiments:

1. Test on specific gravity and water absorption of fine and course aggregate.
2. Test on grading analysis of fine and course aggregate.
3. Test on Bulk density of fine, course aggregate and bulking of fine aggregate
4. Test on Specific gravity and fineness of cement
5. Test on Normal consistency and initial and final setting time of cement.
6. Test on Soundness of cement
7. Test on compressive strength of mortar.
8. Mix design of concrete-Fresh concrete: Slump , compaction factor, vee bee test and flow test.
9. Properties of hardened concrete -Compressive strength and flexural strength, Split tensile strength, relation between them and codal provision.
10. Non destructive test on hardened concrete using rebound hammer and pandit.

Text Books:

1. M.S Shetty, "Concrete Technology ", S. Chand & Co. Ltd, New Delhi.
2. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.

Reference Books:

1. Neville AM, "Properties of Concrete", ELBS Publications, London.
2. Relevant BIS codes.

FLUID MECHANICS LABORATORY

Course code: CVL 58

Pre-requisite: Fluid Mechanics

Course Credits: 0:0:2:0

Contact Hours: 28

Course outcomes:

Students will be able to:

1. Demonstrate experiments on flow measuring devices in pipe and calibrate them.
2. Demonstrate experiments on flow measuring devices in open channel and calibrate them.
3. Chart the characteristics of hydraulic machinery for analyzing their performance.
4. Analyze and interpret the result for practical fluid flow problems.
5. Estimate the performance of hydraulic machinery and its suitability.

List of Experiments

1. Calibration of V- Notch
2. Calibration of Rectangular Notch
3. Calibration of Cipolletti Notch
4. Calibration of Broad Crested Weir
5. Calibration of Ogee Weir
6. Orifice/mouth piece
7. Venturimeter
8. Pipe losses
9. Impact of jet on vanes
10. Centrifugal pump
11. Pelton wheel turbine

Text Books:

1. P.N. Modi & S.M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House
2. Madan Mohan Das, "Fluid Mechanics and Turbo Machines", PHI Learning Pvt. Ltd. 2011

Reference Books:

1. Streeter, Wylie and Bedford, "Fluid Mechanics", Tata McGraw-hill Edition 2010
2. Subramanya .K, "Fluid Mechanics Through Problems", Tata McGraw-hill Publishing Company

ENVIRONMENTAL ENGINEERING LABORATORY

Course code: CVL 59

Course Credits: 0:0:2:0

Pre-requisite: Environmental Engineering-I & II

Contact Hours: 28

Course outcomes

Students will be able to:

1. Analyze the quality of water and sewage sample.
2. Recommend suitability of tested sample as per the Indian standards for drinking.
3. Identify and choose the water source for water supply schemes.
4. Determine air and noise pollution levels in the surrounding environment
5. Demonstrate working of sewage treatment process.

LIST OF EXPERIMENTS:

1. Determination of pH, Alkalinity and Acidity
2. Determination of Chlorides, available chlorine in bleaching powder and residual chlorine.
3. Determination of Dissolved Oxygen
4. Determination of BOD.
5. Determination of COD
6. Determination of Turbidity and Jar Test for Optimum Dose of alum.
7. Determination of Iron.
8. Determination of Nitrates/ Fluoride
9. Determination of Solids in Sewage: Total, Suspended, Dissolved, Volatile, fixed and Settle able.
10. Determination of particulates in air using high volume air sampler
11. Determination of noise levels in the locality
12. Visit to sewage treatment plant.

Reference Books:

1. Dr R B Kotaiah & N Kumara Swamy “Environmental Engineering Laboratory Manual”, Charotar Publishing House, 1994.
2. E W Rice, R B Baird et.al, “Standard Methods for the examination of water and waste water, 22nd Edition” American Water Works Association [2012].
3. IS Standards 2490 – 1974, 3360 -1974, 3307 – 1974.
4. Clair N Sawyer, Perry L McCarty “Chemistry for Environmental Engineering”.

DESIGN OF STRUCTURAL STEEL ELEMENTS

Course code: CV 61

Prerequisite: Nil

Course Credits: 3:1:0:0

Contact Hours: 56

Course outcomes

Students will be able to:

1. Design of steel elements with different types of bolted connections.
2. Design of welded connections between different elements.
3. Design of tension members with different cross sections.
4. Design of compression members with different cross sections and column bases.
5. Design of beams for all types of boundary conditions.

Course Content:

UNIT – I

Bolted Connection: Introduction, Design Philosophies, Limit State Method, Concepts in design of connections, codal provisions and usage of HSFG bolts. Transfer of forces in bolted connections. Failure of bolted connections, simple and eccentric bolted connections, Prying forces, Beam to beam to column connections.

UNIT – II

Welded Connections: Concepts in design of connections, Codal provisions, types of welds, Defects in welds, simple and eccentric welded connections, Beam to beam and beam to column connections.

UNIT – III

Tension Members: Introduction, Types of sections, Grades of steel, Codal provision, shear lag and block shear, Analysis & Design of tension members with different cross sections, Lug angles.

UNIT – IV

Compression Members: Codal provisions, Slenderness ratio, Analysis and design of simple compression members (angles and I-Sections), built-up cross section Lacing and battens, Column splices, Column bases and Gusseted bases (Bolted and welded connections)

UNIT – V

Flexural Members: Codal provision, Lateral buckling, Web buckling and crippling, Analysis of laterally restrained and unrestrained beams. Design of restrained simple beams and built-up beams.

Text Books:

1. Subramanian .N, “Design of Steel Structures”, Oxford University Press, New Delhi
2. K.S. Duggal, “Design of Steel Structures”, Tata Mcgraw Hill, New Delhi

Reference Books:

1. Gaylord and Gaylord, “Design of Steel Structures”, Mcgraw Hill Publications, New York.
2. Relevant IS Codes: IS800, 2007, “SP:6 (Part I) Structural Engineering Hand Book”, BIS, New Delhi.

GEOTECHNICAL ENGINEERING – I

Course code: CV 62

Prerequisite: Nil

Course Credits: 3:0:0:1

Contact Hours: 56

Course outcomes:

Students will be able to:

1. Describe the physical properties of the soils and their significance in foundations design.
2. Classify the soil, evaluate the permeability of soil and its importance in stability analysis of earthen structures.
3. Analyze the seepage flow & estimate the compaction characteristics.
4. Evaluate the settlements study characteristics of soils and their significance.
5. Appraise the shear parameters of soils for foundations.

Course Contents:

UNIT - I

Introduction : Formation of soils, Phase Diagrams, Definitions of Voids ratio, Porosity, Percentage Air voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their inter relationships. Problems.

Index Properties Of Soils and their Determination: Index Properties of soils –Water content, Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, in-situ density. Laboratory methods of determination of index properties of soils: Moisture content, Specific Gravity, Particle size distribution by Dry sieve analysis and Hydrometer analysis, In-situ density by core cutter & sand replacement methods, Relative Density, Liquid Limit by Casagrande's method and Cone penetration method, Plastic limit and shrinkage limit determination. Importance of index properties in foundation design.

UNIT - II

Classification of Soils: Purpose of soil classification, basis for soil classification, Particle size classification - MIT classification and IS classification, Unified soil classification and IS classification – Plasticity chart and its importance, Field identification of soils.

Soil Water & Permeability: Free water, held water – adsorbed water & capillary water, Capillary phenomenon, Darcy's law- assumptions and validity, coefficient of permeability and its determination in laboratory, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation. Importance of permeability in stability analysis of slopes & earthen dams.

UNIT - III

Stresses in Soils & Seepage Analysis: Effective stress concept - total pressure, neutral pressure and effective stress, quick sand phenomenon. Laplace's equation, assumptions and limitations, characteristics and uses of flow-nets. Estimation of quantity of seepage for Dams and sheet pile walls. Determination of phreatic line in earth dams with horizontal filter near the toe. Importance of flow-nets & hydraulic gradient in stability analysis of slopes & earthen dams.

Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, types of field compaction, Field compaction control, Proctor's needle, principles of dynamic compaction & vibro-flotation.

UNIT - IV

Consolidation of Soils: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory- assumption and limitations (no derivation), Normally consolidated, under consolidated and over consolidated soils, pre- consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (C_c , a_v , m_v and C_v). Laboratory one dimensional consolidation test for determination of - compression index, and coefficient of consolidation (by square root of time fitting method and logarithm of time fitting method).

UNIT - V

Shear Strength of Soils: Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelopes, Total and effective shear strength parameters, Concept of pore pressure, Sensitivity and Thixotropy of clay. Determination of shear parameters using - Direct shear test, Unconfined compression test and Triaxial compression test; Shear strength tests under different drainage conditions, importance of pore pressure & shear strength in geotechnical applications.

Text Books:

1. Ramamurthy T.N. & Sitharam T.G. (2010), "Geotechnical Engineering", S. Chand & Company, New Delhi.
2. Gopal Ranjan and Rao A.S.R. (2000), "Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.

Reference Books:

1. Alam Singh and Chowdhary G.R. (1994), "Soil Engineering in Theory and Practice" CBS Publishers and Distributors Ltd., New Delhi.
2. Murthy V.N.S. (1996) "Soil Mechanics and Foundation Engineering", 4th Edition, UBS Publishers and Distributors, New Delhi.

WATER RESOURCES ENGINEERING – II

Course code: CV 63

Prerequisite: Fluid Mechanics

Course Credits: 3:0:0:1

Contact Hours: 56

Course outcomes

Students will be able to:

1. Design various types of canal regulation and C/D works
2. Evaluate ground water resources and response of aquifers for various discharge and recharge conditions
3. Enumerate various types of head works and illustrate their functional requirements
4. Analyze various forces encountered in gravity dams and thereby the design of dams
5. Estimate the floods and design the reservoir systems

Course Content:

UNIT - I

Canal Regulation and C/s drainage works: Canal Regulation - Canal Fall, Necessity and location of canal fall, Types of falls, Hydraulic design principles for Notch type and Sarda type of Drop. Canal Regulators – Cross Regulator, Head Regulator, Functions of Regulators. Cross-Drainage Works – Types of Cross-Drainage Works, Classification of Aqueducts and Syphon Aqueducts, Factors affecting suitability of Aqueduct and Syphon Aqueduct. Features of design of C-D Works. River Training works

UNIT - II

Groundwater Hydrology: Introduction. Occurrence and movement of ground water – Vertical distribution of groundwater, Aquifers, Specific retention, Specific yield, Darcy's Law, Hydraulic conductivity, Transmissivity. Well Hydraulics - Steady-radial flow into a confined aquifer, Thiem's equation, Steady-radial flow into an unconfined aquifer. Groundwater resources of India, Artificial recharge. Well irrigation: Advantages and disadvantages, Tube wells – types, methods for drilling, yield, problems

UNIT- III

Head Works :Introduction, Types of headworks, Components of Diversion Head Works, Weir and Barrages, Theories of Seepage – Design of Impervious floor using Bligh's theory, Introduction to Khosla's theory. Design of Vertical Drop weir. Storage headworks-Dams, Classification and Selection of site for a dam, Types of Earthen dams, Causes of failure of Earthen dams.

UNIT – IV

Gravity Dams: Gravity Dam – Forces acting on a gravity dam, Vertical stress at the base of the dam & Middle-third rule, Elementary profile of a gravity dam, Practical profile of a gravity dam, Design of dam by Gravity method, Joints, Keys, Water stops and Galleries. Spillways – Essential requirements of a spillway, Spillway capacity, Types of spillways. Stilling basins.

UNIT – V

Flood Estimation and Reservoir Planning: Introduction. Floods – Flood estimation, Rational method, PMF, Levees and flood walls. Reservoir Planning- Types of reservoirs, Investigations for reservoir planning, Selection of site for a reservoir, Zones of storage in a reservoir, Reservoir yield, Mass curve and Demand curve, determination of reservoir capacity using mass curve, Flood routing – reservoir routing by ISD method, Reservoir losses, Useful life of a reservoir, numerical problems. Principles of Sediment transportation, Water Resources development in India and Inter-state water disputes

Text Books:

1. Modi.P.N, “Irrigation water resources and water power engineering.”, Standard Book House, New Delhi.
2. Garg SK,” Irrigation Engineering and Hydraulic Structures”, Khanna Publishers, New Delhi.
3. K. Subramanya, Engineering Hydrology, Tata McGrawHill

Reference Books:

1. P. Jayarami Reddy, “Hydrology”, Laxmi Pulications.
2. Punmia BC et.al., “Irrigation and Water Power Engineering”, Laxmi Publications.
3. Shyamal K. Majumdar, “Irrigation Engineering ”, McGraw-Hill Publisher

EXTENSIVE SURVEY PROJECT

Course code: CV 64

Prerequisite: Nil

Course Credits: 0:0:4:1

Contact Hours: 70

Course outcomes

The students will be able to carry out survey field work and design & develop the drawings of:

1. The components of a proposed new tank
2. Canal cross-sections, canal regulation and cross-drainage works
3. Redesign of the tank bund, surplus weir and increase in the reservoir capacity.
4. Comprehensive water supply and sewerage system for a specified community
5. Alignment and realignment of Roads.

Course Contents:

An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks (14 days). The student shall submit a project report consisting of designs and drawings.

1. **General instructions:** Reconnaissance of the sites
2. **New Tank Project:** The work shall consist of
 - i. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
 - ii. Capacity surveys.
 - iii. Details at Waste weir and sluice points.
 - iv. Canal alignment.
3. **Restoration of an Existing Tank:** The work shall consist of:
 - i. Alignment of centre line of the existing bund, Longitudinal and Cross sections along the CL.
 - ii. Capacity surveys, Details at sluice and waste weir.
4. **Water Supply and Sanitary Project:** Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying, location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.
5. **Highway Project:** Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

COMPUTATIONAL STRUCTURAL MECHANICS

Course code: CVPE 651

Prerequisite: Nil

Course Credits: 3:0:0:0

Contact Hours: 42

Course Outcomes:

Students will be able to:

1. Describe structural systems and application of the concepts of flexibility and stiffness matrices
2. Adopt flexibility matrices to solve problems in trusses, beams, rigid frames and grids
3. Adopt stiffness matrices to solve problems in trusses, beams, rigid frames and grids
4. Adopt direct stiffness methods to solve problems in trusses, beams, rigid frames and grids
5. Describe various storage schemes and standard commercial packages

Course contents:

UNIT - I

Introduction: Structural systems, Geometrical and material nonlinearities. Static and Kinematic indeterminacy. Concepts of stiffness and flexibility. Flexibility and stiffness matrices of truss and beam elements. Energy concepts- Principle of minimum potential energy and minimum complementary energy.

UNIT - II

Element Flexibility Method: Transformation of system forces to element forces in flexibility method. Assembly of structure flexibility matrix in element flexibility method, Flexibility method applied to trusses, continuous beams and rigid frames.

UNIT - III

Element Stiffness Method: Transformation from system forces to element forces in stiffness method, Assembly of structure stiffness matrix in element stiffness method. Stiffness method applied to trusses, continuous beams and rigid frames.

UNIT - IV

Direct Stiffness method: Local and Global coordinate systems, Stiffness matrices of truss and beam elements in global coordinates, Analysis of trusses and beams by Direct Stiffness method

UNIT - V

Storage Techniques: Half band, skyline storage, Equation solvers, Frontal solvers, Bandwidth consideration, Algorithms and flow charts, Solution of equations, Uses of commercial packages

Text Books:

1. Weaver W and Gere J H, "Matrix Analysis of Framed Structures", CBS Publications, New Delhi
2. Rajasekaran S, "Computational Structural Mechanics", PHI, New Delhi

Reference Books:

1. Pundit and Gupta, "Theory of Structures", Vol II, TMH Publications, New Delhi
2. A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee
3. C S Reddy, "Basic Structural Analysis", TMH Publications, New Delhi

SOLID WASTE MANAGEMENT

Course code: CVPE 652

Course Credits: 3:0:0:0

Prerequisite: Nil

Contact Hours: 42

Course outcome:

Student will be able to:

1. Describe the components of solid waste management and the laws governing it.
2. Prioritize the solid waste processing methods and analyze collection systems to propose optimized routes for waste collection.
3. Implement and control the composting process for treatment of organic fraction of solid waste.
4. Design of sanitary landfills and control their conditions of operation and maintenance.
5. Evaluate the conditions of operation and maintenance of incinerators. Identify the waste recovery systems and impacts of plastic waste on environment.

Course Content:

UNIT - I

Introduction to Solid Wastes: Definition of solid wastes, classification and characteristics of solid wastes, Municipal Solid Waste (Management and Handling) Rules, Biomedical Waste Handling Rules and Recycled Plastic usage Rules.

UNIT - II

Collection of Solid Waste: Systems of collection of solid wastes, transfer stations, collection equipments, route optimization techniques and numerical problems on route optimization, processing techniques of solid wastes (principle of operation and function only).

UNIT - III

Composting: Composting, factors affecting composting process, aerobic and anaerobic composting, Indore and Bangalore method of composting, mechanical composting process, vermicomposting.

UNIT - IV

Landfills: Sanitary landfilling, trench method, area method, ramp method and pit method, factors considered for a landfill site selection, cell design, leachate collection systems, control of gas movement and gas recovery systems.

UNIT - V

Incineration: Incineration process, factors affecting incineration process, air pollution prevention in incinerators, pyrolysis process, plastic waste, biomedical waste and its Impact on health, industrial solid waste recycling and recovery-electronic industry, sugar industry and thermal power plants.

Text Books:

1. George Tchobanoglous et al., "Integrated Solid Waste Management", Mc-Graw-Hill, Inc. New York, 1993.
2. Howard S. Peavy et al., "Environmental Engineering", Mc-Graw-Hill Book Company, New York, 1985.

Reference Books:

1. A.D. Bhide and B.B. Sudareshan, "Solid Waste management in Developing Countries", NEERI, Nagpur 1983.
2. S.K. Garg "Environmental Engineering (Vol II)" Khanna Publishers, New Delhi 2009.
3. Robert A. Corbit, "Standard Handbook of Environmental Engineering", McGraw Hill Inc, New Delhi, 1990.
4. P. Aarne Vesilind, William Worrel and Reinhart, "Solid Waste Engineering", Thomson Brooks, Cole.
5. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Govt. of India, 2000.
6. Management and Handling Rules for Municipal Solid Waste and Biomedical Waste and Plastic Waste, MOEF publications.

PAVEMENT MATERIALS AND CONSTRUCTION

Course code: CVPE 653

Course Credits: 3:0:0:0

Prerequisite: Nil

Contact Hours: 42

Course outcomes:

Students will be able to:

1. Characterize materials for pavement construction based on MORTH specifications.
2. Design bituminous mixes.
3. Determine usage of equipment's for pavement construction.
4. Adopt construction techniques, specifications and quality control for pavement layers.
5. Compare construction procedure and quality checks for pavement systems.

Course Content:

UNIT – I

Aggregates - origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation, design gradation, maximum aggregate size, aggregate blending to meet specifications. Bitumen and Tar - origin, preparation, properties and chemical constituents of bituminous road binders, requirements.

UNIT – II

Binders-Bituminous Emulsions, Cutbacks and Modified binders– preparation, characteristics, uses and tests. Bituminous Mixes – mechanical properties, design methods using Rothfutch's method and specifications for voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen.

UNIT – III

Equipment in highway construction –various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

UNIT – IV

Subgrade – functions, requirements and tests, earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests. Base course and sub-base course layers – functions, requirements, types, specifications, construction methods, quality control tests.

UNIT – V

Pavement Construction: Flexible pavements – specifications of materials, construction method and field control checks for various types of flexible pavement layers. Cement concrete pavements – specifications and method of cement concrete pavement construction, quality control tests, construction of various types of joints.

Text Books:

1. Khanna SK and Justo CEG, “Highway Engineering”, Nem Chand and Bros, Roorkee.
2. Sharma BC, “Construction Equipment and Its Management”, Khanna Publishers.

Reference Books:

1. Bituminous Materials in Road construction, RRL, DSIR, HMSO Publications.
2. “Soil Mechanics for Road Engineers”, HMSO Publications.
3. Relevant IRC Codes and MoRT&H Specifications.

GROUND WATER HYDROLOGY

Course code: CVPE 654

Prerequisite: Nil

Course Credits: 3:0:0:0

Contact Hours: 42

Course outcome:

Students will be able to:

1. Evaluate the groundwater resources and aquifer characteristics.
2. Analyze well hydraulics and design the spacing of pumping wells.
3. Design of water well for different discharge and recharge conditions.
4. Enumerate various methods of groundwater development and management.
5. Describe the quality of groundwater, sources of pollution and their remedial measures.

Course Content:

UNIT - I

Occurrence and Movement of Groundwater: Introduction. Groundwater in the hydrologic cycle. Inflow and effluent streams. Occurrence of groundwater-origin of groundwater, geologic formations as aquifers, groundwater basins, springs. Groundwater resources and groundwater potential in India. Groundwater Flow – Darcy's law, permeability, hydraulic conductivity, transmissivity, Sp. Yield, Sp. Retention. General Flow equations – three dimensional flow equation, Laplace equation, flownet analysis.

UNIT - II

Well Hydraulics: Introduction .Flow into a well. Steady Radial flow into a well- Unconfined aquifer and confined aquifer (Thiem equation). Unsteady Radial flow into a well – Theis method, Chow's method. Well flow near aquifer boundaries – image wells, recharge boundary, spacing of tube wells, method of images. Multiple well systems. Types of wells.

UNIT - III

Water Wells: Introduction. Types of wells and methods of construction. Comparison between open wells and bore wells. Design of water well – well diameter, well depth, well screen. Well completion. Collector wells. Infiltration galleries. Well development. Tube well design. Well yield. Well performance test. Pumping equipment. Maintenance and repair of wells.

UNIT - IV

Groundwater Development and Management: Introduction. Geomorphic and geologic controls on groundwater. Safe yield and overdraft. Factors governing safe yield. Equation of hydrologic equilibrium. Land subsidence due to groundwater withdrawals. Water logging – prevention and control of water logging, spacing of drain tiles. Conjunctive use. Artificial recharge.

UNIT - V

Quality of Groundwater: Introduction. Sources of salinity. Groundwater samples. Measures of water quality – chemical quality, physical quality, bacterial quality. Quality criteria for

groundwater use. Groundwater pollution. Applications of water- quality data for quantitative assessments. Sea water intrusion.

Text Books:

1. H.M.Raghunath, "Ground Water", New Age International Publishers- 2007
2. K R Karanth, "Groundwater Assessment Development and Management", Tata McGraw – Hill Publishing Company Limited, New Delhi- 2008.

Reference Books:

1. D.K.Todd, "Groundwater Hydrology", John Wiley & Sons, Inc.-2003.

DESIGN OF PSC ELEMENTS

Course code: CVPE 655

Course Credits: 3:0:0:0

Prerequisite: Nil

Contact Hours: 42

Course Outcomes:

Students will be able to:

1. Describe the principle of PSC and role of high strength concrete and steel
2. Enumerate various losses in PSC. Analyze of deflection of PSC elements under limit state serviceability.
3. Evaluate the ultimate flexural and shear strength for design requirements.
4. Analyze the end block and design as per I.S code
5. Design the beam sections.

Course Content:

UNIT- I

Materials, Basic Principles Of Pre - Stressing & Analysis of Sections For Flexure: High strength concrete and steel, Stress-Strain characteristics and properties, Pre-tensioning and Post-tensioning systems with end anchorages, Stresses in concrete due to pre-stress and loads for different types of cross sections, stresses in steel due to loads, Cable profiles, Load balancing concept, Centre of Thrust.

UNIT- II

Losses of Pre-Stress & Deflections: Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force, Deflections of pre-stressed members, Short term and long term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflections limits as per IS 1343. Effect of creep on deflection, methods of reducing deflection. Limit state of serviceability, and control of deflections, crack widths.

UNIT- III

Limit State of Collapse: Flexure and Shear - IS code recommendations, Calculation of principal tensile stress, Ultimate flexural strength of sections, shear resistance of sections, shear reinforcement.

UNIT- IV

Design of End Blocks: Transmission of prestress in pretensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force, stresses in end blocks, IS code method, provision for the design of end block reinforcement.

UNIT- V

Design of Beams: Design of pre-tensioned and post-tensioned sections. Permissible stress, design of pre - stressing force and eccentricity, limiting zone of pre-stressing force, cable profile.

Text books:

1. Krishna Raju N, "Pre - stressed Concrete", Tata Mcgraw Hill, New Delhi
2. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi

Reference books:

1. Lin T Y and Burns N H, "Design of Pre - stressed Concrete Structures" , John Wiley and Sons, New York
2. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi

DESIGN OF SUB-STRUCTURES

Course code: CVPE 656

Prerequisite: Nil

Course Credits: 3:0:0:0

Contact Hours: 42

Course outcomes

Students will be able to:

1. Analyze the field data and assess the capacity of soils to support the foundations of structures.
2. Design the different types of shallow foundations based on the soil characteristics.
3. Design the pile foundations in different load and soil conditions.
4. Design the pile group and pile cap based on the bearing capacity and settlement analysis.
5. Analyze and design different tower foundations and retaining walls.

Course Content:

UNIT - I

Classification of foundation systems- General requirement of foundations, Selection of foundations, Computation of Loads & Design concepts. Shallow Foundations - Bearing capacity failures, Bearing capacity formulae & factors, Factor of safety, Selection of soil shear strength parameters, Settlement analysis of footings, Shallow foundations in clay, Shallow foundation in sand & $c-\phi$ soils, Footings on layered soils and sloping ground, Design for Eccentric Loads or Moment.

UNIT - II

Combined footings- (rectangular & trapezoidal) & strap footings. Soil-structure interaction effects & general concepts of structural design. Types of rafts- bearing capacity & settlements of foundation, Rigid method only.

UNIT - III

Deep foundations - Load Transfer in Deep Foundations. Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, laterally loaded piles, tension piles & batter piles. Load testing of piles.

UNIT - IV

Pile groups- Bearing capacity, settlement, uplift capacity & load distribution between piles. Proportioning and design concepts of pile cap.

UNIT - V

Foundations for tower structures-Introduction- Forces on tower foundations, Selection of foundation type. Stability and design considerations. Retaining walls – analysis and design.

Text Books:

1. Swami Saran – “Analysis & Design of Substructures”, Oxford & IBH Pub. Co. Pvt. Ltd., 1998.
2. Nainan P Kurian – “Design of Foundation Systems”, Narosa Publishing House, 1992.

Reference Books:

1. R.B. Peck, W.E. Hanson & T.H. Thornburn – “Foundation Engineering”, Wiley Eastern Ltd., Second Edition, 1984.
2. Joseph E. Bowles – “Foundation Analysis and Design”, McGraw-Hill Int. Editions, Fifth Ed.,
3. W.C. Teng – “Foundation Design”, Prentice Hall of India Pvt. Ltd., 1983.
4. Bureau of Indian Standards codes: IS-1498, IS-1892, IS-1904, IS-6403, IS-8009, IS-2950, IS-11089, IS-11233, IS-2911, IS - 802 and all other relevant codes.

HIGHWAY ENGINEERING LABORATORY

Course code: CVL 66

Course Credits: 0:0:2:0

Prerequisite: Transportation Engineering-I

Contact Hours: 28

Course outcomes:

Students will be able to:

1. Characterize aggregates based on mechanical properties.
2. Evaluate bitumen properties for its suitability for various conditions.
3. Characterize and identify the source of binders.
4. Evaluate soil for gradation and strength parameters.
5. Design bituminous mix based on Marshall mix properties.

Course Contents:

1. Tests on Aggregates:
 - i. Aggregate Crushing Value Test
 - ii. Los Angeles Abrasion Test
 - iii. Aggregate Impact Test
 - iv. Shape tests (Flaky, Elongation, Combined Index, Angularity number)
 - v. Specific gravity and water Absorption Test
2. Tests on Bituminous Materials and Mixes:
 - i. Specific Gravity Test,
 - ii. Penetration Test,
 - iii. Ductility Test,
 - iv. Softening point Test,
 - v. Flash and fire point Tests,
 - vi. Viscosity Test
 - vii. Marshall Stability tests
3. California Bearing Ratio test on subgrade soil
4. Traffic studies: Volume and speed studies.
5. Wet Sieve Analysis

Reference Book:

1. Relevant IS Codes and IRC Codes.
2. S.K Khanna, C.E.G. Justo, and A.Veeraragavan, "Highway Material and Pavement Testing Laboratory Manual" Revised 5th Edition 2009, Nemi Chand & Bros.

DETAILING OF R.C AND STRUCTURAL STEEL ELEMENTS

Course code: CVL 67

Prerequisite: Nil

Course Credits: 0:0:2:0

Contact Hours: 28

Course Outcomes

Students will be able to:

1. Determine the bond length, lap length, splicing and detailing for RC members as per SP 34.
2. Detail the reinforcement of retaining wall and water tank as per codal provisions.
3. Detail the reinforcement of different types of foundation systems.
4. Classify the beam to beam and beam to column connection as pinned, semi rigid and fixed depending on steel connections.
5. Detail the built column with gusset base as per IS:800-2007.

Course contents:

Part - A

1. Beams: Simply supported, Cantilever and Continuous
2. Slabs: One-way, Two-way and One-way continuous
3. Staircase: Dog legged
4. Cantilever Retaining wall,
5. Counter fort retaining wall
6. Circular Water tanks, Rectangular Water tank
7. Raft Foundation

Part - B

8. Beam to beam connections by bolted and welded connection
9. Beam to column connection by bolted connection
10. Beam to column connection by welded connection
11. Built –up Columns with Lacings
12. Built –up Columns with battens
13. Column bases and Gusseted bases with bolted connections
14. Column bases and Gusseted bases with welded connections

Text Books:

1. N. Krishnaraju “Structural Design & Drawing Reinforced Concrete & Steel”, University Press.
2. Krishnamurthy “Structural Design and Drawing (Concrete Structures)”, CBS publishers, New Delhi. Tata Mc-Graw publishers.

Reference Books:

1. B.C. Punmia “Reinforced Concrete Structures” Laxmi Publishing Co.
2. S.N.Sinha “ Reinforced Concrete Design”, McGraw Hill Education.
3. Subramanian .N, “Design of Steel Structures”, Oxford University Press, New Delhi.
4. K.S. Duggal, “Design of Steel Structures”, Tata Mcgraw Hill, New Delhi.