RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2021 – 2022

CIVIL ENGINEERING

VII & VIII SEMESTER B.E

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A^{+}' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems & Schneider Centre of Excellence. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), by MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 65th rank among 1143 top Engineering institutions of India for the year 2021 and is 1st amongst the Engineering colleges affiliated to VTU, Karnataka.

About the Department:

The Department of Civil Engineering was started as the third department in the institute with an intake of 60 students in the year 1971. Structural Engineering was first Post Graduate program started in the year 1984 of the institute with an intake of 10 students. The UG and PG programs have been accredited by NBA for three years 2017-2020 and 2019-2022 respectively. After obtaining the autonomous status in the year 2007, the department focused towards providing state of the art curriculum development, offering electives of the present day need and techno innovative projects. These initiatives resulted in enhanced performance of the students in terms of increase in placement, increase in the number of students writing competitive examinations and pursuing higher education in the foreign universities.

Further Department of Civil Engineering was recognized as a research centre in the year 1994 leading to PhD/MSc in Civil Engineering under Bangalore University till 1994 and later it was brought under State Technological University VTU. The research centre has attracted 30 PhD research scholars to pursue their degree from this research centre and 17 research scholars have completed PhD degree. The areas of research include Structural Engineering, Transportation Engineering, Geo-Technical Engineering, Water resources Engineering and Environmental Engineering.

The Department has close interaction with number of industries and Government agencies through R&D, and consultancy works. It also has MOU's with industries and other institutes for improved interactions and coordination with outside world.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

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.

PEO1	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)**
PEO2	To pursue higher education and show intellectual curiosity for lifelong learning. **(THEME: Higher education and lifelong learning)**
PEO3	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

Batch 2018-22

Semester	Humanities & Social Sciences (HSS)	Basic Sciences / 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		9	11						**20**
Second	2	8	10						**20**
Third		4	3	18					**25**
Fourth		7		18					**25**
Fifth	3			15	3	3			**24**
Sixth				11	6	3	4		**24**
Seventh	3			10	6			1	**20**
Eighth							14	3	**17**
Total	**8**	**28**	**24**	**72**	**15**	**6**	**18**	**4**	**175**

SCHEME OF TEACHING

VII SEMESTER

Sl. No	Subject Code	Subject	Teaching Department	Credits			
				L	T	P	Total
1.	CV 71	Estimation, Costing and Valuation Engg	Civil	3	1	0	4
2.	CV 72	Transportation Engineering	Civil	4	0	0	4
3.	CV 73	Engg Management & Entrepreneurship	Civil	3	0	0	3
4.	CVE 74X	Professional Elective - 4	Civil	3	0	0	3
5.	CVE 75X	Professional Elective - 5	Civil	3	0	0	3
6.	CVL 76	Geotechnical Engineering Lab	Civil	0	0	1	1
7.	CVL 77	Computer Aided Design Lab	Civil	0	0	1	1
8.	CVSE 78	Technical Seminar	Civil	0	0	1	1
Total				**16**	**1**	**3**	**20**

Professional Elective – IV

Sl. No	Sub Code	Subject
1	CVE 741	Fundamental of Structural Dynamics & Seismic Resistant Design
2	CVE 742	Air pollution & Control
3	CVE 743	Ground Improvement Techniques
4	CVE 744	Pavement Design
5	CVE 745	Prefabricated Structures

Professional Elective – V

Sl. No	Sub Code	Subject
1	CVE 751	Finite Element Method
2	CVE 752	Green Building Technology
3	CVE 753	Industrial Waste Water Treatment
4	CVE 754	Urban Transport Planning
5	CVE 755	Design of tall Structures

SCHEME OF TEACHING

VIII SEMESTER

Sl. No	Subject Code	Subject	Teaching Department	Credits			
				L	T	P	Total
1	CVIN/ CVE86X	Internship/NPTEL/Professional Elective -6	Civil	0	0	3	3
2	CVP	Project Work	Civil	0	0	14	14
Total							**17**

Professional elective-VI

Sl. No	Sub Code	Subject
1	CVE 861	Design of Form work & Scaffolding
2	CVE 862	Urban Hydrology
3	CVE 863	Statistical Methods in Civil Engineering
4	CVE 864	Foundation Engineering
5	CVE 865	Intelligent Transport Systems

ESTIMATION, COSTING AND VALUATION ENGINEERING

Course Code: CV 71 **Credits: 3:1:0**

Contact Hours: 42+14

Course Content

Unit I

Introduction, Importance of Estimation in Civil Engineering. Different type of Estimates, Methods in Estimations, study of various drawings with estimates, Concept of measurement, Units of Measurement. Methods of taking out quantities and cost by centre line method and long wall and short wall method. Preparing of detailed and abstract of estimates for the Building, flat and slopes roof.

Unit II

Estimates of components Reinforced Cement Concrete (RCC) works in beams, column footings and roof slabs, Estimation of septic tank, manhole, and RCC slab culverts. Estimation of Industrial building with steel Truss, Estimation of framed structures, Estimation of Demolition repair works.

Unit III

Measurement of Earth Work for Roads: Methods for computation of Earthwork-cross sections- mid sections formula, trapezoidal and average end area or mean sectional area formula, promotional formula for different terrains. Estimation of road works- Water Bound Macadam (WBM), Bituminous mixes and cement concrete roads.

Unit IV

Rate Analysis: Definition, and purpose, or importance working out quantities and rates for the following standard items of works-Earth works in different types of soils, cement concrete of different mixes, Brick masonry, stone masonry, plastering, flooring, painting and steel works, wooden works for Doors, windows and ventilator. Schedule of Rates (SR) rates as per Central Public Works Department (CPWD).

Valuation-Definitions – Various types of valuations – Valuation methods – Necessity – Capitalised value –Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent –Mortgage – Lease

Unit V

Specifications- Definition of specifications, objectives of writing specifications, Essentials of specification, general and detail specification of various items of works in buildings.

Contracts- Types of contract, essential of contracts agreement and document –legal aspects, penal provisions on breach of contract.
Tender- E.M.D, security deposit, tender from Tender notification procedures, Administrative Approval, Technical approval/sanction, Nominal muster roll, Measurement book- procedure for recording and checking measurements- stores and records, maintaining.

Text Books:

1. Chakraborti N, "Estimating, costing, specification and valuation in Civil Engg" (2006).
2. Dutta B.N. "Estimating & Specification", UBS Publishers and distributors, New Delhi.
3. D.N. Banerjee, Principles and Practices of Valuation, V Edition, Eastern Law House, 1998

Reference Books:

1. Basin P.L, 'Quantity surveying", S. Chand & Co, New Delhi.
2. Rangawala S.C, 'Estimating & specification' – Charotar publishing House, Anand.
3. Nanavati J, 'Professional Practice for Civil Engineers'

Course Outcomes (COs):

At the end of the course, students will be able to

1. Estimate the quantities for buildings.
2. Perform estimation and costing of RCC works.
3. Compile earthwork estimation for roads.
4. Apply the method of working out unit rate analysis of different construction items and Evaluate valuation for building and land.
5. Understand types of specifications. Create tender and contract documents.

TRANSPORTATION ENGINEERING

Course Code: CV 72 **Credits: 4:0:0**

Contact Hours: 56

Course Content

Unit I

Introduction to Railway Engineering: Advantages of railways as transportation mode, Typical cross sections, suitability of different gauges, Coning of wheels, components of the permanent way-Rails, Sleepers, Ballast and Fixtures-functions, types, requirements, Quantity calculations of railway track components.

Unit II

Geometrics of Railway: Gradients, super elevation, cant deficiency, Negative super elevation, speed restrictions on turnouts, Design of turn outs, points and crossings.

Unit III

Airport Engineering: Features &Role of Airways in transportation, Aircraft characteristics, Air transportation planning, site selection, Airport component sand diagram, basic length and corrected length of runway length, Taxiway-Turning radius, exit taxi way, design factors and elements.

Unit IV

Harbor Engineering: Harbors- types & components. Natural phenomenon affecting the design of harbours. Wind, waves, tides & Currents. Breakwaters -types, wharf and quays, Jetties and piers. Dry dock and wet docks, spillways & navigational aids.

Unit V

Urban Transportation Systems: advantages of mass transportation, general transportation problems in urban centres, interrelationship between land use and transportation, urban road patterns, at grade and grade separated intersections.

Text Books:

1. S.C Saxena and S.P Arora “A Text Book of Railway Engineering”, Dhanpat Raj Publications.
2. Satish Chandra and MM Agarwal “Railway Engineering”, Oxford Press Publications.
3. Rangawala “Airport Engineering”, Charotar Publications.
4. R Srinivasan “Harbour dock and tunnel Engineering”, Charotar Publications.

5. Kadiyali L.R, “Traffic Engineering and Transport Planning”, Khanna Publishers, New Delhi.

Reference Books:

1. S.C Saxena “Airport Engineering”, Dhanpat Raj Publications.
2. SK Khanna, MGArora and SS Jain “Airport planning and Design”,
3. Dr. SP Bindra “A Course in Docks and Harbour Engineering”, Dhanpat Raj Publications

Course Outcomes (COs):

At the end of the course, students will be able to

1. Identify different components of railway track and select right materials for construction.
2. Compute the various geometric features of railways for a given set of requirements.
3. Describe the importance of airway system, characteristics of aircrafts and planning of airport facilities.
4. Describe factors affecting design of harbours.
5. Describe the problems in urban transportation system. Demonstrate planning of urban transport facilities.

ENGINEERING MANAGEMENT AND ENTREPRENEURSHIP

Course Code: CV 73 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction to Engineering Economics: Project Feasibility – Economic and Financial – Time value of Money, Cash flow – diagram – Interest formulae – Basis for comparison of alternatives – benefit – cost ratio, Present worth Future worth Annual equivalent, capital recovery, Rate of return, Depreciation and taxes. Introduction of GST and Entrepreneurship, labour loss and safety in Construction industry.

Unit II

Linear Programming: Introduction, problem formulation, Graphical method of LP-, Standard form of LPP, Simplex method- Maximization case, Simplex algorithm – Minimization case.

Unit III

Construction Mechanization: Introduction to mechanization, Mechanization through construction equipment: earth excavation, moving and hauling, aggregate manufacturing; concrete production and placement- types of equipment, trench-less technology. Factors for selecting equipment and performance and economic life.

Unit IV

Construction Planning: Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities - Estimating Activity Durations – Estimating Resource Requirements for Work Activities, Scheduling and controlling-Introduction-CPM and PERT, resource allocation, time-cost tradeoff.

Unit V

Construction Industry and Management: Management- Meaning – nature and characteristics of Management, Scope and functional areas of management – Management as a science, art or profession, Planning- importance and purpose of planning process, steps in planning, Organization-purpose, principles of organization – Types of organization, Directing and controlling-meaning, Leadership styles, Coordination-meaning, importance, techniques.

Text Books:

1. NVR Naidu and T. Krishna Rao, Management and Entrepreneurship, I K International Publishing House Pvt. Ltd, 2nd Edition (2016), New Delhi.
2. P.S. Gahlot , B. M. Dhir, Construction Planning and Management, New Age International Publishers, Reprint 2018, New Delhi.
3. Mahesh, Verma, Construction, Planning and Management through System Techniques, Metropolitian Book Co.
4. Srinath. L. S, Linear Programming: Principles and Applications, New jersey: Affiliated East- West press Pvt. Ltd.

Reference Books:

1. Peurifoy R L, Construction Planning Equipments and Method, Mc graw Hill Publication 3rd Edition. New Delhi.
2. Kohli and Uddesh, Project Management Hand Book for Engineering Construction, TMH Publications, New Delhi.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe project feasibility and time value relationship for selected work.
2. Optimizing in Engineering Management for Sustainable development.
3. Adopt mechanization concepts in Construction projects.
4. Distinguish between different alternatives in Construction tasks.
5. Adopt, coordinate and manage different tasks in Management.

FUNDAMENTAL OF STRUCTURAL DYNAMICS & SEISMIC RESISTANT DESIGN

Course Code: CVE 741 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction and Free vibrations of SDF systems: Objectives, Types of Dynamic Analysis, Types of Dynamic forces, Typical Definitions in vibrations, Undamped and damped free vibrations with viscous damping, definition of Logarithmic decrement.

Unit II

Forced vibrations of SDF systems: Forced vibration response to harmonic excitations, Definition of Vibration isolation and Transmissibility, Evaluation of damping, Introduction to Duhamel integral only, Free vibrations of MDF systems: Formulation of equations of motion for MDOF (3 DOF), Free vibration analysis of systems using stiffness approach and introduction to forced vibration.

Unit III

Engineering Seismology: Elastic rebound theory and Theory of plate tectonics, Seismic waves, Seismic zoning, Magnitude and intensity, Introduction to Strong ground motion and Peak ground acceleration.

Response Spectra: Elastic design spectra, Tripartite plot, Use of response spectrum in earthquake resistant design, Energy dissipating devices.

Unit IV

Conceptual design: Structural configuration for earthquake resistant design, Simplicity and symmetry, frames, shear walls and dual systems, effect of infill masonry on frames, soft and weak storeys, Ductility and energy absorption in buildings, Strong column - weak beam design, Base isolation.

Linear Earthquake Analysis: Seismic design requirements, Load combinations including earthquake loading, Introduction to Mathematical modeling, Methods of analysis - Seismic coefficient method, Response spectrum method, Earthquake resistant design methods.

Unit V

Ductile design of RC and Masonry structures: Ductility and codal guidelines, (IS13920-2016) Design of beams and columns and introduction to: shear walls, Retrofitting, Behaviour of unreinforced and reinforced masonry walls during past earthquakes.

Text Books:

1. Mario Paz, 'Structural Dynamics', CBS Publishers, New Delhi.
2. Madhujit Mukhopadyay, 'Vibrations, Dynamics and Structural Systems', Oxford Publishers, New Delhi.
3. Pankaj Agarwal and Manish Shrikande, 'Earthquake Resistant Design of Structures', Prentice Hall of India Private Ltd, New Delhi.
4. Duggal S K,' Earthquake Resistant Design of Structures', Oxford University Press, New Delhi.

Reference Books:

1. Anil K Chopra, 'Dynamics of Structures', Pearson Publications, New Delhi.
2. Dhamodharaswamy and Kavitha, 'Structural Dynamics and Earthquake Engineering', Prentice Hall of India, New Delhi.
3. Relevent Codes; IS456-2000, SP16, IS13920-2016, IS1893-2016

Course Outcomes (COs):

At the end of the course, students will be able to

1. Apply the knowledge of basic science to know the behaviour of single degree structural systems subjected to free vibrations with and without damping.
2. Analyze the SDOF/MDOF structural systems subjected to forced vibrations
3. Construct the response spectra.
4. Analyze the building for different earthquake loading.
5. Design the structures for ductility provisions.

AIR POLLUTION CONTROL TECHNOLOGIES

Course Code: CVE 742 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: Definitions, classification and properties of air pollutants, primary and secondary air pollutants, sources of pollutants, concentrations of air pollutants and numerical calculations, air pollution episodes. Effects of air pollutants on human health, vegetation and on materials.

Air Quality Standards and Legislations: Air pollution control legislation, air quality criteria and standards, ambient air quality standards, stack emission standards, automobile emission standards, Air Act, industrial plant location.

Unit II

Meteorology: Temperature lapse rate & atmospheric stability, wind velocity profiles & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, pollution roses, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models - Gaussian dispersion model.

Unit III

Air Sampling: Sampling procedures, classification of sampling methods, Basic consideration of air sampling, duration of sampling period, sampling methods, dust fall jar, high volume air samplers, Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3) Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3), Stack sampling techniques, isokinetic sampling, particulate sampling, gaseous sampling, smoke measurements.

Unit IV

Air pollution control using equipment: Objectives, types of collection equipment's, settling chambers, inertial separators, cyclones, multiples cyclones, design calculations, filters - fabric filters, bag house filters, Electrostatic precipitators- plate type precipitators, scrubbers– types of scrubbers, spray towers, venturi scrubbers, cyclone scrubbers, packed scrubbers, design calculations. (Working principle, advantages, disadvantages, applications and designs)

Unit V

Vehicular Emissions Control and current issues: Air pollution due to automobiles, standards and control methods. Indoor air pollution & control, odor pollution and control. Noise pollution & control.

Current Issues: Hazardous air pollutants, air pollution effects on climate change, global air pollution, air pollution mitigation and adaptation to climate change.

Text Books:

1. Rao, M.N. and Rao, H.V.N. (1993) 'Air Pollution', Tata-McGraw-Hill Publishing Company Ltd. New Delhi, India.
2. Anjaneyulu Y. (2002) "Air Pollution and control Technologies", Allied Publishers

Reference Books:

1. Rao. C.S, (1992) "Environmental Pollution Control Engineering", Wiley Eastern Limited,
2. Gilbert M Masters, (2004), "Introduction to Environmental Engineering and Science" Second Edition. Pearson Education.
3. Mahajan. S. P, "Pollution Control in Process Industries", Tata McGraw Hill Publishing Co., New Delhi.
4. Wark, K. and Warner, C.F., 1981. Air pollution: its origin and control. Harper and Row Publishers Inc., New York, USA.
5. Peavy, H.S. Rowe, D.R. and Tchobanoglous, G., 1985. Environmental Engineering. McGraw Hill International Editions, New York.
6. Theodore, L., 2008. Air Pollution Control Equipment Calculations. John Wiley & Sons Inc Publication, New Jersey.
7. Boubel, R.W., Fox, D.L., Turner, D.B. and Stern, A.C., 2005. Fundamentals of Air Pollution, 3rd Edition, Academic Press, New York.
8. De. Nevers, N.,2000. Air Pollution Control Engineering. McGraw Hill, Boston.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Identify the sources and effects of air pollutants & regulatory control to reduce air pollution.
2. Estimate the stack height considering the meteorological conditions in the atmosphere.
3. Estimate the quantity of pollutants by different sampling techniques.
4. Illustrate and design of particulate control equipment.
5. Identify indoor air pollution, odour pollution, automobile pollution & describe global effect of air pollution.

GROUND IMPROVEMENT TECHNIQUES

Course Code: CVE 743 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: Need and objectives of ground improvement, Factors to be considered in the selection of best soil improvement technique. Classification of ground improvement techniques - economic considerations and suitability.

Mechanical and Hydraulic Modification: Principle of densification, mechanical modifications - shallow compaction, Deep compaction methods - In-situ densification of cohesive and cohesionless soils - Effect of compaction on properties of soil. Objectives of Hydraulic modification, methods of dewatering systems - open sumps and ditches, well point system, deep well system, vacuum dewatering and Electo - Osmosis method. Hydraulic modification by Preloading technique, vertical drains, sand wicks and prefabricated vertical drains. Design of vertical drains.

Unit II

Physical and Chemical Modification: Introduction on modification using admixtures - Lime, cement, bitumen, stabilization using municipal solid waste and industrial wastes. Using chemicals - calcium chloride, lignin. Lime piles, modification by deep grouting, thermal modification methods.

Unit III

Modification by Inclusions and Confinement: Concept of Soil reinforcement - Types of reinforcing materials - Advantages and disadvantages of strip reinforcement - Functions and applications of various Geosynthetic materials. Mechanism, Advantages and Practical applications of Reinforced earth - Components of Reinforced Earth. Design principles of Reinforced soil structures - Failure modes in Reinforced soil structures.

Unit IV

In–Situ Ground Reinforcement: Soil nailing - Objectives - Advantages - Components of soil nail wall - Types and construction procedure of soil nail wall. Ground anchorage - objectives and applications, Uplift capacity of anchors. Crib walls - applications - stability aspects in designing crib walls. Gabions and Mattresses - advantages and applications. Rock bolts - Types - applications - Functions - Bolting principles.

Unit V

Other Miscellaneous Methods: Micro Piles - Types – Advantages - Limitations - Applications. Diaphragm walls - Applications. Touch piles - Advantages - Design procedure. Soil Liners - Types - Applications. Sources and type of ground contamination - Impact of contamination on geo-environment. Remediation of contaminated sites.

Text Books:

1. "Ground Improvement techniques", Dr. P. Purushotham Raju, University Science Press,1999.
2. Manfred R. Hausmann, "Engineering principles of ground modification", McGraw–Hill Publishing Co. 1990.

Reference Books:

1. Robert M. Koerner: Construction and Geotechnical Methods in Foundation Engg, McGraw Hill.
2. Ingles O.G. and Metcalf J.B., "Soil Stabilization – Principles and practice", Butterworths, London, 1972.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Identify the problems associated with the existing ground condition.
2. Select and implement soil stabilization techniques based on field conditions.
3. Acquire knowledge on soil reinforcement techniques.
4. Apply in-situ reinforcement techniques.
5. Demonstrate the ground improvement techniques such as micro piles and application of soil liners.

PAVEMENT DESIGN

Course Code: CVE 744 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction - Factors affecting design and performance of the pavements. Pavement composition. Parameters for the Pavement Analysis- Elastic Modulus, Poisson's ratio, Wheel Load, Wheel configuration, Tire Pressure & Temperature. Concepts of analysis of bituminous pavement structure and concrete pavement structure.

Unit II

Stresses and Deflections in Flexible Pavements - Stresses and deflections in homogenous masses, wheel load stresses and various factors in traffic wheel load. ESWL [graphical method only] for multiple wheel loads, repeated loads and EWL factors.

Unit III

Design Methods for Flexible pavements for Highways - Mc - Leod method, Kansas Method, California Resistance Value method & IRC Method- according to the IRC38-2001.

Unit IV

Stresses in Rigid Pavements - Types of stresses and causes, factors influencing the stresses, general considerations in rigid pavement analysis, EWL, wheel load stresses, warping stresses, frictional stresses and combined stresses.

Unit V

Design of Cement Concrete pavement - Designing thickness of Concrete Pavement [IRC 58, 2002]. Types of joints in cement concrete pavements and their functions. Joint spacing: design of joints, details of longitudinal joints, contraction joints and expansion joints, Design of Pavements using Recycled/Alternate Materials.

Text books

1. Yoder E J and Witczak, "Principles of Pavement Design", Edition, John Wiley and sons.
2. Khanna SK and Justo C E G, "Highway Engineering, Nem Chand Bros", Roorkee.

Reference books

1. IRC 37:2012 “Guidelines for the design of Flexible Pavements”, Third Revision.
2. IRC 58:2011 “Guidelines for the design of Plain Jointed Rigid Pavements for Highways”, Third Revision.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Explain pavement components in flexible and rigid pavement.
2. Illustrate stresses and strains in flexible pavements & rigid pavements.
3. Design the flexible pavement.
4. Describe stresses and strains in rigid pavements.
5. Design the cement concrete pavements with different joints.

PRE-FABRICATED CONCRETE STRUCTURES

Course Code: CVE 745 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: Need for prefabrication, principles, materials, Modular coordination, Standardization, Systems production, Transportation and Erection.

Unit II

Prefabricated components: Behaviour of structural components, large panel constructions, Construction of roof and floor slab, Deck slabs, Wall panels, Columns, and Shear walls.

Unit III

Design principles: Disuniting of structures. Design of cross section based on efficiency of material used. Problems in design because of joint flexibility & Allowance for joint deformation.

Unit IV

Joint in structural members: Joints for different structural connections, Dimensions and detailing & Design of expansion joints.

Unit V

Design for abnormal loads: Progressive collapse, Code provisions, Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., Importance of avoidance of progressive collapse.

Text Books:

1. CBRI, "Building materials and components", India, 1990.
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., "Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994.

Reference Books:

1. Koncz T., "Manual of precast concrete construction", Vols. I, II and III, Bauverlag, GMBH, 1971.
2. Structural design manual, Precast concrete connection details, Society for the studies in the use of Pre cast concrete, Netherland Betor Verlag, 1978.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Use modular construction, industrialized construction.
2. Design prefabricated elements.
3. Design cross section based on efficiency of material used & joint flexibility for structural connections.
4. Use the knowledge of the construction methods and prefabricated elements in buildings.
5. Design prefabricated structures for abnormal loads.

FINITE ELEMENT METHOD

Course Code: CVE 751 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: Basic concepts, Background review, Theory of elasticity, Matrix displacement formulation, energy concepts, equilibrium and energy methods of analyzing structures, Rayleigh-Ritz method, Galerkin's method & simple application in structural analysis.

Unit II

Fundamentals of Finite element method: Displacement function and natural coordinate's construction of displacement functions for 2D truss and beam elements. Applications of FEM for the analysis of truss, continuous beam and simple frame problems.

Unit III

Analysis of 2D continuum Problems: Elements and shape functions, triangular, rectangular and quadrilateral elements, different type of elements, their characteristics and suitability for application, polynomial shape functions, lagrange's and Hermitian polynomials, compatibility and convergence requirements of shape functions.

Unit IV

Theory of Isoparametric Elements: Isoparametric, sub-parametric and super-parametric elements. Characteristics of isoparametic quadrilateral elements.

Unit V

Introduction to plate bending problems and non-linear analysis, Structure of computer program for FEM analysis, description of different modules & pre and post processing.

Text Books:

1. Krishnamoorthy C S, "Finite Element Analysis," Tata McGraw Hill.
2. Bhavikatti, "Finite Element Analysis," Tata McGraw Hill.
3. Desai C and Abel J F, "Introduction to the Finite Element Method," Eats West Press Pvt. Ltd., 1972.

Reference Books:

1. Bathe K J, “Finite Element Procedures in Engineering Analysis”, Prentice Hall, 1996.
2. Rajasekaran S, “Finite Element Analysis in Engineering Design”, Wheeler Publishing, 1999.
3. Cook R D, Malkan D S & Plesta M.E., “Concepts and Application of Finite Element Analysis”, 3rd Edition, John Wiley and Sons Inc., 1989.
4. Shames I H and Dym C J, “Energy and Finite Element Methods in Structural Mechanics” McGraw Hill, New York, 1985.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Illustrating and applying concepts of elasticity, Rayleigh-Ritz method, finite difference method and FEM in solving engineering problems.
2. Illustrating and developing the requirements of interpolation for one, two dimensional elements, fundamentals of finite element methods for small displacement linear elastic analysis.
3. Computation of shape functions of different types of finite elements having different shapes.
4. Defining, illustrating and applying the concepts of isoparametric elements for one, two & three dimensional problems.
5. Applying the knowledge of FEM in understanding problems related to plate bending and nonlinear analysis; to understand the structure and functioning of a finite element analysis program.

GREEN BUILDING TECHNOLOGY

Course Code: CVE 752 **Credits: 3:0:0**

Contact Hours: 42

Course Content

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. Carbon footprint calculations, 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, recycled material alternative/neo materials.

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, LEED, USGBC & IGBC.

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. Case studies of residential and commercial green buildings.

Text Books:

1. Kibert, Charles J. Sustainable construction: green building design and delivery, Wiley, 2008. 2nd Edition.
2. TERI "Sustainable Building Design Manual- Volume I & II" Tata Energy Research Institute.

Reference 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.

Course Outcomes (COs):

At the end of the course, 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 environmental 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.

INDUSTRIAL WASTEWATER TREATMENT

Course Code: CVE 753 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Industrial waste and Environment: Water usage in Industry, Difference between domestic and industrial wastewater. Parameters of pollution: Inorganic salts, Acids and Alkalis, Organic matter, Suspended solids, Floating solids and liquids, Hot discharges, color, toxic chemicals, microorganisms and foam producing matter. Pollution of receiving body of water. Environmental standards for industrial effluents as per Central Pollution Control Board.

Unit II

Industrial wastewater treatment - Theories and Practices:

Volume Reduction: classifying wastes; conserving wastewater; changing production to decrease wastes; reusing both industrial and municipal effluents as raw water supplies and eliminating batch or slug discharges of process wastes.

Concentration Reduction: process changes, equipment modifications, segregation of wastes, equalization of wastes, by-product recovery and proportioning wastes.

Pre-treatment of Industrial wastewater –Neutralization: Mixing of wastes and chemical treatment. Equalization and Proportioning: objectives and methods.

Unit III

Effluent sampling: Significance of sampling. Grab and composite sampling.

Removal of suspended solids: Sedimentation- Theory and design of circular sedimentation tank. Flotation- Theory and methods. Screening- theory and methods. Removal of colloidal particles- chemical coagulation and adsorption. Removal of Inorganic Dissolved Solids- Evaporation, Ion exchange and Reverse Osmosis.

Unit IV

Removal of Organic Dissolved Solids: Lagooning, Activated-sludge treatment, Trickling filtration, anaerobic digestion, Rotating Biological Contactor (Theory and methods- No design). Treatment of sludge- Anaerobic and Aerobic Digestion, vacuum filtration and Drying Beds.

Unit V

Manufacturing process: flow sheet with sources of wastewater, characteristics of waste and treatment of the following industrial effluents. Dairy industry, Sugar Mill, Paper and pulp Industry, Distillery industry and Plating industry.

Text Books:

1. Industrial Waste Treatment Contemporary Practice and Vision for the Future by Nelson Leonard Nemerow, Elsevier, 2007, ISBN-13: 978-0-12-372493-9.
2. Waste Water Treatment: Rational Methods of Design and Industrial Practices, 3/E, By M N Rao, Oxford & IBH Publishing Company Pvt. Ltd. (2007), ISBN-13: 978-8120417120.

Reference Books:

1. Industrial water pollution control, by W. Wesley Eckenfelder, Jr., Third Edition, McGraw- Hill, IESBN 0 07 116275·5, 2000.
2. Pollution Control in Process Industries by S P Mahajan, McGraw Hill Education (2017), ISBN-13: 978-0074517727.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe the nature of industrial wastewater and summarize the pollution of streams.
2. Illustrate the waste reduction techniques and pretreatment.
3. Demonstrate the sampling techniques and primary treatment.
4. Outline the organic treatment of industrial wastewater.
5. Provide wastewater management plan in industrial setup.

URBAN TRANSPORT PLANNING

Course Code: CVE 754 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Scope of Urban Transport Planning: Interdependence of land use and transportation system. Approach to transport planning, Stages in transport planning. Fore cast of future conditions and plan synthesis.

Unit II

Various Transportation Surveys & Inventories of transport facilities: Trip generation: trip purpose, factors affecting trip generation and attraction– category analysis–Analysis/ Numerical Problems.

Unit III

Trip distribution: Growth Factor Method, Synthetic Methods- Fratar and Furness Methods, Gravity model, Analysis/ Numerical Problems.

Unit IV

Factors affecting Modal Split Analysis: Characteristics of modal split, model split in Urban transport planning-problems. Trip assignment, assignment techniques, traffic forecasting, Analysis/ Numerical Problems.

Unit V

Public Transport and Intermediate Public Transport in Indian Cities: Inter-modal transportation and coordination of different modes of transport, role of metro rail. Urban transport planning for small and medium cities. Difficulties in transport planning, computer application in transportation planning.

Text Books:

1. Kadiyali, LR, "Traffic Engineering and Transport Planning, Khanna Publishers.
2. Subash C Saxena, "A Course in Traffic Planning and Design", Dhanapat Rai & Sons, Delhi,1989.

Reference Books:

1. JothiKristey & Lal, “Introduction to Transportation Engineering”, PHI, New Delhi.
2. Huchinson AG, “Urban and Regional Models in Geography and Planning”, John Wiley and Sons, London.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe land use pattern, transportation needs and forecast present conditions for the development of feasible urban transport system.
2. Generate transportation inventories and solutions for the trip generation and attraction.
3. Demonstrate trip distribution us in various trip distribution models.
4. To characterize the modals plitam on various travel modes and assign the trips generated.
5. To characterize the transportation means for various categories to cities and apply the latest computer if or transportation planning.

DESIGN OF TALL STRUCTURES

Course Code: CVE 755 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: History, Advantages & disadvantages, Economics, Essential amenities, Lifts (elevator), Fire safety, Water supply, Drainage and garbage disposal, Miscellaneous services, Structural and foundation systems, Design criteria, Design philosophy, loading, Sequential loading, Materials, High performance Concrete, Fibre reinforced Concrete, Light weight Concrete, Design Mixes.

Unit II

Loading and movement: Gravity loading: Dead and Live load, methods of live load reduction, Impact, gravity loading, construction load. Wind loading: Static and Dynamic approach, Analytical and wind tunnel experimental method. Earthquake loading: Equivalent lateral force, Modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.

Unit III

Behaviour of various structural systems: Factors affecting growth, Height and Structural form- High rise behavior, Rigid frames, braced frames, in filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, outrigger- Braced and hybrid mega system.

Unit IV

Analysis and design: Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of building as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, computerized general three dimensional analysis. Structural elements: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance.

Unit V

Stability of tall buildings: Overall buckling analysis of frames, wall- frames – Approximate methods, second order effects of gravity loading, P-Delta analysis,

simultaneous first order and P-Delta analysis- Translational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation.

Text Books:

1. Taranath B.S., "Analysis & Design of Tall Building", McGraw-Hill Book Co,2011.
2. Bryan S.S, and Alexcoull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc., 1991.

Reference Books:

1. Chandrashekhara K, "Theory of Plates" Universities Press (India)Ltd., Hyderabad, 2001.
2. Ansel c.ugural, "Stresses in Plates and shells", Second Edition, McGraw-Hill International Editions 1999.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Illustrate analysis and design of tall buildings.
2. Describe behaviour of tall buildings subjected to lateral building.
3. Discuss the principles of designing tall buildings as per the existing codes.
4. Analyze and design structural elements of tall structures.
5. Analyze and check the stability of tall building.

GEOTECHNICAL ENGINEERING LABORATARY

Course Code: CVL 76 **Credits: 0:0:1**

Contact Hours: 14

List of Experiments

1. Determination of specific gravity and moisture content.
2. Grain size analysis of soil sample (sieve analysis).
3. In situ density by core cutter and sand replacement methods.
4. Relative Density of sands.
5. Consistency limits – Liquid limit (by Casagrande, Plastic limit & Shrinkage limit and Cone Penetration methods).
6. Standard proctor Compaction Test.
7. Coefficient of permeability by constant and variable head methods.
8. Determination of shear strength parameters using Unconfined compression test.
9. Determination of shear strength parameters using Direct shear test.
10. Determination of shear strength parameters using Triaxial Compression test.
11. Demonstration of Consolidation test – Determination of compression index and coefficient of consolidation.
12. Demonstration of Hydrometer test, Modified Proctor's test & Proctor's needle.

Text Books:

1. BIS Codes of Practice: IS 2720.
2. Punmia B.C. (2005), "Soil Mechanics and Foundation Engg.", 16th Edition, Laxmi Publications Co., New Delhi.

Reference Books:

1. Gopal Ranjan and Rao A.S.R. (2000), "Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.
2. Bowles J.E. (1996), 'Foundation Analysis and Design"' 5th Edition, McGraw Hill Pub. Co. New York.
3. Alam Singh and Chowdhary G.R., "Soil Engineering in Theory and Practice" CBS Publishers and Distributors Ltd., New Delhi

Course Outcomes (COs):

At the end of the course, students will be able to

1. Carry out experiments on the Index properties of soils and summarize the results.
2. Classify different soils based on their gradation and plasticity characteristics and predict the behaviour of soil to use it as construction material.
3. Provide the field density of soils and integrate the field compaction process with the laboratory results.
4. Carry out the permeability tests of different types of soils and select the suitable soil for earthen embankments.
5. Differentiate the shear strength tests for different types of soils and select the drainage condition required for shear test based on the site conditions.

COMPUTER AIDED DESIGN LABORATORY

Course Code: CVL 77 **Credits: 0:0:1**

Contact Hours: 14

List of Experiments

1. Chi -square test of goodness of fit. Curve fitting by the method of least square.
2. Linear correlation and regression multiple linear regression, Analysis of Variance.
3. Prepare the spread sheet for the given data and calculate the Quantity for RCC elements – Beam, Slab, Column using formula bar.
4. Prepare the Spread Sheet for the given plan and calculate the quantity and total amount using Formula bar. (Use separate column for rate and units).
5. Design and Analysis problems in Excel for Given Dimension of Masonry / RCC Dam-Top width, height of Dam, Height of Water, Specific Weight of masonry/Cement Concrete. Specific Weight of Water etc, Find the Base pressure and check the stability of the Dam.
6. Use of FEM packages for analysis of propped cantilever, fixed beams, continuous beam.
7. Use of FEM packages for analysis of pin jointed frames single bay and multi bays.
8. Use of FEM packages for analysis of pin jointed frame, 2D rigid frame.
9. Use of FEM packages for analysis of 3D rigid frame and Multistory Frame structures.
10. Introduction to Microsoft project, Preparation of schedule for a project by using Microsoft project, Work breakdown Structure – Planning, Techniques-bar charts – preparation of network diagram – critical path method- program evaluation and review technique – lab components.

Text Books:

1. Computer aided design by C.S. Krishnamoorthy and S. Rajeev – Narosa publishing house.
2. Referral on Cad Laboratory, - by Jayaram & Rajendra Prasad, Sapna Publishers.

Reference Books:

1. Finite Element analysis – by C.S. Krishnamoorthy, Tata McGraw Hill publishers.
2. Project Management and Tools & Technologies – An overview - by Shailesh Mehta, Shroff Pub & Dist. Pvt. Ltd.
3. Analysis and Design of Structures - A Practical Guide to Modeling – by D. Trevor Jones, Bentley Publishers.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Apply statistical skills using soft computing tools to arrive at regression value and goodness to fit curve.
2. To execute problems using spreadsheets for estimating the different components of building (foundation, column, beam, slab).
3. Apply the soft skill techniques to arrive at simulating engineering problems related to hydraulics.
4. To model and analyze different components of building (foundation, column, beam, and slab) using FEM software.
5. To execute engineering stages of project works using soft skill techniques (foundation, column, beam, slab)

TECHNICAL SEMINAR

Course Code: CVSE 78 **Credits: 0:0:1**

Guidelines:

1. The students with consultation with faculty adviser shall arrive at topic of seminar based on exhaustive literature review, current civil engineering scenario, latest techniques or materials etc.
2. The students shall review available information and compile the information.
3. The students shall prepare technical report.
4. The students shall present their seminar to the review committee.
5. The seminar topic shall be chosen during the 2nd week of the semester.
6. The review and organizing the seminar shall be completed during 6th week.
7. The seminar report shall be submitted during 10thweek.
8. The presentation will be held during 12thweek.
9. The award of marks is based on the following criteria
    a. Selection of Topic for the seminar and its relevance-10%
    b. The quality of Seminar Report-40%
    c. Presentation skills and depth of knowledge -30%
    d. Viva and discussion -20%

Course Outcomes (COs):

At the end of the course, students will be able to

1. Appraise the current civil engineering research/ techniques / developments / inter disciplinary areas.
2. Formulate seminar topic by utilizing technical resources/ Journals/ web sources.
3. Carry out detailed review of available literature.
4. Compose technical report.
5. Demonstrate command of voice modulation, voice projection, and pacing during presentation.

DESIGN OF FORMWORK AND SCAFFOLDING

Course Code: CVE 861 **Credits: 3:0:0**

Contact Hours: 42

Course Content

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.

Text 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.

Reference Books:

1. Michael P. Hurst, "Formwork", Construction Press, London and New York, 1997.
2. Austin, C.K., "Formwork for Concrete", Cleaver – Hume Press Ltd., London 1996.
3. Tudor Dinescu and Constantin Radulescu, "Slipform Techniques", Abacus Press, Turn Bridge Wells, Kent, 1992.
4. "Guide for Concrete Formwork", American Concrete Institute Detroit, Michigan, 1996.
5. "Safety Requirements for Scaffolding", American National Standards Institute, New York, 1994.

Course Outcomes (COs):

At the end of the course, 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.

URBAN HYDROLOGY

Course Code: CVE 862 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction: Effects of urbanization on catchment hydrology; Climatic changes; Runoff changes; Reduction in base flow & groundwater recharge; Increased downstream pollution; Peak flow formulae for urban areas – Rational method, Empirical formulae, Unit hydrograph method, Rain fall-runoff correlation.

Unit II

Hydrologic Statistics and Frequency Analysis: Probabilistic treatment of hydrologic data; Statistical parameters; Return period; Frequency analysis; Probability plotting; PMP and PMF; Design storms; IDF curves; Risk analysis.

Unit III

Components of Drainage Systems: Sewer inlets; Manholes and catch basins; Drop structures; Overflow structures; Outlets of sewers and culverts; Hydraulic design of storage facilities; Gutter flow; Hydraulics of sewer inlets; Flash floods in urban areas.

Unit IV

Storm water control: Storm systems; Storm water drainage channels; Storm water detention; Drainage of street and highway pavements; Hydraulic design of culverts; Stage-storage relationship; Stage-discharge relationship; Pond routing; Channel routing; Infiltration practices; Porous pavements.

Unit V

Urban Storm Water Management: Storm water quality enhancement – storm water pollutants, suspended solids in storm water, sedimentation principles. Use of models-SWMM, SMDA, operation and maintenance of urban drainage system, interaction between urban drainage and solid waste management.

Text Books:

1. VenTe Chow, David R. Maidment, Larry W. Mays," Applied Hydrology", McGraw Hill International Editions,1988.
2. Larry W. Mays," Water Resources Engineering", Blackwell publishing, 2nd edition, 2011.

Reference Books:

1. K. Subramanya, “Engineering Hydrology”, McGraw Hill Education; Fourth edition (2017).

Course Outcomes (COs):

At the end of the course, students will be able to

1. Summarize the effects of urbanization on urban catchment and evaluate the peak floods.
2. Apply the knowledge of statistics for analyzing the hydrologic data to yield design storms.
3. Design the components of drainage systems.
4. Design storm water control structures.
5. Demonstrate various software’s to develop storm water management systems.

STATISTICAL METHODS IN CIVIL ENGINEERING

Course Code: CVE 863 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Fundamental statistical concepts and Probability concepts, histogram, data reduction and interpretation, mean, median, mode, standard deviation, span of values over which your data set occurs -range.

Unit II

Statistical techniques and its applications: Scope of Statistics, random sampling, event, sampling distribution, statistical process control.

Unit III

Fitting straight lines, correlation analysis, regression analysis, estimation of parameters, Statistical hypothesis- normal and chi square methods.

Unit IV

Data quantitative methods – Statistical interference, forecasting, statistical quality control.

Unit V

Application of Statistical analysis for: flood prediction, rainfall prediction, traffic engineering analysis, mix design of concrete and estimation of compressive strength. Application problems related to structural, geotechnical and environmental engineering.

Text Books:

1. Higher Engineering Mathematics, 44th Edition, Dr. B S Grewal, Khanna Publishers,2018.
2. Higher Engineering Mathematics, 32nd Reprint, B V Ramana, Tata McGraw-Hill, 2018.
3. Schaums Theory and Problems of Statistics (SI Units), Spiegel, Murray R, New York: Mcgraw-Hill Publishing Company Limited, 1972.

Reference Books:

1. Applied Statistics and Probability for Engineers, 6th Edition, Douglas C. Montgomery Arizona State University George C. Runger, John Wiley & Sons, Inc., 2014.
2. Miller & Freund's Probability and Statistics for Engineers, 6th Edition, Richard A Johnson, Pearson Education, 2005.
3. Schaum's Theory and Problems of Probability, 2nd Edition, Lipschutz, Seymour, New Delhi: Tata Mcgraw-Hill.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Understand the fundamentals of statistical and probability concepts.
2. Illustrate fundamentals of statistical applications and processes.
3. Understanding usage of the regression and corelation analysis and statistical hypothesis.
4. Understanding of data quantitative methods.
5. Application of statistical analysis to Civil Engineering Applications.

FOUNDATION ENGINEERING

Course Code: CVE 864 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Bearing capacity and settlement analysis: Penetration tests and Plate load tests; Settlement Analysis; Bearing capacity of foundations on layered soils and sloping grounds; Foundations with tilted base.

Design of Isolated footings: Assessments of foundation loads; Choice of foundation types, Proportioning of footings; Structural design (limit state) of isolated footings; Design of eccentrically loaded footings.

Unit II

Combined footings: Proportioning of combined footings - Rectangular, Trapezoidal and Strap footings using field test data; Structural design of combined footings; Raft foundations - Necessity; Types of rafts; Bearing capacity and settlement of rafts.

Unit III

Pile Foundations: Classification and Uses; Load carrying capacity of single pile using Static and Dynamic formulae; Pile load tests; Pull out resistance; Structural design of piles.

Pile groups: Group capacity of pile groups in different soils; efficiency of pile groups; Settlement of pile groups; Negative skin friction; Pile capacity from SPT and CPT values. Structural design of pile foundations and pile cap.

Unit IV

Sheet pile structures: Cantilever sheet pile walls in granular and cohesive soils - Anchored bulk heads - Free earth support and fixed earth support methods - Anchors. Cofferdams - types - cellular cofferdam – uses;

Well foundations: Types of caissons; Bearing capacity and settlement; Design of well foundations; determination of scour depth; steining thickness; well sinking.

Unit V

Foundations of tower structures: Loads on tower footings; design of Concrete pad and Chimney type footing in different soils; design of under reamed piles; Piled raft foundation.

Foundations on problematic soils: Foundation Failures - Types and causes of failures, Remedial measures, Shoring and Underpinning. Expansive soils - factors influencing swelling, problems and remedial measures; Principles of foundation design on expansive, collapsible and contaminated soils.

Text Books:

1. Das, B.M., "Principles of Foundation Engineering", 4th Edition, PWS Publishing, Singapore, 1999.
2. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw- Hill International, 2000.
3. W. C. Teng, "Foundation Design", Prentice Hall of India Ltd.

Reference Books:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", 4th Edition, Sai Krupa Technical Consultants, 2000.
2. Venkataramah, C., "Geotechnical Engineering", 5th Edition, New Age International Pvt. Ltd., 2009.
3. Swami Saran, "Analysis and Design of Substructures", 2nd Edition, Oxford & IBH Publishing Company Pvt. Ltd., 2009.
4. Gopal Ranjan & ASR Rao, "Basic and Applied Soil Mechanics", 3rd Edition, New Age International Pvt. Ltd, Publishers, 2002.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Predict the bearing capacity of soil and select suitable foundation based on site conditions.
2. Differentiate the suitability of various combined footings and carry out the design for different soil conditions.
3. Integrate the field test results with the structural design of pile foundations.
4. Provide the sheet pile wall design and select the type of caisson required based on the soil properties at the site.
5. Select the suitable foundation on problematic soil and suggest remedial measures against foundation failures.

INTELLIGENT TRANSPORT SYSTEMS

Course Code: CVE 865 **Credits: 3:0:0**

Contact Hours: 42

Course Content

Unit I

Introduction and Fundamentals to Intelligent Transportation Systems (ITS) - Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques - Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection. Benefits of ITS.

Unit II

Telecommunications and Data requirements in ITS - Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle - Road side communication - Vehicle Positioning System. Application of sensors to Traffic management, ITS Data collection techniques - Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection.

Unit III

ITS Architecture –Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS planning.

Unit IV

ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).

Unit V

ITS User Needs and Services - Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

Text Books:

1. Intelligent Transport Systems by Pradip Kumar Sarkar and Amit Kumar Jain.

Reference Books:

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
2. Perspective on ITS Sussman, J. M., Artech House Publishers, 2005.
3. National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).
4. Fundamentals of intelligent transportation systems planning By Mashrur A. Chowdhury, Adel WadidSadek.
5. Sensor technologies and Data requirements of ITS Lawrence A. Klein,
6. Sustainable Transport System in Context of Indian Cities by Pradip Kumar Sarkar.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Identify and comprehend the usage of Intelligent Transport System.
2. Relate and articulate the sensor and communication technologies for efficient transportation system.
3. Interpret and devise the ITS Architecture based on the current needs.
4. Interpret and select the ITS technology based on the current requirements.
5. Design and implement ITS components for the user.

INTERNSHIP

Course Code: CVIN **Credits: 3:0:0**

Course Content

The student has to choose elective or undergo internship or industrial training. The students who undergo internship or industrial training, the minimum period specified is four weeks. During the 2nd week of training the students shall submit synopsis report of the training which will be evaluated for 40% of the total marks based on choice of the agency, type of training or internship and possible outcomes of the training or internship. The students shall submit a final report which is ratified by the agency which has provided the training. The students shall be evaluated based on the final report, presentation and viva-voce for 60% of marks. The students has to submit the certificate from the company indicating the period of training and certifying student's performance (e.g. Satisfactory or not).

Course Outcomes (COs):

At the end of the course, students will be able to

1. Indentify an industry of his interest and obtain permission.
2. Draft synopsis during first phase of internship.
3. Perform the required assignment as specified by the industry.
4. Gather information during the internship. Collect the necessary literature and analyze the data.
5. Draft internship report & present the report.

National Programme on Technology Enhanced Learning (NPTEL)

Course Code: CVNP **Credits: 3:0:0**

Course Content

The students are informed to choose relevant NPTEL course from the available 12 weeks NPTEL online courses recommended from the department. The students can register the course during 7th and 8th semester only. The 100 marks CIE assessment is based on the final NPTEL score. The NPTEL score will be mapped directly to the CIE marks only if student has passed the exam completely for the registered NPTEL course. Those who do not take-up/ complete the NPTEL course shall be declared as failed and have to complete during the subsequent examination after satisfying the NPTEL requirement. The department will offer NPTEL course to those students who do not pursue their Internship in any Industry. The course to be offered will be decided by the committee in the department as per the requirements.

PROJECT WORK

Course Code: CVP **Credits: 0:0:14**

Guidelines:

- The process for the project work begins in the 7th semester with students forming project group of four students.
- The group shall submit registration form to the project coordinator after choosing the faculty adviser based on mutual consent.
- The selection of topic, the methodology to be used and scheduling of project work shall be carried out in consultation with faculty adviser.
- The students are encouraged to select topics which shall satisfy some of the following criteria
  - ✓ Innovation
  - ✓ Relevance to current scenario
  - ✓ Sustainability issues addressed
  - ✓ Social relevance
  - ✓ Use of modern tools / Smart technologies
  - ✓ Non repetitive projects
  - ✓ Interdisciplinary
  - ✓ Chance of publication
  - ✓ Real life project
- The students are encouraged to study current journals, web sources and interact with industry/ research organization/ consultants before choosing the project title.
- The title of the project and abstract of the project work shall be submitted to the coordinator in the 2nd week of 8th semester.
- The group shall to carry out project work under the supervision of faculty adviser.
- There will be two project reviews during the 8th semester.
- The group shall prepare and present during the review as per the departmental guidance.
- The CIE marks will be based on the presentations and assessment by the faculty adviser.
- Each review shall carry 20 marks and faculty adviser will award 10 marks totaling to 50 marks.
- The preparation of presentations & project report shall be intimated to the students during 8th semester.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Select the project title based on the literature background or real live projects.
2. Compile required data and formulate the methodology for the project.
3. Analyze/ conduct experiment/ field study required for the project.
4. Organize and analyze the results.
5. Able to draw conclusions, prepare and present report.