RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2020 – 2021

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 13 UG programs and 15 PG programs. All these programs are approved by AICTE. All the UG programs & 09 PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A' grade by NAAC in 2014. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs till the year 2029. 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 to 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 & 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 Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) 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), an initiative of Ministry of Human Resource Development(MHRD), 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. It 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, MHRD, Government of India, M S Ramaiah Institute of Technology has achieved 59th rank among 1071 top Engineering institutions of India for the year 2020 and 1st rank amongst Engineering colleges(VTU) in 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.

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 valuesand 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 2016-17

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	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	-	5	-	24
Seventh	-	-	-	16	6	4	-	-	26
Eighth	-	-	-	-	4	-	13	6	23
Total	08	22	24	100	16	4	18	8	200

SCHEME OF TEACHING
VII SEMESTER

Sl. No	Subject Code	Subject	Teaching Department	Credits				
				L	T	P	S**	Total
1	CV71	Transportation Engineering – II	Civil	4	0	0	0	4
2	CV72	Estimation and Costing	Civil	3	0	0	1	4
3	CV73	Geotechnical Engineering – II	Civil	3	0	0	1	4
4	CVOE --	OPEN ELECTIVE	---	4	0	0	0	4
5	CVE74X	Elective – III	Civil	3	0	0	0	3
6	CVE75X	Elective – IV	Civil	3	0	0	0	3
7	CVL76	Geotechnical Engineering Laboratory	Civil	0	0	2	0	2
8	CVL77	Computer Aided Design Laboratory	Civil	0	0	2	0	2
			Total	20	0	4	2	26

ELECTIVE-III

Sl. No	Sub Code	Subject
1	CVE741	Principles of Bridge Engineering
2	CVE742	Traffic Engineering
3	CVE743	Structural Masonry
4	CVE744	Air Pollution & Control
5	CVE745	Optimization Methods in Civil Engg

ELECTIVE-IV

Sl. No	Sub Code	Subject
1	CVE751	Advanced Design of Concrete Structures
2	CVE752	Urban Hydrology
3	CVE753	Ground Improvement Techniques
4	CVE754	Pavement Design
5	CVE755	Structural Dynamics

SCHEME OF TEACHING
VIII SEMESTER

Sl. No	Subject Code	Subject	Teaching Department	Credits				
				L	T	P	S**	Total
1	CVE81	Elective – V	Civil	4	0	0	0	4
2	CVE82	Elective –VI / Internship/Industrial Training	Civil	4	0	0	0	4
3	CV83	Project Work	Civil	0	0	14	0	14
4	CV84	Technical Seminar	Civil	0	0	1	0	1
			Total	8	0	15	0	23

Elective – V

Sl. No	Sub Code	Subject
1	CVE811	Rehabilitation of Structures
2	CVE812	Industrial Waste Water Treatment
3	CVE813	Pavement Evaluation and Management
4	CVE814	Analysis and Design of Tall Structures
5	CVE815	Fundamentals of FEM
6	CVE816	Water Power Engineering

Elective – VI

Sl. No	Sub Code	Subject
1	CVE821	Design of Earthquake Resistant Structures
2	CVE822	Urban Transport Planning
3	CVE823	Environmental Impact Assessment
4	CVE824	Pre – Fabricated Structures
5	CVE825	Composites and Smart Materials
6	CVE826	Design of Hydraulic Structures

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

TRANSPORTATION ENGINEERING II

Course Code: CV71
Credit: 4:0:0:0 **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.

Unit II

Geometrics of Railway: Gradients, super elevation, cant deficiency, Negative super elevation, speed restrictions on turn outs, 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 components and diagram, basic length and corrected length of runway length, Taxiway - Turning radius, exit taxiway, design factors and elements.

Unit IV

Harbor Engineering: Harbors- types & components. Natural phenomenon affecting the design of harbors. 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 centers, interrelationship between land use and transportation, urban road patterns, at grade and grade separated junctions, ITS and its applications.

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.

References

1. S C Saxena “Airport Engineering”, Dhanpat Raj Publications.
2. S K Khanna, M G Arora and S S Jain “ Airport planning and Design”,
3. Dr S P 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 harbors.
5. Describe the problems in urban transportation system. Demonstrate planning of urban transport facilities

ESTIMATION AND COSTING

Course Code: CV72
Credit: 3:0:0:1 **Contact Hours: 56**

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 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

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.

Unit IV

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- WBM, Bituminous mixes and cement concrete roads.

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.

References

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. Describe basic of estimation, carry out measurements and prepare estimates.
2. Perform estimation and costing of RCC works
3. Analyze the rates of building components.
4. Compile earthwork estimation for roads
5. Describe specifications. Develop tender and contract documents

GEOTECHNICAL ENGINEERING – II

Course Code: CV73
Credit: 3:0:0:1 **Contact Hours: 56**

Course Content

Unit I

Subsurface Exploration: Importance of exploration program. Methods of exploration: Boring and sounding tests. Types of samples- undisturbed, disturbed and representative samples. Samplers, sample disturbance, area ratio, Recovery ratio, clearances, typical bore log, Number and depth of borings for various civil engineering structures. Soil exploration report. Importance of drainage & dewatering during laying of foundations.

Stresses in Soils: Boussinesq's theory – assumptions, Equations for concentrated, line, strip and circular loads. Pressure bulb, Derivation for circular load area with UDL only. Newmark's chart and its application. Westergard's theory. Pressure distribution diagrams, contact pressure below foundations, effect of loss of contact on foundations.

Unit II

Lateral Earth Pressure: Active and passive earth pressures, Earth pressure at rest, Earth pressure coefficients. Earth pressure theories- Rankine's and Coulomb's theories – assumptions and limitations. Lateral earth pressure in cohesive and cohesion less soils. Graphical solutions for active earth pressure (cohesion less soil only) – Culman's and Rebhan's graphical methods.

Unit III

Stability of Earth Slopes: Types of slopes, causes of failure and type of failure of finite slopes. Definition of factor of safety. Stability of finite slopes - Method of slices, Friction Circle method, Fellineous method, using Taylor's stability number.

Unit IV

Bearing Capacity of Shallow Foundations: Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's bearing capacity equations-assumptions and limitations, IS Code's bearing capacity equations, Bearing capacity of footings subjected to eccentric loading. Effect of ground water table on bearing capacity. Standard penetration test - Bearing capacity based on corrected SPT value.

Foundation Settlement: Calculation of settlement - immediate, consolidation and secondary settlements (no derivations), differential settlement, tilt, permissible settlements & tilts as per B.I.S

Unit V

Deep Foundations: Types of Deep Foundations; Load Transfer in Pile Foundations, Classification of pile foundations based on load transfer only; Ultimate bearing capacity of different types of piles in different soil conditions, Bearing capacity & settlement of Pile groups.

Text Books

1. Punmia B.C. (2017), "Soil Mechanics and Foundation Engg." 17th Edition, Laxmi Publications Co., New Delhi.
2. Gopal Ranjan and Rao A.S.R. (2005), "Basic and Applied Soil Mechanics", New Age International(P) Ltd., New Delhi.

References

1. Bowles J.E. (1996), 'Foundation Analysis and Design"' 5th Edition, McGraw Hill Pub. Co. New York.
2. Alam Singh and Chowdhary G.R. (1994), "Soil Engineering in Theory and Practice" CBS Publishers and Distributors Ltd., New Delhi.
3. Murthy V.N.S. (2009) "Soil Mechanics and Foundation Engineering", 4th Edition, UBS Publishers and Distributors, New Delhi.
4. Arora K.R., "Soil Mechanics & Foundation Engineering", Standard Publishers & Distributors, New Delhi

Course Outcomes (COs):

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

1. Prepare a detailed site investigation report based on geotechnical data.
2. Analyze the earth pressure on retaining structures.
3. Evaluate the stability of slopes based on different methods of analyses.
4. Assess the bearing capacity of soils and foundation settlements.
6. Select type of deep foundation required for the soil at a place and load carrying capacity of pile foundations

GEOTECHNICAL ENGINEERING LABORATORY

Course Code: CVL76
Credit: 0:0:2:0 **Contact Hours: 28**

List of Experiments

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

References

1. Punmia B.C. (2017), "Soil Mechanics and Foundation Engg." 17th Edition, Laxmi Publications Co., New Delhi.
2. Gopal Ranjan and Rao A.S.R. (2007), "Basic and Applied Soil Mechanics", New Age International (P) Ltd., New Delhi.
3. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi
4. BIS Codes of Practice: IS 2720

Course Outcomes (COs):

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

1. Determine the index properties of soils.
2. Classify different soils based on their gradation and plasticity characteristics.
3. Determine the field density of cohesive and cohesion less soils.
4. Determine the permeability of different types of soils.
5. Evaluate the shear strength of different types of soils

COMPUTER AIDED DESIGN LABORATORY

Course Code: CVL77
Credit: 0:0:2:0 **Contact Hours: 28**

Topic

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 estimate sheet with given data (provide all the measurement details) and calculate the Quantity using formula bar.
4. Prepare the Abstract sheet for the given data and Calculate Amount 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. Experiments using R o a d estimator.
7. Use of FEM packages for analysis of propped cantilever, fixed beams, continuous beam
8. Use of FEM packages for analysis of pin jointed frame,2D rigid frame
9. Use of FEM packages for analysis of 3D rigid and pin jointed frame and Multistory& multi bay 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

References

1. Computer aided design by C.S. Krishnamoorthy and S. Rajeev – Narosa publishing house.
2. Finite Element analysis – by C.S. Krishnamoorthy, Tata McGraw Hill publishers.
3. Project Management and Tools & Technologies – An overview - by Shailesh Mehta, Shroff Pub & Dist. Pvt. Ltd
4. Analysis and Design of Structures - A Practical Guide to Modeling – by D. Trevor Jones, Bentley Publishers
5. Referral on Cad Laboratory, - by Jayaram & Rajendra Prasad, Sapna Publishers

Course Outcomes (COs):

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

1. Determine the index properties of soils.
2. Classify different soils based on their gradation and plasticity characteristics.
3. Determine the field density of cohesive and cohesion less soils.
4. Determine the permeability of different types of soils.
6. Evaluate the shear strength of different types of soils

PRINCIPLES OF BRIDGE ENGINEERING

Course Code: CVE741
Credit: 3:0:0:0 **Contact Hours: 42**

Course Content

Unit I

Introduction: Definition, components of bridge & Historical Developments. Site Selection for Bridges, Classification of Bridges, Survey and data collection for a bridge site selection. Hydraulic design, Design Discharge, linear waterway & economical span.

Unit II

Specifications of road bridges: Indian Road Congress Bridge code, carriageway, clearance, Forces on bridge, Review of IRC loadings, applications of loads on bridge such as dead load, live load, impact effect etc.

Unit III

RCC slab culvert: R C C Slab culvert, dead load, BM & SF. BM & SF For IRC Class AA Tracked Vehicle, BM & SF For IRC Class AA Wheeled Vehicle, BM & SF For IRC Class A Loading. Structural Design and drawing of Slab Culvert.

Unit IV

'T' Beam Bridge: Proportioning of Components, Analysis of Slab Using IRC Class AA Tracked Vehicle. Structural Design of Slab. Analysis of Cross Girder for Dead Load & IRC Class AA Tracked Vehicle, Structural Design of Cross Girder. Analysis of Main Girder Using COURBON'S Method, Calculation of Dead load BM and SF, Calculation of Live load B M & S F using IRC Class AA Tracked vehicle. Structural design and drawing of main Girder

Unit V

Substructure, foundations, bearings, joints and appurtenances: Definition of pier and abutment, Design and drawing of pier and abutments, Scour at abutments and pier, types of foundations, pile, well and pneumatic caissons with design examples, Importance of bridge bearings, sketches of different types of bearings.

Text Books

1. Johnson D Victor, "Essentials of Bridge Engineering", Oxford & IBH Publishing Co New Delhi
2. Krishna Raju N, "Design of Bridges", Oxford & IBH Publishing Co New Delhi

References

1. SP Bindra, Dhanpat Rai & Sons, “Principles and Practice of Bridge Engineering”, New Delhi
2. IRC 6–2000 Standard Specifications and Code of Practice For Road Bridges Section II Loads and Stresses, The Indian Road Congress New Delhi

Course Outcomes (COs):

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

1. Demonstrate the components of bridge and define the load flow mechanism.
2. Describe the concept of planning, loads and investigation for bridges.
3. Design slab culverts as per IRC specifications.
4. Design T-beam bridges as per IRC specifications.
5. Identify the causes of failure of bridges due to faulty design, poor quality of materials and construction methods

TRAFFIC ENGINEERING

Course Code: CVE742
Credit: 3:0:0:0 **Contact Hours: 42**

Course Content

Unit I

Scope of traffic engineering, Road-user characteristics – physical, mental, psychological and environmental. Reaction time of drivers, PIEV theory, Driver testing equipment. Vehicular characteristics – static, dynamic. Power performance of vehicles. Numerical examples.

Unit II

Traffic studies and analysis - volume studies, speed studies, origin and destination studies, parking studies & accident studies. Analysis of individual traffic accidents. Causes of accidents and measures to prevent accidents. Capacity of roads, PCU and PCU factors. Numerical examples.

Unit III

Traffic regulation and control – driver controls, vehicle controls, road controls. Traffic control devices - road markings, traffic signs & traffic signals. Webster's method and IRC method of signal design and signal coordination. Intelligent transport system. Numerical examples.

Unit IV

Road-side furniture – delineators, guard rails & safety barriers. Traffic flow theories – definitions, Lighthill and Whithams Theory, fundamental diagram, relationship between speed, concentration and flow. Numerical examples.

Unit V

Sampling theory - types of samples. Normal distribution and its application to traffic engineering, Poisson's distribution and its application to traffic engineering, Significance tests and application to traffic engineering. Traffic simulation. Numerical examples.

Text Books

1. Khanna S K and Justo C E G., "Highway Engineering". Nem Chand and Bros., Roorkee.
2. Kadiyali L R., "Traffic Engineering and Transport Planning", Khanna Publishers., New Delhi

References

1. Matson T M, Smith W S and Hurd F W., “Traffic Engineering”, McGraw Hill Book Co., New York.
2. Drew D R., “Traffic Flow Theory and Control”, McGraw Hill Book Co., New York

Course Outcomes (COs):

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

1. Describe the road user and Vehicular characteristics affecting traffic behavior.
2. Carry out traffic studies. Analyze the traffic data and interpret the flow behavior.
3. Evaluate different traffic regulatory and control devices.
4. Analyze the various traffic flow theories and find solutions to traffic problems.
5. Apply suitable statistical tools to evaluate traffic situations

STRUCTURAL MASONRY

Course Code: CVE743
Credit: 3:0:0:0 **Contact Hours: 42**

Course Content

Unit I

Introduction, Masonry units, materials and types: History of masonry, Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units. Strength, modulus of elasticity and water absorption. Masonry materials – Classification, properties of mortars & Selection of mortars.

Unit II

Strength of Masonry in Compression: Behavior of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength.

Unit III

Flexural and shear bond, flexural strength and shear strength: Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. Permissible stresses: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

Unit IV

Design of load bearing masonry buildings: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall.

Unit V

Earthquake resistant masonry buildings: Behavior of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions, Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure.

Text Books

1. Dayaratnam P, "Brick and Reinforced Brick Structures"- Oxford & IBH
2. Sinha B.P & Davis S.R., "Design of Masonry structures"- C R C press

References

1. Hendry A.W., "Structural masonry"- Macmillan Educaon Ltd., 2nd edition
2. Curtin, "Design of Reinforced and Pre-stressed Masonry"- Thomas Telford
3. Sven Sahlin, "Structural Masonry"-Prentice Hall
4. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, "Alternative Building Materials and Technologies"-New Age International, New Delhi & Bangalore
5. IS 1905, BIS, New Delhi.
6. SP20(S&T), New Delhi

Course Outcomes (COs):

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

1. Classify the various types of masonry units and properties of binding mortar.
2. Analyze the behavior of masonry in compression and failure theories in masonry walls
3. Describe the flexural and shear strength of the masonry walls
4. Design a masonry wall subjected to various loading and boundary conditions as per codal provisions.
5. Identify and solve masonry structural system subjected to gravity, wind and seismic loadings

AIR POLLUTION & CONTROL

Course Code: CVE744
Credit: 3:0:0:0 **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.

Unit II

Effects of air pollutants on human health, vegetation and on materials. Meteorology, meteorological parameters, lapse rate, dispersion and inversion stability, wind rose diagram, plume behavior and stack design.

Unit III

Air pollution 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, determination of SPM, $SO_2$and NO_X, Stack sampling techniques, isokinetic sampling, particulate sampling, gaseous sampling, analytical methods, instrumental methods, smoke measurements.

Unit IV

Air pollution control objectives, types of collection equipments, settling chambers, inertial separators, cyclones, multiples cyclones, design calculations, filters - fabric filters, bag house filters, electrostatic precipitators- plate type precipitators and design calculations.

Unit V

Scrubbers – types of scrubbers, spray towers, venturi scrubbers, cyclone scrubbers, packed scrubbers, design calculations. Industrial plant location, air pollution due to automobiles, greenhouse effect, global warming, standards and legislation.

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

References

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. Karl B. Schnelle and Charles A. Brown, (2002) “Air Pollution Control Technology Handbook” CRC Press ISBN 0-8493-9588-7

Course Outcomes (COs):

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

1. Identify and classify the sources of air pollution
2. Describe the impact of air pollutants on environment and influence of meteorological parameters on pollutant dispersion
3. Estimate the quantity of pollutants by different sampling techniques
4. Illustrate and design of particulate control equipments
5. Summarize air pollution due to automobiles & describe global effect of air pollution

OPTIMIZATION METHODS IN CIVIL ENGINEERING

Course Code: CVE745
Credit: 3:0:0:0 **Contact Hours: 42**

Course Content

Unit I

Operation Research and Optimization Techniques: Introduction. Models – Types of models, Objective function, and Decision variable, Constraints, Feasible & Optimal solutions, Model construction, Model solution, Model validity and implementation. Classification of optimization problems. Review of probability & statistics and Set theory concepts.

Unit II

Linear Programming – I: Introduction. Formulation of Linear programming models, Graphical solution, Linear Programme in standard form, Solving system of linear equations, Simplex method.

Unit III

Network Analysis: Introduction. Transportation Problems – Formulation of L.P., Finding initial basic feasible solution, Northwest corner rule, The least cost rule, Vogel's Approximation method. Transshipment Problems – Multiple source and sinks, Max-flow problems. Man power scheduling Introduction to Dynamic programming and Decision theory.

Unit IV

Civil Engineering Applications – I: Introduction, Applications of Optimization Methods in Structural Engineering, Materials & Construction Engineering, Foundation Design.

Unit V

Civil Engineering Applications – II: Introduction. Applications of Optimization Methods in Water Resources Engineering, Environmental Engineering, Traffic Engineering.

Text Books

1. S.S. Rao, "Engineering Optimization Theory and Practice", New Age International (P) Ltd.
2. Ravindran, Phillips & Solberg, "Operation Research Principles and Practice", John Wiley & Sons (Asia) Pvt. Ltd

References

1. Taha, “Operation Research An Introduction”, Pearson Education (Singapore) Pte. Ltd.

Course Outcomes (COs):

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

1. Summarize planning and optimal design of civil Engineering projects.
2. Describe precious resources in the environment are and how to conserve them.
3. Integrate the overall development with minimum cost.
4. Demonstrate the techniques to maximize the benefits with minimum cost of the project.
5. Explain by way of education, public participation, scientific practice, awareness, law and by engineered systems, the damage to the environment can be reduced or mitigated

ADVANCED DESIGN OF CONCRETE STRUCTURES

Course Code: CVE751
Credit: 3:0:0:0 **Contact Hours: 42**

Course Content

Unit I

Retaining walls: Design of Cantilever retaining wall and Counter fort retaining wall.

Unit II

Footings: Design of Rectangular slab and beam type combined footing and Raft foundation.

Unit III

Water Tanks: Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground.

Unit IV

Bunkers and Silos: Design of bunkers, silos using Janssen's Theory and Airy's Theory.

Unit V

Chimneys: Design of RCC Chimneys.

Text Books

1. Reinforced Concrete Structures, Vol-II- B C Punmia : Laxmi Publications (P) Ltd, New Delhi.
2. Limit State Design of Reinforced Concrete Vol-II- P C Varghese: Prentice Hall of India (P) Ltd, New Delhi

References

1. Plain and Reinforced Concrete – Vol-II- Jai Krishna and Jain,: Nem Chand Bros, Roorkee.
2. 2. Analysis of Structures- Vol-II : Vazirani V N & M M Ratwani : Khanna Publishers, New Delhi.

Course Outcomes (COs):

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

1. Provide basic knowledge in the areas of limit state method and the concept of design of retaining walls.
2. Identify, formulate and solve engineering problems in footings.
3. Design water tanks with fixed and flexible base as per codal provisions
4. Design of bunkers and silos using Janssen's & Airy's Theory
5. Design reinforced cement concrete chimneys

URBAN HYDROLOGY

Course Code: CVE752
Credit: 3:0:0:0 **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; 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

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. Hal M J, "Urban Hydrology", 2nd edition, Elsevier Applied Science Publishers, 1984
2. Viessman W I, Knapp J W, Leuis G L and Heutrough , T E, "Introduction to Hydrology", 2nd edition, Harper and Row Publishers, 1977

3. Stephenon D. “Storm water Hydrology and drainage” 2nd edition, Elsevier publishers,1982

Reference books:

1. Ven Te 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
3. Adams, B J and Papa F, ”Urban Storm water Management Planning”2000
4. Overterns DE and Medows M E, “Urban hydrology”, Academic press, NY 1976.

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

GROUND IMPROVEMENT TECHNIQUES

Course Code: CVE753
Credit: 3:0:0:0 **Contact Hours: 42**

Course Content

Unit I

Introduction: Need for ground improvement, principles of ground improvement, classification of improvement techniques, suitability, feasibility & desirability.
Mechanical Modification: Principles of densification, Compaction – shallow & deep compaction, hydro- mechanical compaction, properties of compacted soils, compaction control tests, specifications.

Unit II

Hydraulic Modification: Objectives, techniques, dewatering methods, preloading and use of vertical drains, electro-kinetic dewatering and stabilization.

Unit III

Physical And Chemical Modification: Modification by admixtures – lime, cement, chemicals, stabilization using industrial wastes, modification by deep grouting, thermal modification.

Unit IV

Modification By Inclusions And Confinement: Soil reinforcement – Reinforced earth and other strip reinforcing methods, flexible geosynthetic sheet reinforcement.

Unit V

In-Situ Ground Reinforcement: Ground anchorage, rock bolting and soil nailing.

Text books:

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

Reference books:

1. 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. Analyze the field data and assess the requirement for improving the locally available soils.
2. Describe various available techniques of ground improvement and their suitability for various soil conditions and requirement for the proposed structure.
3. Analyze and suggest / propose suitable ground improvement technique for a given site with the knowledge of basic concepts
4. Evaluate the stability and safety of the structures on improved ground.
5. Design rock bolting and soil nailing in unstable ground

PAVEMENT DESIGN

Course Code: CVE754
Credit: 3:0:0:0 **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, Passion'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.

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.

STRUCTURAL DYNAMICS

Course Code: CVE755
Credit: 3:0:0:0 **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, Logarithmic decrement.

Unit II

Forced vibrations of SDF systems: Forced vibration response to harmonic excitations, Vibration isolation, Transmissibility, Evaluation of damping, Vibration measuring instruments, Duhamel's integral and applications to undamped systems.

Unit III

Free vibrations of MDF systems: Formulation of equations of motion for Shear Buildings, Free vibration analysis of undamped systems using stiffness approach, Orthogonality conditions, Normal modes, Matrix Iteration method, Rayleigh's and Dunkerley's method to calculate fundamental frequency.

Unit IV

Forced Vibrations of MDF systems: Forced Vibration analysis using Mode Superposition method for harmonic loadings and simple pulse loadings.

Unit V

Continuous Systems: Free flexural and axial vibrations of continuous systems and application to single span elements.

Text books:

1. Mario Paz, 'Structural Dynamics', CBS Publishers, New Delhi
2. Madhujit Mukhopadyay, 'Vibrations, Dynamics and Structural Systems', Oxford Publishers, 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

Course Outcomes (COs):

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

1. Evaluate the damping in structural systems and apply the knowledge of energy absorption mechanisms to minimize the vibration.
2. Identify, formulate and solve problems of transmissibility of forces to foundations of structural systems.
3. Analyze the shear buildings and their performance to dynamic loadings.
4. Assess the impact of arbitrary loadings on performance of structures and behaviour of continuous systems subjected to flexural vibrations.
5. Formulate the lumped, Consistent mass and stiffness matrices for bar and beam element using finite element approach for continuous system.

REHABILIATION OF STRUCTURES

Course Code: CVE811
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Maintenance: Definition, necessity of maintenance, classification of maintenance, environmental agencies, normal wear and tear, failure of structures, inspection of structures, inspection periods, preventive maintenance, predictive maintenance, reliability centered maintenance, reactive maintenance, organization for maintenance, computerized maintenance & management system. Condition of flooring, roof leakage, condition of service fittings, drainage from terrace roof, growth of vegetation, steps to reduce repairs and replacement, normal breakup & management tools for effective maintenance.

Unit II

Durability and deterioration: Physical causes: Durability of concrete causes of distress in concrete, shrinkage, freeze and thawing, weathering, abrasion, temperature, fire, form work movement, settlement, foundation settlement, construction errors, overloads, accidental loadings and design errors.

Chemical causes: Chemical attack on concrete, Sulphate attack, acid attack, alkali reaction, aggregate reaction, silica reaction, crystallization of salts in pores, sea water attack, biological attack & other chemical attacks. Corrosion: Principle of corrosion, mechanism, process, damage due to corrosion, codal provisions, symptoms of distress due to corrosion & corrosion protection techniques.

Unit III

Structural damage assessment: Inspection, structural appraisal, economic appraisal, components of quality assurance & conceptual basis for quality assurance schemes. Destructive testing systems - direct load tests & load test on structural elements. Semi destructive testing systems - penetration techniques, Pull out test, core sampling & permeability test. Nondestructive testing systems – NDT methods, ultrasonic pulse velocity test, pulse echo method, electromagnetic methods, acoustic emissions & radiographic methods.

Unit IV

Functional materials for repair and rehabilitation: Criteria for selecting repair materials, classification of materials, physical and chemical strength tests, adhesive strengths and test for surface quality. Patching materials-cementitious materials,

polymer mortar and concrete, quick setting compounds, bituminous materials, protective coatings, sealing materials, water stops, water proofing materials, coatings, membranes & bonding materials. Special repair materials, chemicals and mineral admixtures, SP, accelerators, fly ash, GGBS,CSF, polymeric materials and coatings, SFRC, application of SFRC to repair, FRF composites, ferro cement, carbon fibers SIFCON, SIMCON, Slurry Infiltrated Fibrous Concrete & Nano materials for rehabilitation.

Unit V

Rehabilitation and Strengthening techniques: Repair of cracks, methods of repair, stages of repair, resin injection, routing and sealing, stitching, external stressing, bonding, blanketing, overlays, flexible sealings, drilling, plugging, surface coatings, grinding, sand blasting & acid etching. Rust eliminators and polymers coating for re-bars, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Examples of repairs to structures, repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure. Structure concrete strengthening, jacketing, external bonding, section enlargement, externally bonded steel plates, external reinforcement & NSM techniques.

Text Books:

1. Dr. B. Vadivelli, "Rehabilitation of Concrete Structures", Standard Publishers Distributors, Delhi .
2. M S Shetty, "Concrete Technology – Theory and practice", S.Chand and company, New Delhi.

Reference books:

1. Dension Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical, U.K, 1991.
2. RT. Allen and S.C. Edwards, "Repair of concrete Structures", Blakie and sons, UK, 1987.
3. "Training course notes on damage assessment and Repair in low cost housing Santhakumar", S.R.RHDC-NBO Anna University, Madras, July, 1992.
4. "CPWD hand book for Rehabilitation of structures"

Course Outcomes (COs):

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

1. Summarize the importance of maintenance and inspection of structures.
2. Identify the causes of deterioration in structures due to physical and chemical attack.
3. Inspect and assess the structures using techniques of visual inspection and NDT.
4. Evaluate structural damage and recommend suitable repair materials and strengthening methods.
5. Identify and suggest the Rehabilitation and Strengthening techniques.

INDUSTRIAL WASTEWATER TREATMENT

Course Code: CVE812
Credit: 4:0:0:0 **Contact Hours: 56**

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, ISBN 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.

PAVEMENT EVALUATION AND MANAGEMENT

Course Code: CVE813
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Introduction Definition, Components of Pavement Management Systems, Pavement Management Levels and functions. Influence Levels- Use of Pavement Management System as a planning and technology improvement tool; PMS applications.

Unit II

Data Requirements- Classes of data required: Importance of performance related data; Construction and Maintenance data - Modern Technologies for Inventory Data Collection like LIDAR, Drone - Pavement Surface Distress Surveys- Types of Distress- Causes and Treatments as per IRC:82 and IRC:SP:83; Equipment for Automatic Distress Evaluation- Development of Condition Index (PCI); field studies on distress data collection and development of PCI as per PAVER.

Unit III

Pavement Condition Evaluation Functional Condition Evaluation*:* Serviceability-Performance Concept - Evaluation of Surface Condition by physical measurements- Equipments for evaluating roughness like MERLIN, Bump Integrator, Hawkeye, ROMDAS and their calibration- Applications of Roughness data in PMS
Structural Condition Evaluation*:* Pavement Structural Condition evaluation by non-destructive tests such as Benkelman beam, Falling Weight Deflectometer and other NDT tests - Structural Condition Evaluation as per IRC:81-1997 and IRC : 115-2014; deflection bowl analysis; Bench Marking of structural condition of pavements with deflection bowl parameters; Problems.

Unit IV

Performance models Concepts- modelling techniques- structural condition deterioration models-: mechanistic and empirical models; probabilistic models- comparison of different deterioration models. Functional condition deterioration models: unevenness prediction models and other models- comparison of different models. Models as per HDM-4; Case Studies. Remaining Service Life Estimation.

Unit V

Ranking, Optimisation and PMS at Project and Network level. Sample size selection- establishing criteria - determining needs- rehabilitation and maintenance strategies- priority programming of rehabilitation and maintenance- analysis of

alternate pavement maintenance strategies- selection of optimal design strategy at project and network level; Life cycle cost analysis; Application of HDM-4; Case Studies.

Text Books

1. Ralph Haas and Ronald Hudson with Lynne Cowe Falls, "Pavement Asset Management", Scrivener Publishing, Wiley, 2015.
2. Haas- R. C. G.- W. Ronald Hudson- and John P. Zaniewski. "Modern Pavement Management". Malabar- Fla: Krieger Pub. Co- 1994

Reference Books

1. Hudson- W. Ronald- R. C. G. Haas- and Waheed Uddin. "Infrastructure Management: Integrating Design- Construction- Maintenance- Rehabilitation- and Renovation". New York: McGraw-Hill- 1997.
2. Rajib B.Mallick- Tahar El-Korchi- "Pavement Engineering: Principles and Practice- 2nd Edition"- CRC Press- 2013
3. Prithvi Singh Khandal- "Bituminous Road Construction in India"- PHI Learning Private Limited- 2016.
4. Shahin- M.Y- "Pavement Management for Airports- Roads and Parking Lots"- Chapman & Hall- 1994 (Chapters 2 to 10)
5. Richard Robinson, Uno Danielson and Martin Snaith- "Road Maintenance Management – Concepts and Systems"- Macmillan Press- 1998 (Chapters 4 to 7)
6. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, "Highway Engineering", Revised 10th Edition, Nem Chand & Bros., 2017.

Relevant Codes

1. IRC- "Code of Practice for maintenance of Bituminous surfaces of highways"- IRC: 82-1982- Indian Road Congress- New Delhi.
2. IRC- "Guidelines for Surface Evenness of Highway Pavements"- IRC: SP: 16(First Revision)- Indian Road Congress- New Delhi
3. IRC- "Guidelines for Structural Evaluation and Strengthening of Flexible Road Pavements Using Falling Weight Deflectometer (FWD) Technique"- IRC: 115-2014- Indian Road Congress- New Delhi.
4. IRC, ' Guidelines for Maintenance, Repair and Rehabilitation of Cement Concrete Pavements; IRC:SP:83-2008

Course Outcomes (COs):

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

1. Interpret and assess the components of pavement managements system.
2. Collect and analyze the data for pavement management system.
3. Assess the functional and structural conditions of pavements.
4. Analyze the performance models regarding to the pavement systems.
5. Utilize the optimization methods in road asset management.

ANALYSIS AND DESIGN OF TALL STRUCTURES

Course Code: CVE814
Credit: 4:0:0:0 **Contact Hours: 56**

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 behavior 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.

FUNDAMENTALS OF F E M

Course Code: CVE815
Credit: 4:0:0:0 **Contact Hours: 56**

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 isoparametric quadrilateral elements.

Unit V

Introduction to plate bending problems and techniques for 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 – Theory and programming", Tata McGraw Hill Co.Ltd, New Delhi.
2. Abel J.F. and Desai.C.S-"Introduction to the Finite element Method", Affiliated East West Press Pvt.Ltd., New Delhi.

Reference Books:

1. Bathe.K.J- “Finite element procedure”, PHI Pvt,Ltd, New Delhi.
2. Zienkeiwicz.O.C-“The finite Element Method”, Tata McGraw Hill Co. Ltd, New Delhi.

Course Outcomes (COs):

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

1. Describe the significance and importance of finite element methods.
2. Illustrate fundamentals of finite element methods for small displacement linear elastic analysis (statics).
3. Describe the fundamentals of non-linear finite element method.
4. Analyze elements using FE software.
5. Develop models and interpret the numerical results in design.

WATER POWER ENGINEERING

Course Code: CVE816
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Elementary Hydrology and Extraction of energy from water: Hydrological cycle, Abstractions, Runoff, Estimation of runoff and flood. Statistical methods in hydrology-Frequency analysis, correlation and regression analysis. Sources of power and renewable, Global view of hydro power potentials, hydro power- Indian scenario and prospectus, inter regional imbalances, transmission of power, SWOT analysis of hydro power, estimation of hydro potential & multipurpose development.

Unit II

Load on hydro turbines and classification of plants: Electric load on hydro turbine, load cycle, load factor, power factor, capacity factor, utilization factor, diversity factor, load distribution curves, firm power, secondary power & prediction of load. Classification of plants: Runoff river plants, valley dam plants, diversion canal plants, high head diversion plants, storage and pondage, flow and power duration curves.

Unit III

Components and other accessories of hydro power plant: Dams, penstock and accessories. Classification of penstocks & design criteria of penstocks. Economical diameter of penstock, anchor blocks, conduit valves & surges. Water hammer, resonance in penstock, channel surges, surge tanks. Intake canals and tunnels, intakes, air entrainment at intakes & canal tunnels.

Unit IV

Basic principles of tidal power, prominent sites in India, modes of generation, Structural components of tidal plants, Turbine assembly and generation, Power output and energy from tidal barrage, environmental effects.

Unit V

Environmental Impact of Hydel projects: Hydel projects, positive impact of water projects, possible negative impacts, hydro power and greenhouse gases. Environmental laws in India. Small hydel plants: Historic development, sites for smaller scale, hydro plants, potential of small scale plants, measures of economy, choice of turbines, and prosperity of small scale hydro plants. Role of Alternative Hydro Energy Centre

(established under Ministry of New and Renewable energy) in developing small hydel pants in India.

Text Books:

1. M.M. Dandekar, K.N. Sharma, “Water Power Engineering”, Vikas Publishing House Pvt. Ltd.
2. Deshmukh, “Water Power Engineering” Dhanpat Rai & Sons

Reference Books:

1. B.C. Punmia, “Irrigation and Water Power Engineering”, Laxmi Publication
2. Creager and Justin, “Hydro Electric Engineering” ,Willay Institutional
3. Brown, J.G., “Hydro Electric Engineering Practice”, Blackie and Sons Ltd., London

Course Outcomes (COs):

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

1. Evaluate the of hydropower potential.
2. Design essential elements of hydropower plant.
3. Conduct economic and environmental assessment of hydro power plants.
4. Evaluate the necessity of tidal power generation.
5. Demonstrate the significance of small hydel plants in power generation

INTERNSHIP/INDUSTRIAL TRAINING

Course Code: CVE82
Credit: 4

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 30% 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 70% 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).

DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

Course Code: CVE821

Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Engineering Seismology: Elastic rebound theory and Theory of plate tectonics, Seismic waves, Seismic zoning, Magnitude and intensity, Strong ground motion & Response of structures.

Unit II

Response Spectra: Elastic and inelastic design spectra, Tripartite plot, Use of response spectrum in earthquake resistant design, Selection of design EQs, Peak ground acceleration, Comparison of design and response spectra & Energy dissipating devices.

Unit III

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.

Unit IV

Linear Earthquake Analysis: Seismic design requirements, Design Earthquake loads, Load combinations & Mathematical modeling. Methods of analysis - Seismic coefficient method, Response spectrum method and Time history method. Structural requirements, Earthquake resistant design methods. Response control using external devices.

Unit V

Reinforced concrete structures and Masonry structures: Ductility and codal guidelines, Design of shear walls, Retrofitting, Behaviour of unreinforced and reinforced masonry walls during past earthquakes, Seismic design requirements and design of masonry structures. Retrofitting.

Text Books:

1. Pankaj Agarwal and Manish Shrikande, “Earthquake Resistant Design of Structures”, Prentice Hall of India Private Ltd, New Delhi
2. Duggal S K, “ Earthquake Resistant Design of Structures”, Oxford University Press, New Delhi

References:

1. Anil K Chopra, “Dynamics of Structures”, Pearson Education, Asia, New Delhi
2. Steven L Kramer, “Geotechnical Earthquake Engineering”, Pearson Education, Asia, New Delhi
3. Relevant Codes.

Course Outcomes (COs):

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

1. Describe the theories responsible for occurrence of Earthquakes.
2. Derive elastic response spectra and earthquake design spectra.
3. Describe structural configuration for earthquake resistant design of structures.
4. Analyze response spectrum, time history method and response control using external devices.
5. Describe the need for ductility and ductile detailing of reinforced members.

URBAN TRANSPORT PLANNING

Course Code: CVE822
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Scope of urban transport planning – Interdependence of land use and transportation system. Approach to transport planning -Stages in transport planning. Forecast of future conditions and plan synthesis.

Unit II

Various transportation surveys & inventory of transport facilities. Trip generation: trip purpose, factors affecting trip generation and attraction – category analysis – problems.

Unit III

Trip distribution – growth factor method, synthetic methods – Fratar and Furness methods. Gravity model.

Unit IV

Factors affecting modal split analysis – characteristics of modal split – model split in urban transport planning - problems. Tripassignment – assignment techniques – traffic forecasting.

Unit V

Public transport and intermediate public transport in Indian cities, intermodal 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, L R, "Traffic Engineering and Transport Planning, Khanna Publishers
2. Subash C Saxena, "A Course in Traffic Planning and Design", Dhanapat Rai & Sons, Delhi, 1989.

Reference:

1. Jothi Kristey & 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 using various trip distribution models.
4. To characterize the modal split among various travel modes and assign the trips generated.
5. To characterize the transportation means for various categories to cities and apply the latest computerial for transportation planning.

ENVIRONMENTAL IMPACT ASSESSMENT

Course Code: CVE823
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Definition of EIA, Need for EIA, EIS, FONSI, Utility of EIA, Scope of EIA, Step by step procedure of conducting EIA, REIA, CEIA, Limitations of EIA & Frame work of EIA, EIA Guidelines for developmental projects.

Unit II

Developmental projects - Description of affected environment with factors and indices.

Methodologies of EIA – Adhoc method, Checklist method, Matrices method, Network method and Overlay method.

Unit III

Assessment and prediction of impacts on attributes- Air environment, Water environment & Noise environment.

Unit IV

Assessment and prediction of impacts on attributes – Soil, ground water and Socio economic environment. Public participation in environmental decision making : objectives of public participation and public participation techniques. Practical consideration in preparing in EIA and EIS.

Unit V

EIA for water resource project, Highway project & Iron ore and Coal mining project.

Text Books

1. Y. Anjaneyulu and Valli Manickam, **"Environment Assessment Methodologies",** B.S Publications, Hyderabad, 2007.
2. R.K Jain et.alVan Nostrand, **"Environmental Impact Analysis"** - Reinhold Company, 1993.

Reference Books:

1. Larry W Canter, **"Environmental Impact Assessment"** –McGraw – Hill International Editions, 1996.

2. Guidelines for EIA of Developmental Projects, Ministry of Environment and Forests, GOI.

Course Outcomes (COs):

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

1. Describe the methodology of conducting EIA.
2. Identify and choose a suitable methodology of EIA for different projects.
3. Formulate the procedure for conducting EIA for different attributes.
4. Outline the public participation techniques of EIA for different projects.
5. Provide the procedure of conducting EIA for water resource, highway, mining projects

PRE-FABRICATED STRUCTURES

Course Code: CVE824
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

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

Unit II

Prefabricated components: Behavior of structural components, large panel constructions, Construction of roof and floor slab, Wall panels, Columns & 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

References:

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 precast concrete, Netherland Betor Verlag, 1978.

Course Outcomes (COs):

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

1. Describe materials used in prefabrication.
2. Identify, formulate and solve problems in pre-fabricated structures masonry structural system subjected to various loading
3. Design cross section based on efficiency of material used & joint flexibility
4. Analysis and design of joints for structural connections.
5. Design prefabricated structures for abnormal loads.

COMPOSITES AND SMART MATERIALS

Course Code: CVE825
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic laminae, thermo – mechanical properties, micro – mechanical analysis, characterizaon tests. Classical composite laminationtheory, cross and angle – play laminaes, symmetric, ansymmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories – first fly failure, vibration and buckling analysis. Sandwich structure face and core materials, secondary failure modes environmental effects, manufacturing of composites.

Unit II

Concepts of Smart Materials and their properties – piezoelectric materials – coupled electromechanical constitutive relations –depoling and coercive field – field–strain relation – hysterics – creep – strain rate effects – manufacturing. State-of-the-art smart structures technologies.

Unit III

Actuators and Sensors -Single and dual actuators – pure extension, pure bending – bending extension relaons – uniform strainbeam model – symmetric induced strain actuators – bond shearing force – Bernoulli Euler (BE) beam model – embedded actuators – Asymmetric induced strain actuators in uniform strain and Euler – Bernoulli models. Uniform strain model – energy principle formulation – BE model – single and dual surface bonded actuators – Extension – bending and torsion model.

Unit IV

Introduction to Control System -Open loop and close loop transfer functions – stability criteria – deflection control of beam like structures – using piezoelectric sensors and actuators – shape memory alloys. Control theories and structures with passive or active control measures, advanced sensors, and study in detail some of the most important theories and hardware to implement smart structural systems that contain built-in control, sensory and diagnostic elements.

Unit V

Basics of health monitoring, technical approach to health monitoring, definitions of common terminology, overview of technical areas in health monitoring, modeling needs, modeling damage, measurements, data analysis structural health monitoring method, and sensor data processing.

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

References:

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 precast concrete, Netherland Betor Verlag, 1978.

Course Outcomes (COs):

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

1. Describe basic composite materials, classifications and applications.
2. Describe smart materials and its properties
3. Demonstrate the use of Actuators and Sensors.
4. Explain the use of control systems.
5. Illustrate health monitoring and technical approach to health monitoring.

DESIGN OF HYDRAULIC STRUCTURES

Course Code: CVE826
Credit: 4:0:0:0 **Contact Hours: 56**

Course Content

Unit I

Canal Regulation Works: Introduction, Function of a regulator, Design of cross regulator. Device for sediment control; Silt ejector and silt excluder (No design). Canal falls: types, design of notch type fall.

Unit II

Introduction, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Design of gravity dams.

Unit III

Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.

Unit IV

Arch dams and Buttress dams – definition, concepts and components. Spillways: Design of spillways.

Unit V

Cross drainage works: Introduction, cross section and L Section of an unlined channel. Type of C.D works, Design considerations for C.D works. Transition formula design of protection works (Hydraulic design only).

Text Books:

1. Arora K.R, "Irrigation, water power and water resources engineering". Standard publishers
2. Sharma R.K, " Text book of irrigation engineering and hydraulic structures", Oxford & IBH Publishing co, New Delhi.
3. Asawa G.L., "Irrigation and water resources engineering", New age International publications, New Delhi.

Reference Books:

1. Santhosh Kumar Garg., "Irrigation engineering and Hydraulic structures", Khanna publishers, New Delhi.
2. Modi P.N, "Irrigation, water Resources and water power engineering", Standard Books House, New Delhi.

3. Sharma R.K. & Sharma T.K, “Irrigation engineering”, S. Chand & Co. New Delhi.

Course Outcomes (COs):

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

1. Describe canal regulation works.
2. Analyze the failure of gravity dams.
3. Analyze the hydraulic characteristics of gravity dams.
4. Describe Arch and Buttress dams.
5. Illustrate the cross drainage works

PROJECT WORK

Course Code: CV83
Credit: 0:0:14:0

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

TECHNICAL SEMINAR

Course Code: CV84
Credit: 0:0:1:0

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 10th week.
8. The presentation will be held during 12th week.
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):

The students will be able to:

1. Appraise the current civil engineering research/ techniques / developments / interdisciplinary 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.