SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2022 – 2023

B. Tech. (CIVIL ENGINEERING)

Published By

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ISO 9001 : 2015 CERTIFIED ORGANISATION

About the Department

Civil Engineering Department was established in 1984 at the time of inception of Shri Ramdeobaba College of Engineering & Management (previously RKNEC) with intake of 60 students. The department has experienced and highly qualified faculty; it is equipped with sophisticated laboratories and latest computational software's which helps the students to develop expertise in Civil Engineering. Civil Engineering Department offers Undergraduate Programme B. E. in Civil Engineering and two Post Graduate Programmes namely M. Tech., Structural Engineering (Full Time) and M. Tech., Geotechnical Engineering (Part Time). The Department of Civil Engineering is one of the prime partners in success stories of the institute. The department has all the state of the art laboratories and faculties that provide excellent opportunities for students as well as researchers. The department is accredited by National Board of Accreditation and well recognized by Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. The department is closely associated with industry and extending its testing & consulting services. For overall development of the student, the department provides conducive atmosphere for organization & conduction of various co- curricular and extra- curricular programs while imparting outcome based quality education.

Departmental Vision

To be a knowledge centre in civil engineering education, training, research, entrepreneurship and industry outreach services for creating sustainable infrastructure and enhancing quality of life.

Department Mission

To generate quality civil engineers with strong technical and managerial skills through creation of conducive environment for creative learning and research in association with stake holders.

Programme Educational Objectives

1. Demonstrate professional competence in various civil engineering fields.
2. Exhibit technical ability to deal with and execute various civil engineering problems.
3. Exhibit managerial skills, values and engage themselves in life long learning.

Program outcomes

Engineering Graduates will be able to :

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate

consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems :** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

9. **Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program specific outcome

1. Analyse and design various civil engineering structures by analytical, numerical, graphical and simulation methods.

2. Plan, estimate, execute and manage civil engineering projects with due consideration to economic, safety and environmental issues while following ethical practices.

Teaching Scheme for First Year (Semester I & II) Bachelor of EngineeringGroup 1 : Semester - I / Group 2 : Semester - II

Sr. No.	Code	Course	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PHT158	Mechanics, Optics and Acoustics	3	1	0	4	40	60	100	03
2.	PHP158	Mechanics, Optics and Acoustics Lab	0	0	3	1.5	25	25	50	–
3.	MAT152 / MAT151	Differential Equations, Linear Algebra, Statistics & Probability/ Calculus	3	0/1	0	3/4	40	60	100	03
4.	MAP151	Computational Mathematics Lab	0	0	2	1	25	25	50	–
5.	EET151	Basic Electrical Engineering	3	1	0	4	40	60	100	03
6.	EEP151	Basic Electrical Engineering Lab	0	0	2	1	25	25	50	–
7.	MET151	Engineering Graphics & Design	1	0	0	1	40	60	100	03
8.	MEP151	Engineering Graphics & Design Lab	0	0	4	2	50	50	100	–
9.	HUT152	Constitution of India	2	0	0	0	–	–	–	–
10.	PEP151	Yoga / Sports	0	0	2	0	–	–	–	–
		TOTAL	**12**	**2/3**	**13**	**17.5/18.5**			**650**	

Group 2 : Semester - 1 / Group 1 : Semester - II

Sr. No.	Code	Course	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	CHT151	Chemistry	3	1	0	4	40	60	100	03
2.	CHP151	Chemistry Lab	0	0	3	1.5	25	25	50	–
3.	MAT151 / MAT152	Calculus/Differencial Equations, Linear Algebra, Statistics & Probability	3	1/0	0	4/3	40	60	100	03
4.	CET151	Engineering Mechanics	4	0	0	4	40	60	100	03
5.	CEP151	Engineering Mechanics Lab	0	0	2	1	25	25	50	–
6.	IDT151	Creativity, Innovation & Design Thinking	1	0	0	1	20	30	50	1.5
7.	INT151	Workshop/Manufacturing Practices	1	0	0	1	20	30	50	1.5
8.	INP151	Workshop/Manufacturing Practices Lab	0	0	2	1	25	25	50	–
9.	HUT151	English	2	0	0	2	40	60	100	03
10.	HUP151	English Lab	0	0	2	1	25	25	50	–
		TOTAL	**14**	**2/1**	**9**	**20.5/19.5**			**700**	

Program Scheme and Syllabi for B. E. (Civil Engineering)

Scheme of Teaching & Examination of Bachelor of EngineeringIII Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	MAT251	Maths III (Transform and Discrete Maths)	4	0	0	4	40	60	100	3
2	CET251	Construction Materials	3	0	0	3	40	60	100	3
3	CEP251	Construction Materials Lab	0	0	2	1	25	25	50	--
4	CET252	Fluid Mechanics I	3	0	0	3	40	60	100	3
5	CEP252	Fluid Mechanics I Lab	0	0	2	1	25	25	50	--
6	CET253	Environmental Engineering I	3	0	0	3	40	60	100	3
7	CEP253	Environmental Engineering I Lab	0	0	2	1	25	25	50	--
8	CET261	Programming for Problem Solving	3	0	0	3	40	60	100	3
9	CEP261	Programming for Problem Solving Lab	0	0	2	1	25	25	50	3
10	CET255	Solid Mechanics	3	0	0	3	40	60	100	3
11	CEP255	Solid Mechanics Lab	0	0	2	1	25	25	50	--
		Total	**19**	**0**	**10**	**24**				

Scheme of Teaching & Examination of Bachelor of EngineeringIV Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	CET256	Fluid Mechanics II	3	0	0	3	40	60	100	3
2	CEP256	Fluid Mechanics II Lab	0	0	2	1	25	25	50	--
3	CET257	Geotechnical Engineering	3	1	0	4	40	60	100	3
4	CEP257	Geotechnical Engineering Lab	0	0	2	1	25	25	50	--
5	CEP258	Computer Aided Civil Engg. Drawing Lab	0	0	2	1	25	25	50	--
6	CET259	Structural Analysis	3	1	0	4	40	60	100	3
7	CEP259	Structural Analysis Lab	0	0	2	1	25	25	50	--
8	CET260	Environmental Engineering II	3	0	0	3	40	60	100	3
9	CEP260	Environmental Engineering II Lab	0	0	2	1	25	25	50	--
10	CET299	Open Elective I	3	0	0	3	40	60	100	3
11	HUT260	Effective Technical Communication	3	0	0	3	40	60	100	3
		Total	**18**	**2**	**10**	**25**				

Open Elective I	
Course Code	**Course Name**
CET299-1	Basic Building Components
CET299-2	Basics of Environmental Pollution

Scheme of Teaching & Examination of Bachelor of EngineeringV
Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	CET351	Surveying and Geomatics	3	1	0	4	40	60	100	3
2	CEP351	Surveying and Geomatics Lab	0	0	2	1	25	25	50	--
3	CET352	RCC Structures	3	1	0	4	40	60	100	3
4	CEP352	RCC Structures Lab	0	0	2	1	25	25	50	--
5	CET353	Transportation Engineering	3	0	0	3	40	60	100	3
6	CEP353	Transportation Engineering Lab	0	0	2	1	25	25	50	--
7	CET354	Foundation Engineering	3	0	0	3	40	60	100	3
8		Open Elective II (Humanities)	3	0	0	3	40	60	100	3
9	HUT356	Organizational Behaviour	3	0	0	0	--	--	--	--
			18	**2**	**6**	**20**				

Scheme of Teaching & Examination of Bachelor of EngineeringVI
Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	CET355	Estimation and Costing	3	0	0	3	40	60	100	4
2	CEP355	Estimation and Costing Lab	0	0	2	1	25	25	50	--
3	CET356	Steel Structures	3	0	0	3	40	60	100	3
4	CEP356	Steel Structures Lab	0	0	2	1	40	60	100	3
5	CET357	Hydrology and Water Resource Engineering	3	0	0	3	40	60	100	3
6	CET358	Elective I	3	0	0	3	40	60	100	3
7	CET359	Elective II	3	0	0	3	40	60	100	3
8	CEP360	Comprehensive Viva	0	0	2	1	25	25	50	--
9	CET399	Open Elective III	3	0	0	3	40	60	100	3
			18	**0**	**6**	**21**				

Open Elective III	
Course Code	**Course Name**
CET399-1	Metro Systems and Engineering
CET399-2	Intelligent Transport System

Scheme of Teaching & Examination of Bachelor of EngineeringVII Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	CET451	Elective III	3	0	0	3	40	60	100	3
2	CET452	Elective IV	3	0	0	3	40	60	100	3
3	CEP452	Elective IV Lab	0	0	2	1	25	25	50	--
4	CET453	Contracts Works Accounts and Management	2	0	0	2	40	60	100	3
5	CET454	Construction Engineering and Management	3	0	0	3	40	60	100	3
6	CEP455	Project Phase I	0	0	12	6	50	50	100	--
7	CEP456	Industry Internship Evaluation (6-8 weeks)	0	0	2	0	--	--	--	--
8	CET498	Open Elective IV	3	0	0	3	40	60	100	3
			14	**0**	**16**	**21**				

Open Elective IV	
Course Code	**Course Name**
CET498-1	Green Building

Scheme of Teaching & Examination of Bachelor of EngineeringVIII Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	CET457	Elective V	3	0	0	3	40	60	100	3
2	CET458	Elective VI	2	0	0	2	40	60	100	3
3	CEP459	Project Phase II / Industry Project	0	0	12	6	100	100	200	--
			5	**0**	**12**	**11**				
OR										
4	CEP460	Full Semester Internship (Industry / Research / TBI)	-	-	-	11	100	100	200	
						11				

Scheme of Teaching & Examination of Bachelor of Engineering Honors Specialization (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	CETH41	Construction Technology	4	0	0	4	40	60	100	3
2	CETH51	Fire-fighting system	4	0	0	4	40	60	100	3
3	CETH61	Geotechnical Design	4	0	0	4	40	60	100	3
4	CETH71	Foundation Design	4	0	0	4	40	60	100	3
5	CETH81-1	Design of Environmental Structures	4	0	0	4	40	60	100	3
	CETH81-2	Geometric Design of Highways	4	0	0	4	40	60	100	3

Note : Credit transfer against above courses may be allowed if an appropriate MOOC course is completed by student after prior permission from HOD

Scheme of Teaching & Examination of Bachelor of EngineeringMinors Specialization (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	End Sem Exam	Total	
1	CETH41	Basics of Civil Engineering	4	0	0	4	40	60	100	3
2	CETH51	Basics of Surveying in Civil Engineering	4	0	0	4	40	60	100	3
3	CETH61	Basics of Soil Engineering	4	0	0	4	40	60	100	3
4	CETH71	Plumbing System	4	0	0	4	40	60	100	3
5	CETH81-1	Instrumentation	4	0	0	4	40	60	100	3
	CETH81-2	Rural Water Supply & Sanitation	4	0	0	4	40	60	100	3

Note :- If any of the above course is accessible to a student in his/her parent branch or Open electives then Credit transfer against above courses may be allowed if an appropriate MOOC course is completed by student after prior permission from HOD.

Semester	VI	VI	VII	VII	VIII	VIII
Course Code	CET358	CET359	CET451	CET452/CEP452	CET457	CET458
Elective Group	Elective I (Theory)	Elective-II (Theory)	Elective-III (Theory)	Elective-IV (Theory+Practical)	Elective-V (Theory)	Elective-VI (Theory)
Structural Engineering	CET358-1 Advanced Structural Analysis	CET359-1 Advanced Concrete Technology	CET451-1 Design of Concrete Structures	CET452-1/ CEP452-1 Computer Aided Design & Drafting	CET457-1 Earthquake Resistant Design of RCC Structures	CET458-1 Industrial Structures
Water Resources Engineering	CET358-2 Irrigation Engineering	CET359-2 Open Channel Flow	CET451-2 Urban Drainage and Sewage Systems	CET452-2/ CEP452-2 Pipe line Engineering	CET457-2 Planning and Design of Irrigation Water Networks	CET458-2 Watershed Management
Environmental Engineering	CET358-3 Air Pollution and Control	CET359-3 Solid Waste Management	CET451-3 Environment System Modelling	CET452-3/ CEP452-3 Water and Waste water Treatment	CET457-3 Industrial Waste Water Treatment	CET458-3 Environmental Impact Assessment
Geotechnical Engineering	CET358-4 Advanced Foundation Engineering	CET359-4 Ground Improvement	CET451-4 Earth & Earth Retaining Structures	CET452-4/ CEP452-4 Geotechnical Explorations	CET457-4 Advanced Geotechnical Engineering	CET458-4 Rock Mechanics
Transportation Engineering	CET358-5 Pavement Design	CET359-5 Urban Transportation Planning	CET451-5 Railway Engineering	CET452-5/ CEP452-5 Traffic Engineering and Management	CET457-5 Airport Planning and Design	CET458-5 Highway Construction and Management
Construction Engineering	CET358-6 Advanced Construction Materials	CET359-6 Repairs & Rehabilitationof Structures	CET451-6 Contracts Management	CET452-6/ CEP452-6 Planning of Construction Project Systems	CET457-6 Building Services	CET458-6 Energy Efficient Buildings
General	CET358-7 Biology for Engineers	CET359-7 Numerical Method for Civil Engineers	CET451-7 Finite Element Method for Civil Engineers	CET452-7/ CEP452-7 Remote Sensing and GIS	CET457-7 Disaster Preparedness and Planning	CET458-7 Reuse of Industrial wastes
	--	--	--	--	CET457-8 Industry Elective I	CET458-8 Industry Elective II

Syllabus for Semester BE I / II
Department of Civil Engineering

Course Code : PHT158 **Course : Mechanics, Optics and Acoustics (Theory)L: 3**

Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits : 4**

Course Objectives

1. To build a strong conceptual foundation of mechanics, optics and acoustics
2. To enhance the ability to use the mathematical techniques in its applications

Course Outcomes

After successful completion of the course students will be

1. able to apply concepts of kinematics , dynamics and oscillatory motion in solving engineering problems
2. able to understand how to describe and solve simple general rigid body motions.
3. able to recognize and analyze phenomena of interference, diffraction and polarization of lightwaves
4. able to understand broad principles of acoustics and ultrasonics

Module - I : Newton's Laws and Applications

Forces in Nature, fundamental and derived forces; Newton's Laws of Motion, First law (law of inertia), Inertial and Non-inertial Systems; Second law, concept of force; Third law, Simple applications of Newton's laws, friction, Examples and problems including friction and constraints.

Module - II : Oscillations

Particle Dynamics in One Dimension: Velocity Dependent Force, Position Dependent Force, One-dimensional harmonic oscillator, damped oscillator, over, critical and under damping; Forced oscillator, undammed and damped cases; Examples, resonance and Q factor;

Module - III : Conservation Laws Rigid Body Dynamics

System of Particles and Centre of Mass, Conservation of Linear and Angular Momentum, Angular momentum of a particle, torque of force; L of a system of particles, torque of external forces, Definitionof a rigid body, rotation in a plane, angular momentum about a point of rigid body in planar motion about a fixed axis, Kinematics, concept of moment of inertia, Dynamics of pure rotation about an axis.

Module - IV : Interference, Diffraction Light as an electromagnetic wave, Superposition of waves, Coherence, Interference in thin films, Newton's ring, Applications of thin films.

Diffraction, Diffraction at a single slit, double slit, grating, Resolving power, Bragg's law of crystal diffraction.

Module - V : Polarization

Unpolarized and polarized light, Different types of polarization of light, Malus' law, Optically anisotropic materials, double refraction, wave-plates and compensators, production and analysis of polarized light, Applications of polarizing devices , Applications of birefringence.

Module - VI : Acoustics and Ultrasonics

Fundamentals of vibrations, Sound waves and their characteristics, Sound intensity level-Decibel, Reverberation time , Sound absorption , Reverberation theory, Determination of sound absorption coefficients , Factors affecting acoustics of building and their remedies, acoustic design of hall.

Ultrasonics : Pizoelectric effect, types of ultrasonic waves, Determination of velocity of ultrasonic waves, Industrial and medical applications of ultrasonic waves.

Text Books

1. An introduction to Mechanics, Daniel Kleppner, Robert J. Kolenkow, 2nd Edition (Cambridge University Press)
2. Engineering Physics by Sanjay Jain and Girish Sahasrabudhe , Universities Press

Reference Books

1. The Physics of vibrations and waves by H.J. Pain Sixth edition , John wiley and Sons, Ltd
2. Engineering Physics by M.N. Avadhanulu and Kshirsagar S. Chand Publication

I / II Semester
Department of Civil Engineering

Course Code : PHP158 **Course : Mechanics, Optics and Acoustics LabL: 0**

Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and drawvalid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experimentsbased on the following lists as specific to Program:

1. Ohm's law verification, error analysis and graph plotting using linear least square fit
2. Newton's law of cooling
3. Radius of curvature of a convex lens using spherometer
4. Measurement of Magnetic flux by bar magnet
5. Study of simple pendulum
6. Young's modulus by bending of beam
7. Moment of Inertia of a Flywheel
8. Modulus of rigidity of wire using torsional pendulum
9. Moment of inertia of a rigid body of irregular shape
10. Searle's dynamical method
11. Determination of wavelength of light using Newton's experiment
12. Dispersive power of prism
13. Resolving power of grating
14. Malus law
15. Data analysis using Mathematica

Suggested References

1. Physics Lab Manual written by the Teaching Faculty of Physics Department, RCOEM.A

minimum of 8 experiments are to be performed from the above list of experiments.

I Semester

Department of Civil Engineering

Course Code : MAT151 **Course : Calculus**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 04**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve Tracing, tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus

Module 1 : Differential Calculus: (12hours)

Taylor's and Maclaurin's series expansions; radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 2 : Integral Calculus: (6 hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

Module 4 : Sequences and series: (7 hours)

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 5: Multiple Integrals (10 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module 6 : Vector Calculus (10 hours)

Vector Differentiation, Directional derivatives, total derivative, Gradient, Curl and Divergence. Vector integration , Theorems of Green, Gauss and Stokes and their applications.

Topics for self learning

Rolle's theorem, Mean value theorems, Indeterminate forms , Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation(Tangent plane and Normal line) , Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

II Semester
Department of Civil Engineering

Course Code : MAT152 | **Course : Differential Equations, Linear Algebra, Statistics & Probability**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week | **Total Credits : 03**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equation, statistics, probability and Matrices.

It aims to equip the students to deal with advanced level of mathematics and applications that wouldbe essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Syllabus

Module 1:First order ordinary differential equations(7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree : equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 2: Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variationof parameters, Cauchy-Euler equation.

Module 3:Basic Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation.

Module 4: Basic Probability: (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Topics for Self Learning Application

of Differential Equations.**Textbooks /**

References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory and Problems of probability and statistics : 2nded :J. R. Spiegal ,Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

I/II Semester

Department of Civil Engineering

Course Code : MAP151 **Course : Computational Mathematics LabL:0**

Hr., T:0Hrs., P:2 Hrs., Per week **Total Credits : 1**

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and comparethe results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Suggested References

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

A minimum of 8 experiments to be performed based on the above list.

Semester I

Department of Civil Engineering

Course Code : EET151 **Course : Basic Electrical Engineering**

Course Outcomes

At the end of this course, students will demonstrate the abilityCO1: Understand and analyze basic ac and dc electric circuits and magnetic circuits CO2: Understand working principles of electrical machines: Transformer, Induction motor, DC machinesCO3: Apply the knowledge of power converter for suitable applications

CO4: Introduce and identify the components of power systems and low-voltage electrical Installations.

Module 1: Introduction to Power system (2 hours)– CO4:

Introduction to Power Generation (Thermal, Hydro, Nuclear, Wind, and Solar) with block schematic presentationonly. Single line diagram for Generation, Transmission & Distribution through different voltage levels.

Module 2 : DC Circuits & Magnetic Circuits(8 hours) - CO1:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation, Time-domain analysis of first order RL and RC circuits, Magnetic materials, BH characteristics, Basics of Magnetic circuits.

Module 3: Single Phase AC Circuits (6 hours) - CO1:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Module 4: Three Phase AC Circuits (4 hours) - CO1:

Three phase Ac generation, Three phase balanced circuits, voltage, and current relations in star and delta connections. Power factor improvement.

Module 5: Transformers (6 hours) - CO2:

Ideal and practical transformer, Equivalent circuit, losses in transformers, regulation, and efficiency. Auto transformer and three-phase transformer connections.

Module 6: Electrical Machines (8 hours) - CO2:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components, efficiency, starting of induction motor. Single- phase induction motor. Construction, working, torque-speed characteristic, and speed control of separately excited dc motor.

Module 7: Power Converters (4 hours) - CO3:

Block schematic introduction to power converters and its practical applications (DC-DC, DC-AC, AC-DC, AC- AC),Types of Batteries, Important Characteristics for Batteries and battery backup.

Module 8: Electrical Installations (4 hours) - CO4:

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption, energy tariff.

Text / References

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
6. Electrical Technology: B. L. Thereja, S. Chand Publications.
7. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Semester I

Department of Civil Engineering

Course Code : EEP151 **Course : Basic Electrical Engineering Lab.**

Course Outcomes

Upon completion of this course, the students shall be able to,

CO1: Co-relate, analyze and apply the fundamental principles of science and engineering to understand the laboratory experimental work.

CO2: Connect the electric circuit, perform the experiment, analyze the observed data and make valid conclusion.

CO3: Write report based on the performed experiments (journal) with effective presentation of diagrams and characteristics/graphs.

CO4: Carry out survey of electrical energy consumption at home and calculate monthly energy bill as per the tariff of power Distribution Company.

List of Experiments

1. To verify Kirchhoff's laws for D.C. Circuits
2. Verification of Kirchhoff's laws to AC circuit (RLC series)
3. Verification of Kirchhoff's laws to AC circuit (RLC parallel).
4. To study speed control of D.C. shunts motor by:
   a) Armature voltage Control method.
   b) Field current/flux control method.
5. To study the balanced Three phase system for star and delta connected balanced load.
6. Improvement of power factor by using static capacitors
7. To determine regulation and efficiency of a single phase transformer by open circuit (o.c) and short circuit (s.c.) tests.
8. To determine regulation and efficiency of a single phase transformer by direct loading test

Demonstration / Study experiment

9. To study B-H curve for different magnetic material
10. To study Buck converter
11. To study Boost converter

Demonstration of cut out sections of machines:

i. DC Machine
ii. Three phase squirrel cage induction motor
iii. Synchronous machine

Semester I

Department of Civil Engineering

Course Code : MET151 **Course : Engineering Graphics and Design**

L:1 Hr., T:0Hrs., P:0 Hrs., Per week **Total Credits : 01**

Course Outcomes

The expected learning outcome is that, the students shall be able to

1. Draw and interpret technical drawing
2. Convert 2-D to 3-D drawing and vice versa.
3. Represent the various positions of planes and solids in different orientations.
4 Develop the solid surface for sheet metal working.

UNIT 1 : Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of drawing instruments, Lettering and dimensioning.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions : Projections of Points and lines (line inclined to both planes) Projections of planes (inclined to both the planes), Introduction to Auxiliary Planes; UNIT 3 : Projections of Solids

Inclined to both the Planes - Auxiliary Views; Draw simple annotation, dimensioning and scale. Floorplans that include : windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid Cone-Auxiliary Views; Development of surface of Right Regular solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; Conversion of Orthographic views to Isometric Views / Projection.

Suggested Text / Reference Books :

i) Bhatt N. D. Panchal V.M. & Ingle P.R., (2014) Engineering Drawing, Charotar Publishing House.

ii) Jolhe D. A. (2016) Engineering Drawing with an Introduction to Auto CAD", Tata McGraw- Hill Publishing Co. Ltd., New Delhi.

iii) Narayana K. L. & P. Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

iv) Shah M. B. & Rana B. C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

v) Agrawal B & Agrawal C. M. (2012), Engineering Graphic, TMH Publication.

vi) Corresponding set of CAD Software Theory and User Manuals.

Semester I

Department of Civil Engineering

Course Code : MEP151 **Course : Engineering Graphics & Design LabL:0**

Hr., T:0Hrs., P:4 Hrs., Per week **Total Credits : 02**

Course Outcomes

Students are prepared for actual work situations through practical training in a new state of the art computer designed CAD laboratory using engineering software. The student will learn to :

1. Draw and interpret technical drawing
2. Plan the sheet layout for the given drawing
3. Convert 2-D to 3-D drawing and vice versa
4. Represent the various positions of planes and solids in different orientations.
5. Develop the solid surface for sheet metal working
6. Use & demonstrate drafting package.

UNIT 1 : Introduction to Engineering Drawing

Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloids, Hypocycloid and involutes; Introduction to Scales.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions - Projections of Points and lines inclined to both planes; Projections of planes - Auxiliary Planes.

UNIT 3 : Projections of Solids

Inclined to both the Planes Auxiliary Views; Draw simple annotation, dimensioning and scale, Floorplans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism Cylinder, Pyramid, Cone - Auxilary Views; Development of surfaces of Right Regular Solids Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; conversion of Orthographic views to Isometric views / Projection

UNIT 6 : Overview of Computer Graphics

Demonstrating knowledge of the theory of CAD software such as (the Menu System Toolbars Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, crosshairs, Coordinate Systems), Dialog boxes and windows, Shortcut menus (Button Bars), The command Line (wherever applicable), The Status Bar, Different methods of zoom as used in CAD, select and erase objects; Isometric Views of lines, Planes, Simple and compound solids);

UNIT 7 : Customization & CAD Drawing

Setting up drawing page and the printer, including scale settings, Setting up of units and Drawing limits; ISO and ANSI standards for coordinate dimensioning; Orthographic constraints, map to objects, manually and automatically, Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT 8 : Annotations Layering & Other Functions

Applying dimensions to objects, applying annotations to drawings; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

UNIT 9 : Demonstration of a simple team design project that illustrates

Geometry and Topology of Engineered Components Creation of Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed toplogies for engineering, Introduction to Building Information Modeling (BIM), Drafting and Design Package, 3D Printing.

List of sheets

1. Curves (ellipse, Parabola, hyperbola, Cycloid, involute)
2. Line, Planes, Solids
3. Application of Section and development of solids
4. Orthgraphic Projection
5. Isometric
6. Auto CAD practice sheet 1
7. Auto CAD practice sheet 2
8. Blueprint sheet

Suggested Text/ Reference Books

i) Bhatt N.D. Panchal V.M. & Ingle P.R., (2014), Engineering drawing, Charotar Publiishing house

ii) Jolhe D.A., (2016) Engineering drawing with an Introduction to Auto CAD", Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

iii) Shah M.B. & Rana B.C. (2008), Engineering drawing and Computer Graphic, Pearson Education.

iv) Agarwal B & Agarwal C.M. (2012), Engineering Graphics, TMH PUBLICATION

v) Narayana K.L & P Kannaiah (2008), Text Book on Engineering Drawing, Scitech Publishers.

vi) (Concesponding set of) CAD Software Theory and USER Manuals.

Semester I
Department of Civil Engineering

Course Code : HUT152 **Course : Constitution of India**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 0**

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy& social justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Book

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, LexisNexis

Semester I Department of Physical Education

Course Code : PEP151 **Course : Yoga / Sports**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits : 0**

Course outcome

On successful completion of the course, students will be able to:

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline:

- **Sports :**

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

- **Yoga :** Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.
- **Physical Efficiency Tests :** This includes 6 health related physical fitness tests.

Components	Name of Tests
Speed	50 mts Dash
Agility	Shuttle run
Cardiovascular Endurance	8 mins Run/Walk
Test Flexibility	Sit and Reach Test
Abdominal Strength (M) / shoulder strength (F)	Bent Knee Sit-ups (M)/ Modified Pull-ups (F)
Yogic exercises	Suryanamaskars

Syllabus for B.E. Semester I / II

Course Code : CHT151 **Course : Chemistry**

L: 3 Hrs, T: 1 Hr, P : 0 Hr., Per week **Total Credits : 4**

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand different phenomena; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Explain the differences in the behavior of engineering materials based upon bond type, structure, composition, and processing.
- Analyse microscopic chemistry in terms of atomic and molecular orbitals and to apply this knowledge for understanding the band structure of different types of solids.
- Understand different types of molecular interactions, rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- List major chemical reactions that are used in the synthesis of molecules and to understand structural aspect of organic compounds.
- Analyse impurities present in the water and suggest the methodology for its removal.

Chemistry (Concepts in Chemistry for Engineering)

(1) Engineering Materials (8 Lectures)

Polymeric Materials : Introduction, polymer composites, fibre reinforced composites, Biopolymers (Polylactic acid etc.). Engineering applications of polymers (optical media, data storage, devices, electronics and medical sector).

Nanomaterials : Definition of Nano, Top down bottom up approach, carbon age-new form of carbon (CNT to Graphene), One dimensional, Two dimensional and Three dimensional nanostructured materials, mechanical-physical-chemical, optical properties. Applications of Nanomaterials.

Cement : Raw materials, manufacturing of cement, properties (settling and hardening, heat of hydration, soundness), Types of cement, Rapid hardening, Pozzolonic cement, white cement, High Alumina Cement.

(2) Atomic and molecular structure (8 lectures)

Schroedinger equation. Particle in box solutions, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Equations for atomic and molecular orbitals. Molecular Orbital Theory and Molecular orbital diagrams of different homo-nuclear and hetero- nuclear diatomic molecules. Pi- molecular orbital diagram of butadiene benzene and hexatriene.

Crystal field theory and the energy level diagrams for octahedral and tetrahedral complexes of transition metal ions and their magnetic properties.

Band structure of solids and the role of doping on band structures.

(3) Spectroscopic techniques and applications (8 lectures)

Electromagnetic Spectrum, Principles of spectroscopy.

Electronic spectroscopy – Basic Principles, Lambert-Beer's Law, Woodward-Fisher Rule for conjugated dienes.

Fluorescence and its applications in medicine.

Nuclear magnetic resonance – Basic Principles, Chemical Shift, Spectral interpretation of some simple compounds.

(4) Chemical Thermodynamics and Corrosion Science (6 lectures)

Thermodynamic functions: energy, work, entropy, ethalpy and free energy and numerical based on these thermodynamic functions.

Corrosion – Basic principle, mechanism of corrosion, overview of types of corrosion and preventive measures.

(5) Stereochemistry and Organic Reactions (8 lectures)

Stereoisomers, configurations and symmetry & chirality, enantiomers, diastereomers, optical activity.

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction. Synthesis of a commonly used drug molecule such as Ibuprofen, Aspirin, Paracetamol, Chloroquine/doxycyclineetc.

(6) Water Technology (6 lectures)

Impurities in natural water, hardness and alkalinity, Disadvantages of hardness i. e. sludge and scale formation, softening of water using lime-soda, zeolite and ion- exchange method, advantages and limitations of these water softening processes, Desalination of water using Reverse Osmosis and electrodialysis.

Suggested Text Books

1. A Textbook of Engineering Chemistry by Dr. Rajshree Khare, S. K. Kataria and Son's Publisher.
2. Selected topics in Inorganic Chemistry by W. U. Malik, R. D. Madan &G. D. Tuli, S. Chand Publications.
3. Engineering Chemistry by A. Pahari, B. Chauhan, Firewall Media, Infinity Science Press LLC.
4. A Textbook of Engineering Chemistry by S. S. Dara, S. Chand Publications.
5. Applied Chemistry by V. K. Walekar, A. V. Bharati, Tech-Max Publications.
6. Organic Chemistry by R. L. Madan, Mc-Graw Hill Publications.
7. Elementary Organic Spectroscopy, Revised Edition by Y. R. Sharma, S. Chand Publications.
8. Organic Chemistry – Reactions and Reagents by O. P. Agrawal, Goel Publishing House Publications.
9. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Reference Books

1. Physical Chemistry, by Robert G. Mortimer, Elsevier Academic Press Publications.
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane, Mc-Graw Hill Publications.

Semester I / II

Department of Civil Engineering

Course Code : CHP151 **Course : Chemistry Lab**

L: 0 Hrs., T: 0 Hrs., P: 3 Hrs., Per week **Total Credits : 1.5**

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

- Estimate the amount of different impurities in water/waste water samples.
- Estimate rate constants of reactions and order of the reaction from concentration of reactants/products as a function of time and to validate adsorption isotherms.
- Measure molecular/system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
- Synthesize a polymer or drug molecule or nano-material.

List of Experiments for Chemistry Lab

1. Determination of Surface tension of a given liquid/mixture.
2. Determination of Viscosity of a given liquid/mixture.
3. Estimation of total, temporary and permanent hardness present in a given water sample.
4. Estimation of type and extent of alkalinities present in a given water sample.
5. Estimation of Cu and Zn in a brass sample.
6. Study of chemical oscillations or iodine clock reaction and determination of rate constant of the reaction.
7. Estimation of acid value of oil.
8. Estimation of saponification value of oil.
9. Ion Exchange column for removal of hardness.
10. Study of adsorption of acetic acid by charcoal.
11. Synthesis a polymer / drug molecule / nano-material.

Suggested Books/Reference Books

(1) A Textbook on Experiments and Calculations in Engineering Chemistry by S. S. Dara, S. Chand Publications.

(2) Advanced Practical Physical Chemistry by J. B. Yadav, Krishna's Prakashan Media (P) Limited.

(3) Collection of Interesting General Chemistry Experiments, A by A. J. Elias, Universities Press Publications.

(4) College Practical Chemistry by V. K. Ahluwalia, S. Dhingra and A. Gulati, Universities Press Publications.

(5) Advanced Practical Medicinal Chemistry by Ashutosh Kar, New Age International Publisher.

Semester II
Department of Civil Engineering

Course Code: CST151 **Course : Programming for Problem SolvingL: 4**

Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 4**

Course Outcomes :

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. To apply programming to solve matrix addition, multiplication problems and searching & sorting problems.

UNIT-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

UNIT-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

UNIT-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings.

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

UNIT-VI: File handling

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush().

Text Books

1. Programming in ANSI C : E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

Semester II

Department of Civil Engineering

Course Code: CSP151 **Course : Programming for Problem Solving LabL: 0**

Hrs.,T: 0 Hrs.,P: 2 Hrs.,Per week **Total Credits : 1**

Course Outcomes :

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

Semester II
Department of Civil Engineering

Course Code : IDT151 Course : Creativity Innovation and Design Thinking Course Syllabus

L:1Hrs., T:0Hrs., P:0Hrs., Per week Total Credits : 1

Course Outcomes

C1: Be familiar with processes and methods of creative problem solving C2: Enhance their creative and innovative thinking skills

C3: Practice thinking creatively and innovative design and development

Detailed Topics

UNIT I. Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

UNIT 2. Pattern Breaking: Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking, Mapping thoughts, Other (new approaches)

UNIT 3. Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

UNIT4. Systematic Inventive Thinking : Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats , Ethical considerations

UNIT 5. Design for Innovation : Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation **UNIT 6.Intellectual Property :** Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, TradeSecret, Unfair Competition.

Reference Books and Text Book

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

Semester II
Department of Civil Engineering

Course Code : INT151 | **Course : Workshop/Manufacturing Practices (Theory)**

L:1Hrs., T:0Hrs., P:0Hrs., Per week | **Total Credits:1**

Course Outcomes

1. Identify the different manufacturing process commonly employed in Industry along with prevailing safety practices.
2. Identify the various tools and equipments to carry out different manufacturing processes accompanied by the inspection of the work part.

Syllabus

Unit-1 Fundamentals of metal cutting, single point cutting tool, fundamental mechanics of metalcutting, fitting operations, and associated measuring and marking tools

Unit-2 Introduction to pattern making for metal casting, different types of carpentry tools, measuringtools and marking tools, holding devices, different types of carpentry joints.

Unit-3 Smithy and Forging, Forging tools like chisels, hammers, types of furnaces, types of coal, Forming operations, Hot working and Cold working of metals.

Unit-4 Metal joining Process, mechanics of welding, types of welding, soldering and brazing, types ofjoints.

Unit-5 Introduction to foundries, Metal Casting, types of sand, Introduction to Molding tools & casting process.

Unit-6 Introduction to Plastic Injection Molding

Suggested Text Book

1. "Elements of Workshop Technology" Hajra S.K, Choudhury A. K , Roy Nirjhar Vol. I and Vol .II,Media Promoters and Publishers Private Ltd. Mumbai.

Reference Books

1. Kalpakjian S. and Schmid S. “Manufacturing Engineering and Technology”4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, “Process and Materials of Manufacture”4th Edition, Prentice Hall India 1998.

Semester II

Department of Civil Engineering

Course Code : INP151 **Course : Workshop/Manufacturing Practices Lab (Practical)**

L:0Hrs.,T:0Hrs.,P:2Hrs.,Per week **Total Credits:1**

Laboratory Outcomes

On the completion of the course the students shall be able to;

1. Recognize the different manufacturing process commonly employed in the Industry
2. Make the components using required manufacturing process, inspection methods while practicing the requisite safety precautions

Contents

1. Fitting Practice
2. Welding and Soldering Practice
3. Pattern Making Practice
4. Metal Casting Practice
5. Smithy and Forging Practice
6. Machining Practice
7. Plastic Molding Process
8. Glass Cutting Process

Suggested Text Book

1. "Elements of Workshop Technology'" Hajra S.K, Choudhury A.K , Roy Nirjhar Vol. I and Vol .II,Media Promoters and Publishers Private Ltd Mumbai.

Reference Books

1. Kalpak Jain S. and Schmid S. "Manufacturing Engineering and Technology"4th Edition, PearsonIndia Education 2008
2. Roy A. and Lindberg, "Process and Materials of Manufacture", Prentice hall India 1998.

Semester II
Department of Civil Engineering

Course Code: HUT151 **Course : English**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 2**

Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as wellas communication skills at work place. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

Syllabus

1. Vocabulary Building

   The concept of Word Formation

   Root words from foreign languages and their use in English

   Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

   Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills

   Sentence Structures

   Use of phrases and clauses in sentences

   Importance of proper punctuation

   Creating coherence

   Organizing principles of paragraphs in documents

   Techniques for writing precisely

3. Identifying Common Errors in Writing

Subject-verb agreement

Noun-pronoun agreement

Misplaced modifiers

Articles

Redundancies

Cliches

1. Nature and Style of sensible Writing

Describing

Defining

Classifying

Providing examples or evidence

2. Writing Practices

Comprehension

Precis Writing

Essay Writing

Letter Writing

Email Writing

3. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations : Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Semester II
Department of Civil Engineering

Course Code: HUP151 **Course : English Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 1**

Course objective

1. To enhance competency of communication in English among learners.

Course outcomes

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

List of Practical (2 hours each for each batch) based on unit 6 (oral communication).

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation , Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

III Semester

Department of Civil Engineering

Course Code: MAT 251 | **Course : Transform Calculus and Applied Statistics**

L : 04 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits: 04**

Course Objective:

The objective of this course is to expose student to understand the basic concepts of Laplace Transform, Fourier Series and Partial Differential Equations in Civil Engineering. It also focuses on Linear Programming Problems, Function of Complex variables and Numerical Methods / applied statistics.

Course Outcomes

On successful completion of the course, student shall be able to

1. Understand and use Laplace Transform, Function of Complex variables techniques for solving problems in Civil Engineering.
2. Understand Partial Differential Equations and use it to solve problems in civil engineering.
3. Understand the basic importance of Numerical Methods and Linear Programming to solve problems related to Engineering Applications.
4. Understand applied statistics to analyze data in civil engineering.

Syllabus

Module 1: Laplace Transform

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method._

Module 2: Partial Differential equations

Partial differential equation of first order first degree i.e. Lagrange's form, Solution of partial differential equation by separation of variables, Application to simple problems of vibration of strings&beams.

Module 3: Function of Complex Variables

Functions of a Complex Variable: Analytic function, Cauchy integral theorem, Taylor and Laurentseries.

Module 4: Linear Programming

Linear programming problems, basic theory, graphical solution method, the simplex method.

Module 5: Applied Statistics

Sampling distribution of Means and Proportions, Estimation Theory, Confidence interval. Testing of hypothesis for Means and Proportions when population standard deviation is known and unknown, Testing for difference between means (for large and small samples), Hypothesis concerning one and two variances.

Module 6: Numerical Methods

Errors in numerical calculations, errors in series approximation. Rounding off errors, solution of algebraic and transcendental equations. Iteration method, False position method, Newton Raphson method and their convergence. Solution of system of linear equations, Gauss Seidal method, Crout's method. Numerical solution of ordinary differential equation by Taylor's series method, Euler modified method, Runge-Kutta method.

Textbooks / References

1. S.S.Sastry, Introductory methods of numerical analysis, PHI,4 Edition,2005.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

III Semester
Department of Civil Engineering

Course Code: CET 251 **Course : Construction Materials**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcomes

1. The student shall be able to Identify, describe and explain the fundamental properties of, rocksand minerals.
2. The student shall be able to identify, and understand various building materials.
3. The students should be able to illustrate and control method of manufacture of concrete.
4. The students should be able to design and recommend the mix of concrete for given materials.

Unit I

Mineralogy : Definition and classification of minerals, silicate structure, chemical and physical properties of minerals

Petrology : Igneous Rocks, formation, textures and structures. Classification Sedimentary rocks, formation, classification, metamorphic rocks, agents and kinds of Metamorphism, textures, structures, and classification of metamorphic rocks, grades of Metamorphism.

Unit II

Introduction to various building components, Building materials such as; Masonry units, Flooring material, Roofing materials. IS-875 Part 1.

Application of geology to civil engineering projects, engineering properties of rocks,/ Building- stones, application of geology in location, design, and construction of dams, bridges and tunnels andbuilding.

Unit III

Constituents of concrete and manufacturing process of concrete: batching, mixing, transporting, placing, compacting, and finishing Concreting equipments: Weigh batcher, mixers, transportation equipments, vibrators, and batch mix plant. Workability: Factors affecting it, Testing of workability of concrete: Slump test, Compaction factor test, flow table, vee-bee consistometer. Curing of concrete: Necessity, Methods, duration and frequency of curing, Maturity of concrete

Unit IV : Strength of concrete

Gain of strength of concrete, water cement ration law.

Destructive test: Compressive strength, factors affecting it, determination of compressive strength, cube strength & cylinder strength, accelerated curing test. Tensile and flexural strength:

Significance and testing, indirect tension test, cylinder splitting test, centre point and third point loadingmethod.

Non-destructive test: Significance, surface hardness test, pulse velocity method, semi destructivetests,x raymethod,neutron tomographymethod.

Introduction to High Strength Concrete, Interfacial transition zone (ITZ)

Unit V : Mix Design

Statistical parameters of quality control Factor affecting mix proportions

Method of mix design by IS: 10262- 1982 and IS: 10262-2009 Numericals based on IS method

Unit VI : Failure modes in concrete

Failure in plastic concrete: Segregation and bleeding Failure in hard concrete: Cracks and their causes, failure of bond between concrete & reinforcementShrinkage:

Mechanism ofshrinkage,types,Factoraffectingit.

Creep: Factors influencing relation between creep & time, effect of creep.

Permeability of concrete Sulphate attack, sea water attack, acid attack, efflorescence, corrosion of reinforcement, abrasion and cavitation, Concept of durability of concrete

Text books

1. Concrete Technology by M.S. Shetty, published by S. Chand , Faridabad.
2. Properties ofconcrete, by A.M. Nevile, E.L.B.S London.
3. A text book of Engineering Geology: Pasbin Singh, S.K Kataria & Sons, New Delhi.
4. Building construction by Sushil Kumar, 16th Edition, Standard Publishers Distributors, 2006.

Reference

1. Concrete Technology (Theory and Practice) by M.L gambhir, McGraw Hill Publications, fifth edition.
2. Concrete technology by Santhakumar, Oxford Publication, New Delhi
3. Principles of Petrology, G.W. Tyrrell, Science paper backs.

III semester

Department of Civil Engineering

Course Code: CEP 251 | **Course : Construction Materials Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week | **Total Credits : 01**

Course Outcomes

1. The students should be able to test various building material.
2. The students should be able to interpret the quality of material.
3. The students should be able to analyze various properties of various building material.

List of Practicals

Minimum 10 of the following

Test on Bricks and Blocks

1. Water absorption
2. Compressive strength

Test on Cement

1. Determination of fineness of cement
2. Determination of Normal consistency.
3. Determination of setting time.
4. Determination of soundness.
5. Determination of compressive strength.

Test on Aggregate

1. Determination of particle shape. Elongation and Flakiness index of aggregates.
2. Determination of finess modulus of aggregate and drawing particle size distribution curve.
3. Determination of water absorption and moisture content.

Test on concrete

1. Determination of workability by slump test
2. Determination of workability by compaction factor test
3. Determination of workability by flow test
4. Determination of workability by Vee-bee test.
5. Determination of strength by cube strength of concrete
6. Determination of strength by N D T: Rebound hammer test, ultrasonic pulse velocity test.
7. Determination of cover by covermeter.

III semester
Department of Civil Engineering

Course Code: CET 252 **Course : Fluid Mechanics I**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcomes

The students would be able to,

1. To understand and describe properties of fluids, pressure measurement and broad principles of statics, kinematics and dynamics of fluid flow and studies of dimensional analysis.
2. To apply continuity, momentum and energy principles. Also development of systematic relationship between variables in various phenomenon of fluid flow applying methods dimensional analysis.
3. To understand, apply and analyse the working of various equipments for the measurement of velocity and discharge through pipe flows and open channel flows, tanks etc.
4. To compare effect of various parameters involved in fluids, fluids flows and its geometry.

Unit I

a. **Fluid Properties :** Concepts of fluid, difference between solid, liquid and gases, basic properties of fluids Capillarity and its effect, dynamic and kinematic viscosity, Newton's law of viscosity, , rheological diagram, vapour pressure, Elasticity and compressibility, bulk modulus. Study of effect of pressure and temperature on various fluid properties.

Unit II : Pressure Measurement

Fluid pressure, Variation of fluid pressure with depth, pressure head, atmospheric, gage, vacuum pressure, relationship with diagram, pressure measurement using simple and differential manometer with formation of gage equation. Hydrostatics pressure on plane surface, Center of pressure and total pressure for fluid masses subjected to horizontal, vertical and inclined plane surface.

Unit III : Kinematics of flow

Velocity and its variation with space and time. Acceleration of fluid Particles, Lagrangian and Eulerian approaches in fluid flow description, type of flows. Equation of continuity in cartesian co-ordinate systems and its application.

Unit IV : Buoyancy and Floatation:

(a) Buoyant force and center of buoyancy, Archimedes principle, meta centre. Stability of floating bodies.

(b) Liquid in relative equilibrium and its applications: fluid mass subjected to uniform linear acceleration, liquid containers subjected to constant horizontal acceleration and constant vertical acceleration. Fluid container subjected to constant rotation. Problems based on these applications.

Unit V: Kinetics of fluid flow

Forces influencing motion, various equations of motion, Bernoulli's equation and Its application and limitations, Kinetic energy correction factor. Momentum equation & its application, Measurement of discharge through pipes using Venturimeter, Orifice meter. Measurement of velocity using Pitot tube.

Text Books

1. Hydraulics and fluid mechanics by Dr. P. N. Modi and S. M. Seth, latest edition, Standard bookhouse.
2. Fluid Mechanics - Fundamentals and applications by Yunus cengel, John M Cimbala, Tata McGraw Hill Publishing Company Ltd New Delhi, latest edition / reprint.

Reference Books

1. Theory and Application of Fluid Mechanics by K. Subramanaya, latest edition, Tata McGraw Hill Publishing Company Ltd New Delhi.
2. Fluid mechanics by Streeter and Wylie.

III semester

Department of Civil Engineering

Course Code: CEP 252 **Course : Fluid Mechanics I Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits: 01**

Course Outcomes

The students would be able to,

1. Describe the process of experimentation. Handle and operate the equipments according to its working principle.
2. Plan and conduct the experiments in accordance with the objectives
3. Determine the coefficients of equipments. Also interpret and discuss the experimental observations.
4. Analyze and compare the experimental and theoretical observations.

List of Practical's

Minimum 8 out of the following :

1. Determination of Hydraulic coefficients of Orifice.
2. Determination of coefficient of discharge of Mouthpiece
3. Determination of coefficient of discharge of Rectangular Notch
4. Determination of coefficient of discharge of Triangular Notch.
5. Determination of minor losses for G I pipe various sections
6. Determination of frictional loss for G I pipes.
7. Determination of coefficient of discharge for Venturi meter.
8. Determination of coefficient of discharge for Orifice meter.
9. Determination of Meta-centric height of ship model.
10. Verification of Bernoulli's Theorem.
11. Measurement of velocity and discharge of flow through pipe using ultrasonic flow meter.
12. Any other experiment employing self learning and other tools.

Note : use of python in all or any relevant practical is desirable.

Semester: III semester Department of Civil Engineering

Course Code: CET 253 **Course : Environmental Engineering I**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcomes

The students would be able to,

1. Describe and explain the necessity of water treatment along with the basic knowledge of various components of water supply scheme, treatment processes and distribution methodology.
2. Apply the knowledge of various principles, theories and equations in process analysis and in the design of various components of water supply scheme.

Unit I

Introduction : Importance and need of planned water supply scheme, various components of water supply scheme.

Water Demand : Types of demand, factors affecting per capita demand, variation in demand, losses and theft, water audit, design period and population forecasting methods.

Sources of Water : Various sources of surface water and ground water for water supply scheme including various intake structures, water balance.

Unit II

Water quality : Physical, Chemical and bacteriological characteristics of water, environmental significance of various characteristics for different beneficial use, water quality standards (BIS and other latest standards and amendments), standard for packaged water, general idea of waterborne diseases and its safety measures.

Water treatment : Objectives of treatment, various unit processes, treatment flow sheet of conventional water treatment plant and site selection, criteria for water treatment plant.

Unit III

Aeration : Purpose, types of aerators and simple design of cascade aerator. Sedimentation: Principles, types of setting basins, efficiency of settling basin.

Coagulation and Flocculation : Significance, types of coagulants, coagulant doses, types of mixing and flocculation devices. Simple design of plain sedimentation and sedimentation with coagulation tank. Brief idea about clariflocculator

Unit IV

Filtration : Importance of filtration, mechanism of filtration, types of filters - RSF, SSF, Pressure filters.Simple design of RSF and MGF

Disinfection : Necessity, Mechanisms, criteria for good disinfectant, various types of disinfectants, disinfection by chlorination using different forms of chlorine.

Miscellaneous : General idea about miscellaneous treatment processes, latest methods

Unit V

Conveyance of water : Types of pipes, joints, valves and testing methods of pipe lines. Hydraulic design aspects: Manning's, Darcy's, and Hazen-William formulas.

Rising main and pumps: Classification, working, merits, demerits and selection of pumps. OMR concept

Unit VI

Distribution systems : Ideal requirements for a good distribution system, types of distribution systems,System of water supply.24*7 water supply scheme, Fire hydrants

Storage reservoirs for treated water : Types, various capacities of reservoir, mass curve method for determination of storage reservoir capacity.

Text books

1. Water supply & Sanitary Engineering Vol. I : B. C. Punmia (Laxmi Publication)
2. Water supply & Sanitary Engineering : G. S. Birdie (Dhanpat Rai Publication)
3. Environmental Engg. Vol. I : S. K. Garg (Khanna publication.)

Reference

1. Water Supply and Sewerage By M.J. McGhee (McGraw Hill)
2. Water Supply Engg. By P. N. Modi (Standard Book House)
3. CPHEEO Manual of water supply & treatment
4. WHO guidelines for drinking water standard
5. Handbook for design of water treatment plants by Dr. A.G. Bhole IWWA publication.

III semester

Department of Civil Engineering

Course Code: CEP 253 **Course : Environmental Engineering I Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Outcomes

The student would be able to:

1. Determine the various characteristics of water and understand the significance of various characteristics of water along with the knowledge of drinking water standards and necessity of water treatment.
2. Understand various principles and instruments used in water analysis.

Practicals

Minimum Ten of the following:

1. Determination of pH
2. Determination of Solid's
3. Determination Dissolved Oxygen
4. Determination Chlorides
5. Determination of Alkalinity
6. Determination Hardness
7. Determination Available Chlorine in bleaching powder
8. Jar Test – to decide coagulant dose
9. Determination of Turbidity
10. Study practical of MPN and plate count tests.
11. Determination of Conductivity
12. Determination of silica content

Reference

1. Chemistry for environmental engineering and science by Sawyer and McCarty EE-I,
2. Civil Engineering Department, RCOEM, Laboratory Manual.

Note : use of python in all or any relevant practical is desirable.

III semester

Department of Civil Engineering

Course Code : CET 255 **Course : Solid Mechanics**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 03**

Course Outcomes

The students would be able to

CO1: Understand the behavior of materials under different stress and strain conditions._

CO2: Draw bending moment, shear force diagram and Analyze stresses in member under the different conditions of loading.

CO3: Determine deformations of simple members under various loading conditions.

Simple Stresses and Strains:

Concept of stress and strain, stress strain behavior of ductile and brittle material in uniaxial state of stress Elastic, plastic and strain hardened zones stress-strain relations, elastic constants, relation between elastic constants. Uniaxial loading and deformation of simple cases of statically inderminate problems under axial loading, Bars of varying section – composite bars – Temperature stresses temperature changes etc. Thin walled pressure vessels cylinder and spherical subjected to internal pressure.

Axial force, shear forces and bending moment diagram

Concept of free body diagrams, types of loads, determination of axial force, shear force and bending moment at a section. SF and BM diagrams in beams (Cantilever, Simply supported, Overhang Beam).Relation between load and shear force and bending moment.

Stresses in beams

Assumption and derivation of simple a bending theory, relation between bending moment, bending stress and curvature for homogeneous and composite beams. Shear stresses in simple beams and shear stress distribution.

Deflection of beams and theory of columns

Relationship between moment, slope and deflection, Macaulay's method, double integration Method. Use of these methods to calculate slope and deflection for determinant beams. Buckling of columns and strut columns. Euler's and Rankine's formula.

Torsion of shafts

Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, Analysis of close-coiled-helical springs.

State of stress in two dimensions

State of stress in two dimensions, differential equation of equilibrium, transformation of stresses, principle stresses, maximum shear stress, Mohr's circle, combined bending and torsion. Introduction of theories of failures. Introduction to plastic theory elasto plastic analysis upper bound theorem lower bound theorem

Text Books

1. S.S. Bhavikatti, Strength of Materials, 3rd Edition, Vikas Publishing House, 2008
2. Strength of Materials, 4th ed.: A. Pytel and F. L. Singer, Harper & Row, New York.
3. Strength of Materials: G. H. Ryder - Macmillan, India.
4. Strength of Materials a Rudimentary Approach: M.A. Jayaram, Sapna Book House, Bangalore.
5. Strength of Materials : R. K.Rajput, S Chand.
6. Engineering Mechanics of solids, Popav. ER Prentice Hill of India, New Delhi 2000

Reference

1. Seely, F. B.; and Smith, J.O "Advanced Mechanics of Material", John Wiley and Sons. Inc.
2. Mechanics of materials: Beer & Johnson, McGraw - Hill Publishers.

III Semester

Department of Civil Engineering

Course Code : CEP 255 **Course : Solid Mechanics Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Outcomes

Students will be able to

CO1. Understand the importance of elastic properties of different metals.

CO2. Know the behavior of different metals under different loading conditions such as tension, bending, torsion, shear etc and observe the failure pattern.

CO3. Observe the buckling shape of Column under various end condition and deformations of simple members.

Practicals : Minimum 10 of the following

1. Study of elastic properties of metals.
2. Tension test on metals.
3. Compression test on metals.
4. Hardness test on metals.
5. Torsion test on metals.
6. Impact test on metals.
7. Deflection of springs.
8. Bending test on beams.
9. Verification of SFD and BMD by graphical solution.
10. Timber test. Strength and moisture content
11. Measurement of deflections in statically determinate beam
12. To study behavior of different types of columns and compare the Euler's buckling load for different end conditions.
13. Shear centre.
14. SFD & BMD of beams by MS Excel.

IV Semester Department

of Civil Engineering

Course Code : CET 256 **Course : Fluid Mechanics II**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcomes

The students would be able to :

1. Understand and describe various principles of flow through pipes, open channel and centrifugal pumps.
2. Apply basic principles of flow in pipes and open channel to solve fluid flow problems in steadystate condition.
3. Analyse and design various components of fluid flow system and comparison of possible solutions.
4. Compare and interpret the data / information/concepts/principle and used for solving incompressible fluid flow problems in steady state condition.

Unit I : Flow through Pipes

Hydraulically smooth and rough pipe; frictional resistance to flow; Darcy-Weisbach & Hazen-William equation, moody's diagram. Hydraulic gradient line and Total energy gradient line.

Unit II :

Pipes in series and parallel, branched pipe Water hammer pressure, three reservoir problem, flow through siphon; Concept of drag lift and its simple application.

Unit III : Flow through Open Channel

General : Introduction to open channel flow; Types of channel , Geometrical properties, Types of flow in open channel, Chezy's equation; Manning's equation; determination of discharge; normal depth; most economical channel section.

Unit IV

Uniform Flow : Basics.- continuity, energy and momentum equations, Characteristics of uniform flow, computations of uniform flow.

Non uniform flow (Critical Flow) : Basics and computations; Applications of specific energy concept, specific energy curve, gradual transition of channels, humps, width restrictions.

UNIT V

Gradually Varied Flow (GVF): Introduction to GVF; Equation of gradually varied flow; analysis of GVF: Classification and characteristics of surface profiles; Computations of water surface profile using direct step method.

Rapidly Varied Flow (RVF):, theory and classification of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular channel. Length, height and application of hydraulic jump. Energy dissipation.

UNIT VI

Dimensional analysis: Definition and use, fundamentals and derived dimensions, methods, application of methods to develop relationship in variables. Dimensionless numbers and its significance

Theory of model : Similitude, geometric, kinematic and dynamic similarities, Reynolds and Froude number law its significance.

Text Books

1. Hydraulics and fluid mechanics including Hydraulic machines by Dr. P. N. Modi and S. M. Seth, Latest edition, Standard book house (2002).
2. Theory and application of fluid mechanics by K Subramanya ,Tata McGraw Hill Publishing Company Ltd New Delhi.
3. A textbook of Fluid Mechanics & Hydraulic Machines by R. K. Bansal.

Reference

1. Fluid Mechanics & Hydraulic Machines by S. C. Gupta, Darling Kindersley (I) pvt. Ltd. Pearson lieensee, Nodia, UP.
2. Fluid Mechanics – Fundamentals and applications by Yunus cengel, Jhon M Cimbala, Tata McGraw Hill Publishing Company Ltd New Delhi, latest edition/ reprint.
3. Open Channel Hydraulics by V. T. Chow.

IV Semester
Department of Civil Engineering

Course Code : CEP 256 **Course : Fluid Mechanics II Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Outcomes

The students would be able to,

1. Describe the process of experimentation. Handle and operate the equipments according to its working principle.
2. Plan and conduct the experiments in accordance with the objectives.
3. Determine important parameters, coefficients of equipments and interpret the experimental observations.
4. Analyze and compare the experimental and theoretical / analytical observations.

List of Practical's

Minimum 8 of the following

1. Determination of Manning's constant for open channel.
2. Determination of Chezy's constant for open channel.
3. Developing specific energy diagram for a rectangular channel.
4. Study of GVF profiles.
5. Determination of spillway constant.
6. Analysis of branch network using software like water GEMS, EPANET for pipe flow
7. Analysis of rectangular / trapezoidal section.
8. Three reservoir problem
9. Determination of height of hump for critical flow. (transition of channel)
10. Determination of friction factor in flow through GI pipe
11. Any other experimental employing self learning and other tools.

Note: Use of python in all or any relevant practical is desirable.

IV Semester
Department of Civil Engineering

Course Code : CET 257 **Course : Geotechnical Engineering**

L : 03 Hrs., T : 01 Hrs., P : 00 Hrs., Per Week **Total Credits : 04**

Course Outcomes

On successful completion of the course students will be able to;

1. Identify various types of soils.
2. Identify, determine and correlate different properties of soil.
3. understand various stresses in soil.

Syllabus Unit –I

Introduction: Origin of soil, formation of soil, Major deposits found in India. Various type of soil, soilstructure

Phases of soil: Various soil weight & volume inter-relationship.

Unit –II

Index Properties : Identification and determination of various Index properties of soil. Classificationof course and fine grained soil based on Index properties.

Classification of Soil : Criteria of classification, particle size classification, Unified & I.S. classificationsystem.

Unit –III

Permeability: Darcy's law & its validity, Discharge & seepage velocity, factors affecting permeability, stratification in soil mass, Determination of coefficients of permeability by laboratory and field methods, permeability of stratified soil.

Seepage : Method to draw flow nets, quick sand condition, characteristics & uses of flow nets, preliminary problems of discharge estimation for homogeneous soils.

Unit –IV

Compaction: Mechanics of compaction, factors affecting compaction, standard & modified proctor Tests, OMC, MDD, field compaction equipment, quality control.

Consolidation : Terzaghi's 1-D consolidation theory, determination of coefficient of consolidation, degree of consolidation. Determination of preconsolidation pressure.

Unit – V

Shear Strength – Concept of Mohr's stress circle, Mohr-Coloumb's theory, Drainage condition, Pore pressure and its measurement, shear strength by direct shear test, tri-axial test, unconfined compression test, vane shear test.

Unit – VI

Stress Distribution: Stress distribution in soil mass, Boussinesq's theory, point load, uniformly Loaded rectangular & circular areas, Newmark's influence chart, Equivalent point load method.

Text Book

1. Basics and Applied Soil Mechanics – Gopal Ranjan & A S R Rao, New Age Int.Pub.
2. Geotechnical Engineering – C Ventakramaiah, New Age International Publications
3. Soil Mechanics and Foundation Engineering – B. C. Punmia, Laxmi Publications
4. Textbook of Soil Mechanics & Foundation Engineering - V N S Murthy, CBS Publishers.

Reference

1. Textbook of Geotechnical Engineering – Braja M. Das, Cengage Publications
2. Fundamentals of Geotechnical Engineering – Braja M. Das, Cengage Publications
3. Modern Geotechnical Engineering – Alam Singh, CBS Publishers

IV Semester

Department of Civil Engineering

Course Code : CEP 257 **Course : Geotechnical Engineering Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits: 01**

Course Outcomes

On successful completion of the course students will be able to;

1. Field Identify of soils.
2. Determine index properties of soil.
3. Determine engineering properties of soil.

List of Practicals: Minimum 10 of the following

1. Moisture content
2. Specific gravity of soil
3. Field Density determinations by sand replacement method and core cutter method
4. Grain size Analysis - Sieve Analysis and Hydrometer
5. Atterberge limits
6. Permeability by constant head or falling head test
7. Standard Proctors compaction Test
8. Unconfined compression strength test
9. Direct shear Test
10. Triaxial compression test (Demonstration)
11. To find F.S.I. and D.F.S.I of soil. Identification of swelling soil
12. One field visit & its Report to be included in journal

IV Semester
Department of Civil Engineering

Course Code : CEP 258
L : 00 Hrs., T : 00 Hrs.,
P : 02 Hrs., Per Week

Course : Computer Aided Civil Engineering Drawing Lab

Total Credits: 01

Course Outcomes

1. Student will able to draw dimensional sketches of building elements.
2. Students will able to understand and implement building byelaws in planning of building.
3. Students are able to plan and develop working drawing of residential building.
4. Students are able to plan and develop submission drawing of residential building.

List of practicals (Take any 10)

1. Drafting of dimensional sketches of the building elements.
2. Free hand drafting of the dimensional sketches of the building elements.
3. Study of the IS code provisions for the building drawing.
4. Study of building byelaws for government authorities.
5. Development of single line plan for residential building based on the requirements.
6. Development of working plan for single storied residential building based on the requirements (hand drafted).
7. Development of working plan for single storied residential building based on the requirements.
8. Development of working plan for multi storied residential building based on the requirements.
9. Study of various elements of submission drawing.
10. Development of submission drawing for single storied residential building.
11. Development of submission drawing for multi storied residential building.
12. Study of area calculation of submission drawing for flat scheme.

IV Semester

Department of Civil Engineering

Course Code : CET 259 **Course : Structural Analysis**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 03**

Course Outcome

1. Able to analysis determinant and in-determinant structures
2. Able to understand Structural Responses and
3. Able to analyse field problems of Structural analysis and spread its knowledge to society.

Syllabus

Analysis of continuous beams propped cantilevers, portal frames with and without sway by **Moment**

Distribution Method Influence line for rolling loads on beams with concentrated and uniformly distributed loads, for reactions, maximum B.M. and S.F, Influence lines for forces in members of simple trusses.

Analysis of **Two-Hinged and three hinged arches,** calculation of S.F. ,B.M and normal thrust.

Slope deflection method as applied to indeterminate continuous beams and frames (maximum indeterminacy up to two).

Analysis of fixed and continuous beams by **theorem of three moments,** along with consideration of sinking of support

Strain energy method as applied to the analysis of redundant frames and redundant trusses up to two degrees.

Introduction to **Direct stiffness method** for analysis of structures and its application to beams (upto 2 degree of freedom)

Introduction to conjugate beam method, column analogy and Moment area Method. Introduction to plastic hinge, load factor, shape factor, type of mechanisms and failures calculation of plastic movement capacity

Reference

1. Timoshenko S. P. & Young D.H. "Theory of Structures; International edition", McGraw Hill,1965.
2. C.S.Reddy "Basics Structural Analysis" McGraw Hill 3rd edition 2010
3. Ghali, A.; & Neville A. M. "Structural Analysis A Unified Classical and Matrix Approach (4th Edition)", E & FN SPON; Van Nostrand Reinhold, 1997.
4. Wang, C. K. "Indeterminate Structures", Prentice Hall of India; 2000.

5. Schodek, D.L. "Structures (4th Edition)", McGraw Hill International editions; 1983.

6. Meghre, A.S.; &Deshmukh, S.K. "Matrix Methods of Structural Analysis (1st Edition)", Anand; CharotarPubls, 2003.

7. Weaver J.M.; & Gere, W. "Matrix Analysis of Framed Structures (3rd edition)", Van Nostrand Reinhold; New York, 1990.

8. Jain, O.P. & Arya, A.S. "Theory and Analysis of Structures; Vol. I & II", Nemchand Brothers; Roorkee.

9. Krishnamurthy D., "Theory of Structures", J.K. Jain Brothers, 1976.

10. RajsekaranS., Shankarasubramanian G. "Computational of Structural Mechanics", Prentice Hallof India Pvt. Ltd., New Delhi, 2001.

IV Semester

Department of Civil Engineering

Course Code : CEP 259 **Course : Structural Analysis Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Objective

1) To enable students to determine the behavior of various structural members when subjected to different types of loadings.
2) Will be able to apply their knowledge of structural analysis in addressing analysis problems of structural engineering.

List of practical

1. To determine the deflection of two span continuous beams.
2. To find horizontal reaction of two hinged portal frame.
3. To draw influence line diagram of central reaction in a two span continuous beam.
4. To determine horizontal reaction of two hinged parabolic arch and draw the influence line diagram for horizontal thrust.
5. Verification of Maxwell's reciprocal theorem.
6. Application of standard structural analysis package for verifying SFD ,BMD and deflection for determinant beam subjected to different types of loads.
7. Verification of Three Moments Theorem using standard structural analysis package.
8. Verification of Moment Distribution Method using standard structural analysis package.
9. Verification of Strain Energy Method using standard structural analysis package.
10. Verification of Slope Deflection Method using standard structural analysis package.
11. Study of Photo elasticity.
12. To determine the material fringe constant using compression method in two dimensional photo elasticity. loading.

IV Semester
Department of Civil Engineering

Course Code : CET 260 | **Course : Environmental Engineering-II**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits : 03**

Course Outcomes

The students would be able to,

1. Describe and explain the necessity of wastewater treatment along with the basic knowledge of collection methodology, treatment processes and disposal methods.
2. Apply the knowledge of various principles, theories and equations in process analysis and in the design of various components of sewerage system.

Unit I

General Aspects of waste water treatment : Necessity of treatment, classification of waste water, grey water and black water, system of sanitation, patterns of sewage collection systems. Estimation of storm water and sanitary waste water.

Conveyance of sewage : Types, shapes, hydraulic design of sewer.

Unit II

Laying of sewer : Procedure for laying of sewer to grade, testing of sewer line.

Sewer Appurtenances : Manhole, street inlets, storm water overflows, inverted syphons, flushing, ventilation, drop manhole, lamp hole and catch basin.

House plumbing systems : Ideal requirements of HPS, types of HPS, types of pipes used in HPS, traps and its types, anti-syphonage.

Unit III

Characteristics of sewage : Physical, chemical and biological characteristics of wastewater and its significance, BOD rate constant, BOD equation and its application to simple analysis.

Disposal of wastewater : Disposal standards, disposal by dilution, disposal by land treatment alongwith their advantages and disadvantages.

Unit IV:

Wastewater treatment : Wastewater treatment flow sheet and its site selection, preliminary and primary treatment - Screens, Grit chambers, Primary Settling Tank (including simple design).

Unit V

Secondary treatment : Types of secondary treatment, principle of biological treatment, aerobic and anaerobic treatment processes, activated sludge process and trickling filter.

Treatment of sludge : Principle and necessity of sludge treatment, sludge digestion, sludge drying beds.

Unit VI

Rural sanitation : Pit privy, aqua privy, twin pit toilets bio-gas recovery. Septic tank including soak pit, (including design problem), sullage (Grey water) collection, treatment and disposal, Faecal sludge management.

Introduction to Reuse of Waste Water and Case Studies : Introduction to MBR SBR and constructedwet lands. General idea about various unit operations and treatment processes.

Text Books

1. B.C.Punmia," Waste Water Engineering" - Laxmi Publication
2. G.S.Birdie, "Water Supply & Sanitary Engineering"- Dhanpat Rai Publ. Company (P) Ltd.
3. S.J. Arceivala waste water treatment.

Reference

1. S. K. Garg " Environmental Engineering Vol-II (Khanna Publication)
2. CPHEEO manual on sewerage and sewage treatment
3. Metcalf and Eddy "waste water treatment"

IV Semester
Department of Civil Engineering

Course Code : CEP 260 **Course : Environmental Engineering-II**

L : 0 Hrs., T : 00 Hrs., P : 2 Hrs., Per Week **Total Credits : 01**

Course Outcomes

The student would be able to :

Determine the various characteristics of wastewater and understand the significance of various characteristics of wastewater along with the knowledge of disposal standards and necessity of waste water treatment.

Understand various principles and instruments used in waste water analysis.

Practicals

Minimum 8 of the following

Determination of pH.

Determination of Organic & Inorganic Solids.

Determination of MLSS & MLVSS

Determination of BOD test.

Study practical of COD test.

Determination oil & Grease.

Determination of Sludge volume Index.

Determination of Kjheldhal nitrogen.

Determination of Sulphate by using spectrophotometer.

Analysis of adsorption capacity of adsorbents using spectrophotometer.

Determination of proximate analysis using muffle furnace.

Text Books

1. B.C.Punmia," Waste Water Engineering" - Laxmi Publication

2. G.S.Birdie, "Water Supply & Sanitary Engineering"- Dhanpat Rai Publ. Company (P) Ltd.

3. S.J. Arceivala waste water treatment.

Reference

1. S. K. Garg " Environmental Engineering Vol-II (Khanna Publication)
2. CPHEEO manual on sewerage and sewage treatment
3. Metcalf and Eddy "waste water treatment"

Semester: IV Semester

Department of Civil Engineering

Course Code : HUT 260 **Course : Effective Technical Communication**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcomes

CO1: Students understand the process and types of communication.

CO2: Students understand the objectives of technical communication and role of audience in effective communication.

CO3: Students learn basic grammar rules, develop technical writing skills and produce effective workplace documents.

CO4: Students understand the process of research writing and develop skills to write documents for higher studies.

CO5: Students develop skills to enhance visual appeal of documents.

CO6: Students understand strategies for effective oral communication for professional needs.

Syllabus

Unit 1.Technical communication

Definition, Barriers of Communication, Objectives of technical communication, Promoting the product, Audience recognition and involvement.

Unit 2. Technical Writing

Process of Technical Writing, Types of Technical Writing

Letters: Job application, Job Description, and Resume, Sales, enquiry, complaint, order, follow- upletters, Organizational announcements, Minutes of the Meeting

Reports: Trip, Progress, Incident, Investigative, Feasibility/Recommendation reports, Project reports

Unit 3. Grammar and Editing

Functional Grammar: Punctuations, Mechanics, Active/ Passive, Transformation of sentences

Unit 4.Orientation in Research

Writing proposals, SOP, writing articles for journals and conferences, abstract and executive summary, thesis writing, Case Study evaluation, Case Studies

Unit 5. Preparation of Documents

Visual appeal: Document design, graphics, tables, poster presentations User manuals, Brochures,Fliers

Unit 6.Effective Oral Communication

Non- Verbal Communication, Public speaking, Presentations, Group Discussion and Interviews

Text Books

1. Gerson and Gerson, "Technical Communication: Process and Product", 2018, Pearson
2. Meenakshi Raman and Sangeeta Sharma, "Technical Communication: Principles and Practice",2015, Oxford University Press

Reference

1. S. Kumar and Pushplata, "Communication Skills", 2016, Oxford University Press
2. C. Muralikrishna and Sunita Mishra, "Communication Skills for Engineers", 2016, Pearson
3. Andrea Rutherfoord, "Basic Communication Skills for Technology", 2012, Pearson
4. Barun K Mitra, "Effective Technical Communication: A Guide for Scientists and Engineers",2006, Oxford

IV Semester
Department of Civil Engineering

Course Code : CET 299-1 **Course : OE-I Basic Building Components**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcomes

1. Able to understand various structures
2. Able to understand components of building with its utility.
3. Able to understand material used for building construction with suitability.

Unit I

Types of Civil Engineering structures : Building, Types of building, Load bearing and framed structures.

Foundations : Necessity and types of foundations. Introduction to shallow foundations and deep foundation. Causes of failures of foundations and remedial measures.

Unit II

Masonry : Types of Wall: load bearing, partition, parapet wall and cavity walls, Masonry and its types.

Various building units and its terminology used header, stretcher, bonds, closure bricks. Masonry construction using various building units such as Mud bricks, stone, bricks, AAC, hallow concrete block with suitability and constrains.

Unit III

Lintel and arches : functions and suitability, types chajjas. Pre cast lintels & Arches. Stairs: Types of stairs, functional design of stairs. Introduction of Lift and Escalators.

Unit IV

Floors : Necessity and Types of flooring- floor tiles, synthetic & Ceramic Tiles, vitrified tiles, chequered tiles, paving blocks, wooden floor.

Roofs : Types of Roof, roof material, Thermal Insulation treatment methods, water proofing

Unit V

Doors and Windows: Purpose materials of construction and types.

Unit VI

Plastering : Necessity, procedure of construction, Pointing, Mortar with its types. Painting: White washing, colour washing and distempering new materials & Techniques.

Damp Proofing : Causes and effect of dampness. Various methods of damp proofing, Damp proofingof plinth. Heat and sound insulation.

Text Books

1. Building Construction: B. C. Punmia, Laxmi publication Pvt. Ltd. New Delhi and distributor,1984 &later 2008
2. Building construction by Sushil Kumar, 16th Edition, Standard Publishers Distributors, 2006.
3. Building Construction Material by S.K. Duggal, 4th edition, New Age International, Reprint Nov.2014

Reference

1. Building Construction and Materials by Singh Gurcharan, Standard Publisher and Distributor, Standard Publishers Distributors, 2003
2. Alternative building Materials and Technologies: K. S. Jagdish & B. V. Venkatarama Reddy, Newage international Publishers, 2007.

IV Semester
Department of Civil Engineering

Course Code : CET 299-2 | **Course : OE-I Basics of Environment Pollution**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits: 03**

Course Outcomes

The students would be able to;

1. Understand the basic knowledge about causes and effects of air pollution along with its control methodology.
2. Understand the basics of solid waste management.

UNIT-I

Introduction to air pollution : definition of air pollutants, atmosphere and its zone, composition of various gases is clean atmosphere, air pollution episodes, classification of air pollutants with their sources, effects of air pollutants on man, animals, plants and materials

Lapse rates & atmospheric stability, meteorological parameters affecting dispersion of air pollutants, plume behavior, wind rose, estimation of stack height, greenhouse effect, atmospheric ozone depletion, climate change and relevant topics

UNIT-II

Ambient air sampling, stack sampling, principles of collection of particulate and gaseous pollutants. **Air pollution control:** control of air pollutants by process change and by using various equipments.**Vehicular pollution :** Pollutions due to diesel and petrol engines and its control, latest standards.

Noise pollution: Sources, ill effects, control measures.

UNIT-III

Introduction to solid waste management: Classification, sources, components, quantity and per capita contribution of solid waste. Physical and chemical characteristics, sampling and analysis of solid waste.

Legislation and bylaws in SWM.

Collection and transportation of solid waste: methods of collection, equipments used for collection and transportation of solid waste. Transfer stations and its economic use. Transportation routes for rejuse vehicle.

UNIT-IV

Solid waste processing : Various processing methods and choice of methods.

Solid waste disposal methods : composting: Principles, methods of composting, factors affecting composting. Sanitary land filling: site requirement & various methods of sanitary land filling. Incineration: principles, types, merits and demerits.

Introduction to E-waste management : Sources of E-waste, its characteristics, its effects and its disposal methodology.

Concept of life cycle assessment, organic waste division, waste to wealth, climate change and circular economy

Text Books

1. Air pollution by M. N. Rao and H. V. N. Rao, (Tata McGraw Hill publications)
2. Environmental Pollution Control Engineering by C. S. Rao, (Wiley Estern Ltd.)
3. Solid waster management in developing countries by A. D. Bhide and B. B. Sundaresan (INSDOC, New Delhi)

Reference

1. Environmental Engineering , Volume I,II, III by B.C. Punmia, Laxmi Publishers
2. Environmental Engineering , Volume I,II, III by S.K.Garg, Khanna Publishers

IV Semester

Department of Civil Engineering

Course Code : CETH41 **Course : Construction Technology**

L : 04 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 04**

Course Outcomes

1. Students will be familiar with the technology of major construction as outlined in the listed topic headings.
2. Students will be able to describe, analyze, compare and evaluate the technology of special construction
3. Student will be aware of some of the problems that can be associated with poor management of construction projects.

Syllabus

- **Form work:** Design and scaffolding, slip form and other moving forms techniques. Mechanization in rebar fabrication.
- **Steel and composites construction methods:** Fabrication and erection of structures including heavy structures.
- **General Principles of Pre-Fabrication** (Precast & Pre-Engineered Building), Comparison with monolithic construction, Types of Prefabrication, site and plant prefabrication, Economy of prefabrication, Modular coordination, Standardization , Planning for Components of prefabricated structures, Dis-unitining of structures.
- **Mechanization through construction methods/technologies :** segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology.
- **Prestressed concrete construction :** Principle, methods, materials, Tools and equipment for the construction of a prestressed structures.

Reference

1. Purifoy, Schexnayder, Construction Planning, Equipment and Methods, Tata Mc Graw Hill
2. Edward Nawy , Concrete Construction and engineering Handbook , CRC Press
3. National Building Code -2005.

IV Semester
Department of Civil Engineering

Course Code : CETM41 **Course : Basics of Civil Engineering**

L : 04 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 04**

Course Outcomes

The students would be able to,

1. Understand and describe basics of Building Components & Planning , Construction Materials , Survey and Transportation Engineering, Environment and Water Resource Management.
2. Apply basic principles of various types of Civil Engineering work to solve problems.
3. Apply and analyze various functional principles/ components of Civil Engineering work and compare possible solutions.
4. Compare and interpret the data / information/concepts/principle and used for solving the problems associated with basic infrastructure development.

Unit –I: Introduction to Civil Engineering (7 Hrs)

Role of civil Engineers in the infrastructure development. Selection of site, basic functions of buildings, types of buildings – Residential, Public, Commercial, and Industrial. Principles of planning, orientation of buildings, introduction to bye-laws regarding building height, setbacks (margins) open space requirement, F.S.I., Carpet area, built up area, , plinth area, ventilation.

Unit II- Building Components & Building Planning (5hrs)

Foundation and superstructure, functions of foundation, types of shallow and deep foundations, Suitability in different situation, plinth, walls, lintels, beams, columns, slabs, roofs, staircases, Floors, doors & windows, various levels of structure, Study of Building plans, ventilation, basics of plumbing and sanitary works. Types of construction as Load Bearing, Framed, and Composite

Unit III - Construction Materials (5Hrs)

Basic engineering properties and uses of construction materials: ; cement, bricks, timber , stone, aggregates, bitumen, glass, FRP, composite materials , reinforcing steel, structural glazing, structural steel; Concrete types: PCC, RCC, and Ready Mix Concrete.

Unit – IV: Basics of Survey and Transportation Engineering (7 Hrs) Basics of Surveying

Principles of survey, Various types of maps and their uses; introduction to levelling, concept of benchmarks, reduced level, contours, theodolite, Total Station. Introduction to GIS, GPS and their applications.

Transportation Engineering

Various modes of transportation, Classification of road, Types of Pavements, Traffic Signs, markings, signals, Road traffic safety.

Unit –V Environment and Water Resource Management (8 Hrs)

Water supply - Sources, Standards of purified water and its requirements, impurities in water and their effects; Purification of water, Storage of water , water conveyance systems; Ground water recharge- Roof top rain water harvesting and methods. Waste Management: Collection and Disposal methods of Liquid and solid wastes.

Unit –VI: Instrumentation in Civil Engineering (4 Hrs)

Various Instruments used in construction, condition monitoring equipments Foundation Engineering Potentiometers, Strain Gauges. Management of Utilities using telemetry & SCADA System. Role of Engineers in Sustainable Development.

Books Recommended

1. Elements of Civil Engineering: By S. S. Bhavikatti
2. Basic Civil Engineering: By Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain.
3. Concrete Technology: By M. S. Shetty
4. Surveying and Levelling: By Kanetkar and Kulkarni
5. Water Supply And Sanitary Engineering: By G. S. Birdie, J. S. Birdie
6. Building Construction: By Sushil Kumar
7. Transportation Engineering: By Khanna & Justo
8. Building Drawing Design: By Shah and Kale
9. Construction Planning , Equipments And Methods: Robert Peurifoy, Clifford J. Schexnayder, Aviad Shapira and Robert Schmitt.

V Semester
Department of Civil Engineering

Course Code : CET 351 **Course : Surveying and Geomatics**

L : 03 Hrs., T : 01 Hrs., P : 00 Hrs., Per Week **Total Credits: 04**

Course Outcomes

The course will enable the students to:

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
2. Translate the knowledge gained for the implementation of Civil infrastructure facilities
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, remenElectronic Distance Measut, Global Positioning System, Photogrammetry and Remote Sensing.

Syllabus

Unit - I : (8 Hours)

Introduction to Surveying : Principles, Linear, angular methods, survey stations, Survey lines-ranging. Bearing of survey lines, local attraction, Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Plane Tabling : Intersection / Resection method.

Unit - II : (10 Hours)

Levelling : Principle of levelling - booking and reducing levels; differential, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling.

Unit - III : (10 Hours)

Theodolite Survey : Vernier theodolite, Measurement of horizontal and vertical angle; Gales traverse table, Total Station : Parts of a Total Station - Accessories - Advantages and Applications, Procedure for total station survey, Errors in Total Station Survey, Calculation of area and volume.

Unit - IV : (10 Hours)

Curves : Elements of simple and compound curves - method of setting out - Elements of Reverse curve- Elements of transition curve, Vertical curves.

Unit - V : (7 Hours)

Photogrammetry Surveying aerial photograph, relief and tilt displacements, fight planning, drone survey planning.

Text/Reference Books

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advance Surveying: Total Station, GIS and Remorte Sensing, Pearson India, 2006
2. Manoj, K Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011 3 Bhavikatti, S.S, Surveying and Levelling, Vol. I and II, I. K. International, 2010
3. Chandra, A. M. Higher Surveying, Third Edition, New Age International (P) Limited, 2002
4. Anji Reddy, M., Remote sensing Geographical Information system, B. S. Publication, 2001
5. Arora, K. R. Surveying, VoI-II and III, Standard Book House, 2015

V Semester

Department of Civil Engineering

Course Code : CEP 351 | **Course : Surveying and Geomatics Lab**

L : 00 Hrs., T : 00 Hrs., | **Total Credits: 01**

P : 02 Hrs., Per Week

List Of Practical's

Any Six

1. Measurement of fore and back bearing by compass
2. Measurement and booking of levels by auto level
3. Profile & cross section levelling
4. Traversing by plane table survey
5. Measurement of Horizontal angle by mechanical vernier Theodoite
6. Measurement of Vertical angels by mechanical vernier Theodoite
7. Traversing by total station
8. To plot contour map

Two day survey camp on any one using advanced survey instruments

- Contouring
- Road Survey
- Lay outing
- Location of Boundary and area calculation

V Semester
Department of Civil Engineering

Course Code : CET 352 | **Course : RCC Structures**

L : 03 Hrs., T : 01 Hrs., P : 00 Hrs., Per Week | **Total Credits: 04**

Course Outcomes

On completion of the course, the students

1. Will be able to understand the basic concepts of reinforced concrete analysis and design.
2. Will be able to understand the behavior and various modes of failure of reinforced concrete members.
3. Will be able to analyze and design various reinforced concrete members viz. beam, slab, column, and footings by limit state Design method as per I.S.456-2000.
4. Will be able to understand, analyze and design simple prestressed concrete beams.

Syllabus

Limit state Design Concept, Partial safety factors, load factors, stress-strain relationship, stress block parameters, failure criteria, Balanced failure mode and primary compression failure mode, Use of I.S. 456:2000.

Limit state of collapse in flexure : Design of one way single span and continuous slabs, cantilever slabs. Analysis and Design of Singly reinforced Beams, "T" and "L" beams. Design of Dog- leggedStaircases.

Limit state of collapse under compression axially loaded short column with axial load, uniaxial moment, Interaction diagram / Charts. Isolated footing for axially loaded columns.

Limit state of collapse in shear & bond : design of beam for shear, shear span, post cracking resistance, shear mechanism approach, shear failure modes and collapse load, interaction of shear, flexure and axial force.

Prestressed Concrete : Introduction to IS:1343, 2012 Properties of high grade materials, concepts of prestressed concrete, method of prestressing, losses in prestressing. Various methods of prestressing particular reference to Freyssinet, MangnelBlaton and Gifford Udall system . Ultimate Load Carrying Capacity of Prestressed Concrete Section, Analysis of rectangular, and I section. Design of prestressed concrete rectangular beam

Limit state Design Concept, Partial safety factors, load factor, stress train relationship, stress block parameters, failure criteria, Balanced failure mode and primary compression failure mode, Use of IS 456-2000, Introduction to IS 875

Text Books

1. Reinforced concrete design, S.N. Sinha, Tata McGraw-Hill publications
2. Prestressed concrete, N KrishnaRaju, Tata McGraw-Hill publications
3. RCC Design and draining by Neelam Sharma, S. K. Kataria & Sons.
4. Practical Design of Reinforced concrete structure HPK Ghosh Karuna Moy, PHI Lear Pvt. Ltd.

References

1. Fundamentals of RC Design, M. L. Gambhir, PHI Learning Pvt. Ltd.
2. Limit State Design of Reinforced concrete, P. C. Varghese, PHI Learning Pvt. Ltd.
3. RCC Design, Menon&Pillai, Tata McGraw-Hill publications
4. Reinforced Concrete: Limit State Design, Ashok K. Jain, Nem Chand Publishers.
5. Design of RCC structural Elements Vol. I, II, S. S. Bhavikatti, Ned age International Publish.
6. Limit State Theory and Design of Reinforced Concrete, Karve S.R. and Shah V.L, Structures Publications, Pune. 2007.

Bureau of Indian Standards, I.S:456- 2000: Plain and reinforced concrete, Code of Practice, Bureau of Indian Standards. Bureau of Indian Standards 1967. S.P. (16): Design Aids for Reinforced Concrete. (Interaction Charts Only), Bureau of Indian Standards and IS:1343-2012.

V Semester

Department of Civil Engineering

Course Code : CEP 352 **Course : RCC Structures**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Outcomes

On completion of the course, the students

1. Will be able to understand the basic concepts of reinforced concrete analysis and design.
2. Will be able to analyze and design various reinforced concrete members, using software/excel sheets.

List of Practical's.

Mini Project

- Analysis of small RCC building using appropriate software.
- Manual design of building components such as
  - Beams
  - Columns
  - Slab
  - Foundations
- Preparing detailed drawing

V Semester

Department of Civil Engineering

Course Code : CET 353 **Course : Transportation Engineering**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcome

After the completion of the course in Transportation Engineering, the student should be able to:

1. Define and describe different objectives and requirements of Highway Development and Planning, Alignments.
2. Explain, Discriminate and Design various Geometric Features of Highways.
3. Understand, analyse, apply and evaluate the tests on Highway materials, construction methodsand design the components of Pavements,
4. Understand, analyse, apply and evaluate the parameters of Traffic Engineering.

Unit I

Highway Development & Planning

Principles of Highway planning, Road development in India, Classification of roads, network patterns, Planning, Surveys. Highway Alignment: Requirements, Engineering Surveys.

Unit II

Highway Geometric Design

Cross Section elements, carriageways, camber, stopping & overtaking sight Distances, Horizontal alignment - Curves, design of super elevation, widening, transition curves, vertical curves.

Unit III

Pavement Design

Types of pavements & characteristic, Design parameters, Axle & Wheel load, tyre pressure, ESWL for dual Wheels, repetitions, Group Index & IRC method of flexible pavement design. Analysis of load & temperature stresses of rigid pavement, joints.

Unit IV:

Highway Construction materials, methods & Maintenance

Highway Materials: Properties of sub grade and pavement component materials, Tests on subgradesoils, aggregates and bituminous materials. Application of Geosynthetics, Earthen/Gravel road, Water Bound Macadam, Wet Mix macadam, Bituminous pavement, Cement Concrete pavement. Pavement failures, maintenance and strengthening measures.

Unit V

Traffic Engineering

Traffic characteristics (Road User, Driver and Vehicular characteristics), Traffic Studies (Volume studies, speed studies, parking studies and accident studies), Traffic Safety (Causes and types of accidents, Use of intelligent transportation system), Traffic controls (Road markings, Traffic signs,traffic signals)Text Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised, 10th Edition,Nem Chand & Bros, 2017
2. Kadiyalai, L.R., 'Traffic Engineering and Transport Planning', Khanna Publishers.
3. Partha Chakraborty and Animesh Das ' Principles of Transportation Engineering, PHI Learning,
4. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.

Reference Books

1. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineeringand Traffic Analysis', 4th Edition, John Wiley
3. IRC Codes

V Semester
Department of Civil Engineering

Course Code : CEP353 **Course : Transportation Engineering**

L : 00 Hrs., T : 00 Hrs., P :02 Hrs., Per Week **Total Credits: 01**

Course Outcomes

On successful completion of the course students will be able to;

1. Determine the various properties of aggregates
2. Determine the various properties of bitumen
3. Determine the various properties of soil subgrade

Test on Soil

1. CBR Test
2. AASHO Classification
3. Test on Stabilized soil

Test on Aggregate

1. Specific Gravity & Water Absorption
2. Crushing Value test on Aggregate
3. Abrasion Value test on Aggregate
4. Impact Value test on Aggregate

Test on Bitumen

1. Penetration Test
2. Softening Point Test
3. Ductility Test
4. Specific gravity of bitumen

Study experiments

1. Bituminous Mix Design
2. Road Construction Machineries
3. Stripping Test on Bituminous Mix

V Semester
Department of Civil Engineering

Course Code : CET 354 | **Course : Foundation Engineering**

L: 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits : 03**

Course Outcomes

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

1. Plan the Geotechnical exploration program for major civil engineering structure.
2. Analyze the stability of slopes and solve the field problems.
3. Predict the earth pressure on the resisting structures.
4. Understand various geotechnical designs and select type of foundations.
5. Study the various techniques of ground improvement and apply them on field.

Unit I

Geotechnical Exploration

Principle methods of subsurface exploration, IS 1892, geophysical methods, open pits and shafts, types of boring, number, location and depth of boring for different structures, types of soil samples and samplers. Collection & shipments of samples, plotting of bore log and sampling record. Standard penetration test, corrections for field N- values &correlations for obtained design soil parameters,pressure meter test.

Unit II

Lateral Earth Pressure

Earth pressure at rest, active and passive pressure, general & local states of plastic equilibrium in soil. Rankine's and Coulomb's theories of earth pressure, Effects of surcharge, submergence.. Graphical construction by Culmann for simple cases of wall- soil system for active pressure condition. Concept of reinforced earth retaining wall.

Unit III

Stability Of Slopes

Causes and types of slope failure, stability analysis of infinite slopes and finite slopes, center of critical slip circle, slices method and friction circle. Slopes with pore pressure consideration. Taylor's stability numbers & stability charts, method of improving stability of slopes, types, selection and design of graded filter, concept of soil nailing.

Unit IV

Shallow Foundation

Different types of shallow foundation and modes of failure. Bearing capacity of soil By Terzaghi's theory, Design criteria and codal provisions. Effect of water table on bearing capacity, correction factor for shape and depth of footing. Bearing capacity estimation on sand and clays from N-value, factor affecting bearing capacity.

Settlement of shallow foundation: elastic and consolidation settlement, differential settlement, control of excessive settlement. Proportioning the footing for equal settlement. Plate load test: Procedure, interpretation for bearing capacity and settlement prediction, limitations, IS code method.

Unit V

Pile Foundations

Classification of piles, constructional features of cast-in-situ & pre-cast concrete piles. Pile driving methods. Load transfer mechanism of axially loaded piles. Pile capacity by static formula & dynamic formulae. Pile load test and interpretation of data, group action in piles, spacing of piles, negative skin friction and its effect on pile capacity, general feature of under reamed piles. Settlement of pile group, Introduction to IS2911.

Unit VI

Ground Improvement

Introduction to different methods of ground improvement.

Text Book

1. Basic and Applied soil Mechanics by Gopal Ranjan & A.S. Rao, New Edge Int. Ltd. (2004)
2. Foundation analysis and design by Bowles J. E., McGraw Hill International publishing (1995)
3. Soil Mechanics in Theory and Practice by Alam Singh, Asia Publisher and Dist. (1975 & later).
4. Geotechnical Engineering : A practical problem solving approach by Sivakugan N., Das B. M., Cengage Learning, 2011

Reference

1. Advanced Foundation Engineering: V. N. S. Murthy, CBS Publications (2007)
2. Principles of Foundation Engineering: B. M. Das, Cengage Publications (2011)
3. Foundation Engineering Manual : By N. V. Nayak
4. NPTEL Course
5. IS codes

V Semester
Department of Civil Engineering

Course Code : HUT356 | **Course : Organizational Behavior**

L: 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits: 00**

Course Outcomes

CO1: Students will have better understanding of organisational evolution. **CO2:**

Students will be in a position to analyse and interpret organisational issues

CO3: Students will apply the knowledge of transactional analysis in their interpersonal relationshipsfor smooth professional functioning.

CO4: Knowledge of culture, diversity and leadership would enable the students to evaluate the group behaviour.

CO5: The knowledge of various factors will help the students to create personal and collective happiness at workplace.

CO6: Students will recall the knowledge to foster multiculturalism at work place.

Syllabus

Unit 1: Evolution of Organisational Behaviour

Nature, Scope, Definition and Goals of Organizational Behaviour; Fundamental Concepts of Organizational Behaviour; Models of Organizational Behaviour; Emerging aspects of Organizational Behaviour.

Unit 2: Organisational Issues

Job Motivation: Maslow's Need Hierarchy, Herzberg's Two factor theory, Vroom's Expectancy Theory, Theory of Intrinsic Motivation by Ken Thomas, Johari Window Job Satisfaction: Factors affecting Job satisfaction. Ways to increase Job Satisfaction

Job Stress: Definition, Sources of Stress and Ways to handle Job Stress at Organizational level and Individual level

Unit 3: Interpersonal Behaviour

Interpersonal communication and Feedback: Transactional Analysis. Managing misbehaviour at work: Sexual abuse, Substance abuse, cyberslacking Aggression, violence, insensitivity towards differently able, Conflict Resolution.

Unit 4: Group Behaviour

Organisational Leadership: Styles of Leader: Charismatic and transformational leadership, stewardship and servant leadership, Leadership of culture and diversity, creating high performance culture, strategic leadership, Situational Leadership.

Unit 5: Well-being at work place

Gainful Employment

Individual Level: Happiness and subjective well-being, social capital: Hope and optimism.**Organisational**

Level: Nudge, Relaxation and Meditation.

Interpersonal Level: Empathy, gratitude, kindness, humour, humility, building relationship.

Unit 6: Organisational Process

Organisational Climate: Concept, determinants and OCTAPACE model; Organizational Culture: Organisational behaviour across Cultures.

Text Books

1. Aswathappa K., Organizational Behaviour, Himalaya Publishing House, New Delhi. 2008.
2. Singh, B.P and Chhabra, T.N, Organisational Theory and Behaviour, Dhanpat Rai and Co. Pvt.Ltd., New Delhi, 2000.
3. Fred Luthans (2017), Organizational Behaviour,
4. Stephen Robbins, Timothy Judge, and Neharika Vohra (2016) "Organizational Behaviour", Pearson
5. P.G Aquinas (2006) Organizational Behaviour, Excel Books, India

Reference

1. Moss, J. Unlocking happiness at work: How a data-driven happiness strategy fuels purpose, passion and performance. US: Kogan Page,2016., ISBN 9780749478070,
2. Newstorm, John W., Organisational Behaviour: Human Behaviour at work, Tata McGraw-Hill Pub.Co.Ltd, New Delhi.
3. Pareek Udai., Understanding Organizational Behavior, Oxford University Press, New Delhi, 2007.
4. McGrath, S.J. "Basic Managerial Skills for all" PHI

V Semester
Department of Civil Engineering

Course Code : CETH51 **Course : Fire Fighting System**

L : 04 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 04**

Course Outcomes

On completion of this course the students would be able to;

1. Understand and describe different fire fighting systems with its component including various pipes, fixtures and fittings.
2. Analyse water based fire fighting system and Fire Extinguishing units
3. Design & layout of Fire sprinkler systems, Fire sprinkler hydraulics for buildings.

Unit-I

Fire fighting systems

a) Introduction

Basic concepts, Factor Affecting Fire Flow, Classification of Buildings based on Occupancy as per NBC part IV, Types of Construction, Fire zones. Absolute Safety, Classification of Fire Safety Systems, Passive Fire Safety, Active Fire Safety , Selection, installation, and maintenance of automatic fire detection & Alarm system. Selection, installation, and maintenance of First aid fire extinguisher, Water-Based Systems, Codes & Standards,

b) Fire dynamics

Fire Dynamics, Fire Tetrahedron, Fire Extinguishing Methods and agents, , Fire Classes, Comparison of Classes, Fire Class & Extinguishing Agent, Automatic Fire Suppression System, Foam, Chemical, Gaseous Systems, Types of Extinguishing Agents

Unit-II

Fire sprinkler systems-NFPA 13

Introduction, Water Based Fire Suppression Systems, Fire Extinguishing Properties, Disadvantages, NFPA Standards Related to Fire, Sprinkler Head Construction, Temperature Ratings, Configuration, Sprinkler System description, types and components.

Unit-III

a) Design & layout

Description, Riser, Feed Main, Cross Main, Branch Line, Typical piping Layouts- Grid, Loop, Tree, Hazard Classification- Light, Ordinary, Extra, Special, Floor Area Limitation, Protection Area of Sprinkler, Spacing, Location, Sprinkler pipe sizing- pipe schedule method.

b) Fire sprinkler hydraulics-NFPA 20

Automatic sprinkler system, Design criteria of Automatic sprinkler system, Sprinkler piping pressure, Material, Piping Joints, Wall thickness, Sprinkler Head K-Factor, Basic Design Circuit, Sprinkler Density Requirement, Hydraulic Analysis, Design Density, Area/Density Curves, Flow Adjustments, Riser Detail, wet riser system design, Hazen- Williams Formula for Friction Loss, Sprinkler System Water Supplies.

Unit-IV

Stand pipe systems-NFPA 14

Introduction-Hose Connection, Valve, Nozzle and its projection angle and velocity, Hose Storage Device, Hose Station, Hose reel installation. Typical hose layout for interior fire fighting ,Size of hose for interiar fire fighting, potemtial force of fire fighting, Selection criteria, Combined Standpipe Classes-Class I, Class II, Class III. Fire DepartmentConnection, Standpipe Types- Dry, Wet, Requirements, System Zoning, System Demand, System Design-Location, Number, Interconnection, Minimum Size, Pressure Limitation, Supply and Flow Rates, Fire Tank Sizing, Hydraulic Calculation Procedure, Drains and Test Riser.

Unit-V

Private hydrant and hose systems-NFPA 14

Introduction, Types, Yard Hydrants, pressure at the hydrant, System design like number, size, arrangement, location and Flow Indicators.

Note : 1. Some guest lectures may be planed for specialized topics.

2. Some case studies may be discussed

References

1. Fire safety in buildings by V.K.Jain, 2 Edition, Anabhi publication.
2. A Hand Book of Fire Technology by Gupta .R.S., Anabhi Publication.
3. Manual of fire safety in building by Indian building congress: Forwarded and Recommended by CPWD India, Anabhi Publication.
4. National Building code of India, Part IV, Bureau of Indian standard, New delhi,1982
5. SFPA Hand Book for Fire Protection Engineering, NFPA
6. Electrical safety, Fire safety Engineering and Safety management by S.R.
7. IS 1644-Fire exit requirement and personal hazards
8. IS 3844- 1989 code of practice for installation and maintenance of internal fire hydrant and hosereel on premises

IS 13039-1991 code of practice for external Hydrant system- provisions and maintenance.

V Semester
Department of Civil Engineering

Course Code : CETM51 **Course : Basics of Surveying in Civil Engineering**

L : 04 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 04**

Course Outcomes

The students will be able to

1. Instruments for taking linear and angular measurements.
2. Plot plans and sections 3.Understand the topography

Unit I

Introduction to Surveying

Basic principles of Surveying, Different types of surveys, COMPASS SURVEY: Basic terms and definitions –Bearing and angles-Magnetic declination, Traversing - Local attraction

Unit II

Levelling

Basic definitions, Dumpy level, Leveling staffs, Terms in Leveling, Methods of spirit leveling, Bookingof readings, Balancing of sights, Auto level, Contour characteristics, methods of contouring, uses,

Unit III

Plane Tabling and Tacheometric survey

Plane table surveying-Plane table instruments and accessories- merits and demerits- methods Intersection, - traversing. Tacheometric Surveying: Introduction, Principal of stadia measurement, tacheometric equation for inclined sights.

Unit IV

Theodolite Traversing

Measurement of horizontal and vertical angles, Optical Theodolites, Traverse adjustment, computation of latitudes & departures, consecutive & independent coordinates, Total Station

Unit V

Remote Sensing and GIS

Introduction, principles, applications. Aerial photogrammetry: Introduction, scale of vertical photograph,computation of length of line, determination of height of lens for a vertical photograph. Relief displacement

Text Books

1. Surveying: Vol.I and Vol. II by Dr. B.C. Punmia, Laxmi Publication- New Delhi.
2. Surveying and Levelling Vol. II by T.P. Kanetkar and S.V. Kulkarni, Pune Vidyarthi Publication.
3. Surveying- Vol. II and III by Dr. K.R. Arora Standard Book House.
4. Advanced Surveying- Total station, GIS and Remote Sensing by Satheesh Gopi. R. Sathikumarand N.Madhu, Pearson publication.49

References

1. Textbook of Surveying by C. Venkataramaih, Publisher: Orient Blackswan
2. Surveying and Levelling (vol I & II) by S. S. Bhavikatti, I K International Publ. House3.H i g h e r Surveying by Dr A.M. Chandra, New Age International
4. Fundamentals of Surveying by Roy, S.K., Prentice Hall India, New Delhi
5. Surveying and Leveling by Subramanian, R., Oxford University Press, New Delhi
6. Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.
7. Remote sensing and Image interpretation by T.M Lilles and, R.W. Kiefer,. And J.W Chipman, 5th edition, John Wiley and Sons India

VI Semester

Department of Civil Engineering

Course Code : CET 355 **Course : Estimating and Costing**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 03**

Course Outcomes

The students should be able to,

1. Read the drawings, understand the details, identify the appropriate items and calculate the quantity of items involved in civil Engineering work including earthwork of road / canal and reinforcement of RCC members by applying the basic principles of computation.
2. Prepare approximate and detailed estimate of load bearing & framed structure and various civil engineering works. Evaluate the financial aspect of project.
3. Draft the specifications of various items involved in civil engineering works considering the object, type and principles of specification. Analyze the unit rate of item referring the specification of item and local or regional current market rates of materials and labors.
4. Prepare contract documents, float tender and select proper agency for execution of work according to types of contract. Supervise the work, prepare bills and maintain the accounts of works. Collect logical information and evaluate the present fair value of property for various purpose of valuation & Fixation of standard rent.

UNIT I

- Definition and Purpose of estimate, Mode and Unit of measurement of various items as per IS1200 , Work charge establishment, Contingencies, PWD as construction agency, Technical sanction, Administrative approval, Price escalation, Current schedule of rates .
- Types of estimate, Objective, use and methods of approximate estimate, Estimate of earthwork of road & canal.
- Detailed estimate of RCC members with detailed calculation of reinforcement and bar bending Schedule.

UNIT II

- Methods of detailed estimateDetailed estimate of building for RCC framedtructure.

UNIT III

- Contract, Contract documents, essentials of contract, major conditions of contract & clauses, Types of contract with advantage & disadvantage and its suitability, Earnest money and Securityeposit.

- Tender notice, Tender documents, Types of tender, Acceptance and rejection of tender, unbalanced tender, Pre-qualification & Post qualification of contractor, Drafting of short tender notice, Liquidated damage,rbitration.

UNIT IV

- Specification definition, Objectives, Principles of writing specification, Sources of information, Types of specifications, developing and drafting of details specifications of important items ofbuilding and roadorks.
- Rate Analysis: Definition, Purpose, factors affecting, Task works per day, Rate analysis of important items of work. Comparison of analyzed rates with CSRates.

UNIT V

- Valuation: Purpose, Factor affecting, Cost, price & value, Definition of various values used, Freehold & lease hold property, Methods of valuation of property, valuation of residential building
- Outgoing, gross income, net income, sinking fund, rent fixation, obsolescence, depreciation and its methods.capitalized value,yearurchase.

NOTE : Questions based on unit I and unit II are compulsory and set for 15 marks each. Remainingthree questions set on units III, IV and V with internal choice for 10 marks each. Duration of questionpaper is 4 hours.

Text Books

- M. Chakraborti ,Estimating, costing, specification and valuations in civil engineering, edition 2010 and latest,UBS publication culcutta.

References

- B. N. Dutta , Estimating and costing ,Publisher S. Dutta & company lucknow, Feb 1999 edition. UBS publisher distributors Ltd, 5, Ansari road ,Newelhi.
- S. P. Chandola& V.N.Vazirani, Estimating and costing , Edition 2010 and latest , khanna Publishers, 2-B, Nath market, Naisarak,elhi.
- S.C. Rangwala Estimating Costing and valuation , edition 2011, Charotar publishing house, opposite Amul dairy, Court road Anand.
- D. D. Kohli ,.Estimating costing and accounts (civil), 10th edition, S Chand andompany.
- Roshan Namavati ,Valuation of Real Properties

VI Semester
Department of Civil Engineering

Course Code : CEP 355 **Course : Estimating and Costing Lab**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Outcomes

The students should be able to,

1. Identify the appropriate items; calculate the quantity of items involved in proposed civil engineering work by referring the requirements and detailed drawings.
2. Draft the specifications of various items by considering the object, type and principles of specification. Analyze the unit rate of items by referring the specification and regional current market rates involved in civil engineering work.
3. Prepare the approximate and detailed estimate of load bearing and framed structures, earthwork of road and several civil engineering works and evaluate the financial aspects of project.
4. Draft tender notice for execution of proposed work. Determine depreciation, book value, capitalized value and present fair value of property to evaluate the valuation of property for various purposes and fixation of rent.

Practical

Minimum 8 of the following

1. Units and mode of measurements as per IS 1200 of various items of building and road works with current local market rates of constructional materials.
2. Preliminary estimate of building using plinth area method.
3. Detailed estimate of important RCC Member with detailed calculation of reinforcing steel with bar bending schedule.
4. Detailed estimate of earthwork of hill road for 1 km length with graphical presentation of L-section of road, typical cross sections and Mass haul curve on full graph sheet.
5. Detailed estimate of residential/ public building with RCC framed structure
6. Draft a detailed specification for 5 major items of Bldg and road works.
7. Analyze the unit rates for 5 major items of Bldg and road works.
8. Draft a short tender notice for execution of proposed construction work.
9. Determination of annual depreciation, total depreciation and book value of property
10. Fixation of standard rent of building / property from the given data.
11. Determination of Capitalized value of a property.

VI Semester

Department of Civil Engineering

Course Code : CET 356 **Course : Steel Structures**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 03**

Course Outcomes

On completion of the course, the students will be able to:

1. Learn the analysis and design methods of structural steel
2. Understand the fundamentals of structural steel fasteners and connections
3. Analyze steel structures and their members, under the action of different loads
4. Design of simple structural steel connections and elements of steel structures like tension members, compression members, beams and columns

Unit I

Steel as a structural material, various grades of structural steel, properties, various rolled steel sections and their properties, Introduction to IS 800:2007,808,816,875 etc, Design philosophies, Plate(Local) buckling, Classification of cross-sections (flexure).

Structural Steel Fasteners: Introduction, Behavior of bolted and welded connections (types, designations, properties, permissible stresses), failure of bolted and welded joints. Strength of bolt and strength of weld, Efficiency of joints, Design of simple, bolted and welded connections.

Unit II

Design of axially loaded members (a) Tension members: Introduction, Net area, Shear-lag.

(b) Compression members: Introduction, Euler's buckling theory, Classification of cross- sections (buckling), Imperfection factor.

Analysis of roof truss of an industrial building : Introduction to different components of industrial shed, types of trusses, assessment member forces under various loads (dead load, live load and wind load).

Unit III

Design of simple beams: Introduction, Flexural behaviour of beams which does not undergo lateral buckling, Flexural behaviour of beams which undergo lateral buckling, Shear behaviour, Web buckling and Crippling, Design strength in bending, Design strength in shear, Limit state serviceability – Deflection, Introduction to plate girder.

Unit IV

Design of columns: Introduction, Design of axially loaded rolled sections, built up columns, lacedand battened columns, Column base: slab base and gusseted base under axial loads.

Text Books

1. Design of steel structures by N. Subramanian (Using IS: 800-2007) Publisher: Oxford University Press, India
2. Limit State Design of Steel Structuresby S. K. Duggal Publisher: Tata Mc Graw Hill
3. Limit State Design of Steel Strucutres : Based on IS: 800-2007 by Dr. Ramchandra, Virendra Gehlot Scientific Publishers
4. Design of steel structures by K. S. Sairam Publisher: Pearson Education

References

1. McCormac, J. C., Nelson, J.K. Jr., Structural Steel Design. 3rd edition. Prentice Hall, N.J., 2003.
2. Galambos, T.V., Lin, F.J., Johnston, B.G., Basic Steel Design with LRFD, Prentice Hall, 1996
3. Steel Design Manual by ELBS Publications
4. Salmon, C.G. and Johnson, J.E., Steel Structures: Design and Behavior, 3rd Edition, Harper &Row, Publishers, New York, 1990.

VI Semester
Department of Civil Engineering

Course Code : CEP 356 **Course : Steel Structures**

L : 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Outcomes

On completion of the course, the students will be able to:

1. Analyze and design bolted, welded connections, tension members, compression members, beams and columns, and understand their detailing
2. Develop analytical and design skills while working in a team

Term Work

Design of simple connections

- Welded
- Bolted

Design of steel members for

- Tension
- Compression
- Flexure

Design of steel frame using appropriate software preparing detailed drawing using Auto CAD for all steel designs

VI Semester
Department of Civil Engineering

Course Code : CET 357 | **Course : Hydrology and Water Resources**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits: 03**

Course Outcomes

The students would be able to,

1. Understand the importance of hydrological data and parameters. Describe various hydrological parameters and develop the parametric correlation between the hydrological parameters.
2. Analyze measured hydrological parameters by applying various theories and equations.
3. Analyze hydrological data and apply for determination of design discharge/flood of water resource project using various mathematical techniques and equations.
4. Understand water resource management Importance of , groundwater recharging and reservoir planning and analysis.

Unit - I

- **Introduction :** Definition and its applications in civil engineering. Hydrological cycle, Meteorological factors affecting hydrological cycle, hydrological equation and its application.
- **Precipitation :** Definition, various forms. Determination of optimum numbers of rain gauges and estimation of missing rainfall data. Various methods of estimation of mean rainfall over the catchment. Hyetograph.

Unit - II

- **Initial losses from precipitation :** Interception and depression storage.
- **Evaporation :** Definition, mechanism, factors affecting evaporation. Measurement of evaporation by IS class 'A' pan, Evaporimeter. Estimation of evaporation by using empirical formulas and water budget equation.
- **Evapotranspiration :** Definition, mechanisms and factors affecting evapotranspiration. Estimation of evapotranspiration.

Unit - III

- **Infiltration :** Definition, mechanism and factors affecting infiltration. Infiltration capacity curve and its application. □ -index and its application.
- **Runoff :** Definition, components of runoff, factors affecting runoff and estimation methods.

Unit –IV

Hydrograph Analysis : Definition, types and components of flood hydrograph. Base flow separation from flood hydrograph, Derivation of unit hydrograph from flood hydrograph. Analysis of unit hydrograph by superposition method and S-curve method. Triangular hydrograph and its analysis.

Unit - V

Statistical Methods for estimation of Peak flood and Design flood : Probability and recurrence interval of a flood magnitude. Frequency of point rainfall. Gumbel's probability distribution method. Rational method. Design floods and its types. Indian Standard guideline for design floods for dams (IS: 11223-1985). Risk, reliability, safety factor and safety margin of design flood. Impact of climate change on extreme flow events.

Unit - VI

Reservoir Planning : Types of reservoir, Selection of site for Reservoirs, Fixing of reservoir levels; Different storage zones in reservoir; Determination of storage capacity by mass curve method, Reservoir sedimentation; Multipurpose water resource projects. Economic planning of reservoir.

Water Resources in India need of sustainability of water necessity of ground water recharge and its method and watershed management

Text Books

- Jaya Rami Reddy P.: Hydrology and Water Resource Engineering, University Science Press, Edition 2013 & Latest
- Subramanyam K.: Hydrology and Water Resource Engineering, Tata McGraw Hill publication, Edition 2011 & Latest.

References

- S. K. Garg, Hydrology and Water Resource Engineering, Khanna publication, Edition 2015 & Latest
- B.C. Punmia, Water power engineering, Laxmi Publication.
- Water Resources Engineering by Ray K. Linsley (McGraw-Hill series in water resources and environmental Engineering).

  Applied Hydrology by Ven Te Chow, David R. Maidment, Larry W. Mays (McGraw-Hill Book Company)

VI Semester
Department of Civil Engineering

Course Code : CET 358-1 **Course : Advanced Structural Analysis (Elective I)**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcome

On completion of the course students will be able to;

1. know the deflected shape of structures for understanding response due to various loads.
2. analyze the beam and frames for vertical and horizontal loads and draw SFD and BMD.
3. calculate forces in members of truss due to load by stiffness method.
4. analyze the non-prismatic beam for understanding its behavior

Syllabus

Approximate Method structural analysis for multistoried frames with lateral loads (portal and cantilever method), Approximate methods for vertical loads i.e. Substitute method etc. (Max three bay three storeys)

Analysis of non-prismatic fixed beams by **Column analogy Method,** Application to beams, Calculations of stiffness factors and carryover factors for non-prismatic member.

Introduction to **Flexibility Method** of structural analysis, influence coefficients, Choice of base determinate structure and redundant forces, compatibility equations and solution of simple beam problems with sinking effect, up to 3 degree of indeterminacy.

Basic concept, Degree of Freedom. Formulation of elemental/local stiffness matrix and global stiffness matrix for **Plane Truss.** Transformation Matrix, Assembly of Global/ Structural stiffness matrix up to (8x8). Member load matrix including lack of fit, temperature, Assembly of Global/ Structure load matrix, Solution to problems with maximum degree of freedom three.

Formulation of element/local **Stiffness Matrix** and global stiffness matrix for beam members (without axial deformations) for **Continuous Beams**, Assembly of global/ structural stiffness matrix, Member load matrix due to various type of loading, Assembly of global/ structure load matrix up to Three Elements. Solution to problems with maximum degree of freedom Three.

Formulation of element/ local Stiffness Matrix and global stiffness matrix for **Plane frame** members (without axial deformations), Transformation matrix Assembly of global/ structural stiffness matrix, Member load matrix due to various type of loading, temperature, Assembly of global/ structural load matrix. Solution to Plane frame problems with maximum degree of freedom three. Introduction to FEM

References

1. Timoshenko S. P.; &Young D.H. "Theory of Structures; International edition", McGraw Hill,1965.
2. C.S.Reddy"Basics Structural Analysis" McGraw Hill3rd edition 2010
3. Ghali, A.; & Neville A. M. "Structural Analysis A Unified Classical and Matrix Approach (4th Edition)", E & FN SPON; Van Nostrand Reinhold, 1997.
4. Wang, C. K. "Indeterminate Structures", Prentice Hall of India; 2000.
5. Schodek, D.L. "Structures (4th Edition)", McGraw Hill International editions; 1983.
6. Meghre, A.S.; &Deshmukh, S.K. "Matrix Methods of Structural Analysis (1st Edition)", Anand; CharotarPubls, 2003.
7. Weaver J.M.; & Gere, W. "Matrix Analysis of Framed Structures (3rd edition)", Van Nostrand Reinhold; New York, 1990.
8. Jain, O.P. & Arya, A.S. "Theory and Analysis of Structures; Vol. I & II", Nemchand Brothers; Roorkee.
9. KrishnamurthyD., "Theory of Structures", J.K. Jain Brothers, 1976.
10. RajsekaranS.,Shankarasubramanian G. "Computational of StructuralMechanics", Prentice Hallof India Pvt. Ltd., New Delhi, 2001.
11. P.N.Godbole,R.S.Sonparote, S. U. Dhote. "Matrix methods of Structural Ananlysis", PHI learning PvtLtd.publishers
12. G.S. Pandit& S.P. Gupta. "Structural Analysis-Matrix Approach", Tata McGraw Hill PublishingCo. Ltd.

VI Semester
Department of Civil Engineering

Course Code : CET 358-2
L : 03 Hrs., T : 00 Hrs.,
P : 00 Hrs., Per Week

Course : Irrigation Engineering (Elective I)
Total Credits : 03

Course Outcomes

The students would be able to:

1. Identify, describe and explain the necessity and scope of irrigation engineering.
2. Understand the various types of irrigation schemes, its components and their functions.
3. Apply knowledge of basic science and engineering principles for analysis and design of various components of irrigation scheme.
4. Justify and describe the necessity of various repairs and maintenance work and its methodology for various components of irrigation scheme.

Unit I

Introduction : Necessity ,Importance, Benefits and ill effects of Irrigation; Classification of Irrigation schemes; General principles of flow, lift, perennial, inundation Irrigation systems; Comparative study of sprinkler and drip Irrigation systems.

Water Requirement of Crops : Suitability of soils for Irrigation, Standards of Irrigation water; PET-R method of crop water requirements; Depth & frequency of Irrigation; Command area classification, Relation between duty and delta; Factors affecting duty; Principal crops in India; Crop rotation; Methods of assessment of Irrigation water.

Unit II

Dams : Classification of dams on basis of use, hydraulic design and materials; Factors governing, selection of type of dam.

Gravity Dam : Definition; forces acting on gravity dam; stability requirements; Theoretical & practical profile of gravity dam; Low & High dam; Galleries.

Unit III

Earthen Dams : Types and component parts of earthen dams, seepage and drainage arrangements; Failure of earthen dams; Plotting of pheratic line for homogeneous earthen dams with horizontal filters; Stability checks.

Unit IV

Spillways : Types of spillway, design principles of ogee spillway; Spillway gates – vertical lift, radial, rolling and drum; Energy dissipation methods on downstream of spillways.

Diversion Head Works : Component parts of diversion headworks; Causes of failure of weirs on permeable foundation; Bligh's Creep theory; Dr. Khosla's theory for design of weirs on permeable foundations.

Unit V

Canals: Types of canal; Alignments of canal; Cross section of Irrigation canals; Balancing depth; Losses in canals.

Canals In Alluvial Soils : Kennedy's silt theory – Design procedure, silt supporting capacity, drawbacks; Lacey's silt theory - Definition of initial, final and permanent regime channels, Lacey's Regime equation, channel design procedure, drawbacks; Garret's diagram and Lacey's diagram for channel design.

Lined Canals : Design procedure, types of lining, relative merits and demerits of canal lining, Economics of canal lining

Unit VI

Canal Regulation Works : Theoretical aspects of location, objects, classification, components and schematic section of Head Regulator, Cross regulators, canal escapes, Canal falls and canal outlets.

Cross Drainage Works : Theoretical aspects of location, objects, classification, components and schematic section of aqueducts, siphon aqueducts, super passage, canal siphon, inlets and level crossings.

Water Logging and Land Drainage : Causes, effects, preventive measures of water logging, Types of drains, Layout of tile drains system, flow of ground water to drains.

Soil Erosion : Causes, effects and control

Text Books

1. Santosh Kumar Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers.
2. B. C. Punmia, Irrigation Engineering and water Power Engineering, Laxmi Publications.

References

1. K. R. Arora, Engineering and Hydraulic Structures, Standard Publishers.
2. R. K. Sharma, Irrigation Engineering and Hydraulic Structures, S. Chand Publications.
3. G. L. Asawa, Irrigation and Water Resources Engineering, New Age International Publishers.
4. P. N. Modi, Irrigation Engineering, Standard Publishers.

VI Semester Department of Civil Engineering

Course Code : CET358-3 **Course : Air Pollution and Control (Elective I)**

L: 3Hrs, T: 0Hrs, P: 0Hrs per **Total credit : 3**

Course Outcomes

The students would be able to:

1. Understand and describe various types of air pollutants and its sources, air pollution parameters, Effects of air pollutants.
2. Determination techniques of air pollutants along with the importance of meteorological parameters in air pollution. methods of sampling and analysis of air pollutants
3. Knowledge about Control of various air pollutants methodology and modelling.
4. Knowledge of noise pollution its management and control.

Unit I

Introduction to air pollution, Air pollutants, Sources, classification, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects- Smoke, smog and ozone layer disturbance, Greenhouse effect.

Unit II

Meteorological parameters affecting air pollution, Micrometeorological processes lapse rate and atmospheric stability, plume behavior, wind rose, pollution rose, Stack height computation, Regional air quality models, Source inventories and significance, Gaussian and other dispersion model.

Unit III

Air sampling and pollution measurement methods, principles and instruments, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods.

Unit IV

Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators, scrubbers and other removal methods like absorption, adsorption, precipitation etc. Biological air pollution control technologies, Indoor air quality.

Unit V

Noise pollution : Sources, Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels, calculation of weighted noise level index; plane, point and line sources, multiple sources; outdoor and indoor noise propagation, effects of noise on health, annoyance rating schemes;

Unit VI

Introduction to vehicular pollution, special noise environments; noise standards and limit values; noise instrumentation and monitoring procedure, Noise indices, Noise management and control methods.

Text Books

1. Rao M.N. and Rao H.V. N, Air Pollution, Tata Mc-Graw Hill Publishing Co. New Delhi, Third Edition, 1992.
2. Rao C.S., Environmental Pollution Control Engg, New Age International Pvt. Ltd. Publishers,2006.
3. Y. Anjaneyulu, A textbook of air pollution & control technology, Allied publishers
4. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987

References

1. Air Pollution, NEERI Manual.
2. Nevers N.D, Air Pollution control Engineering, Editions Civil Engineering series, 1995.
3. Stern A. C, Air pollution, Tata McGraw Hill International, Vol I to IX

VI Semester

Department of Civil Engineering

Course Code : CET 358-4

Course : Advanced Foundation Engineering (Elective I)

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week

Total Credits: 03

Course Outcomes

On successful completion of the course students will be;

1. Able to study basic features and theory regarding shallow and deep foundation.
2. Able to design different type of shallow and deep foundation on different soils
3. Able to predict and calculate settlement of shallow and deep foundation.
4. Able to familiarize with different types of deep foundations such as piles, piers, casinos, well foundation etc.

Shallow Foundation

Ultimate bearing capacity of shallow foundation:

Overview of Meyerhof's, Hansen, Vesic, and IS 6403 theories of bearing capacity under centric, inclined & vertical loads. Ultimate & allowable load bearing capacity computation for shallow foundation such as strip; isolated; combine footing.

Settlement analysis

Elastic and consolidation settlement estimation of foundation; settlement analysis from a field test, by penetration test (SPT & SCPT), plate load test and pressure meter test, IS 8009.

Raft foundations

Necessity; Types of rafts; Bearing capacity and settlement of rafts foundation.

Deep Foundation

Axially loaded pile

Necessity; Types of deep foundation; pile; pier; caissons, piles in sand, Piles in pure clay computation of skin resistance by; □, □ and □ methods; load carrying capacity by cyclic pile load test its interpretation of data, negative skin friction and its effect on pile capacity, T - Z curve method, IS 2911.

Settlement analysis of single pile and group of pile. Special types of deep foundation:

Necessity and Constructional features of different piles such as Anchor pile; Micro pile; Secant pile, Screw pile etc. Special features of under-reamed piles.

Well foundation

Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well, griplength. Design of component part of well foundation.

Machine foundation Introduction

to Machine foundation.

Text Books

1. Principles of Foundation Engineering: Das B.M., PWS publishing co., (1999)
2. Advanced Foundation Engineering: Murthy V.N.S., CBS Publishing, (2007)
3. Foundation Engineering Handbook: H.Y. Fang, CBS Publishing (2004)
4. Soil Dynamics: Shamsher Prakash, McGraw Hill Publishing (1981)

References

1. Foundation Engineering: Verghese P.C., Prentice Hall of India, (2007)
2. Theory & practice of foundation Design: Som N.N. & Das S.C., Prentice Hall Edn, Asia (2002)
3. Foundation for high rise structures : Katzenbech, Leppla and Choudhary (2016)
4. Principles of Soil Dynamics: B. M. Das, G. V. Ramana, Cengage Learning (2010)
5. NPTEL Course on Foundation Engineering by Dr. Deepankar Choudhury, Dr. T. G. Sitaram

VI Semester
Department of Civil Engineering

Course Code : CET358-5 **Course : Pavement Design [Elective I]**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcomes

1. The student can understand, analyze, apply and evaluate various parameters required in the design of flexible and rigid pavement of highway and airfield pavements.
2. They can analyze, apply and evaluate the analysis of flexible and rigid of highway and airfield pavements.
3. They can analyze, apply and evaluate the design of flexible and rigid of highway and airfield pavements.
4. Understand and perform field test for pavement distress measurements and design For the strengthening of pavements.

Unit I [06 Hours]

General: Types and component parts of pavements, Factors affecting design and performance of pavements.

Design parameters: Design wheel load, Standard axle load and wheel assemblies for road vehicles. Under carriage system of aircraft. Tyre and contact pressure, contact area, imprints, computation of ESWL for flexible and rigid pavements. ESWL of multiple wheels, repeated loads and EWL factors. Pavement behaviour under transient traffic loads. airport traffic areas, Serviceability concept.

Unit II [06 Hours]

Analysis of flexible pavement : Stress, strain, deflection analysis one layer system by Boussinesq's. Burmister's two layer theory, three layer and multi-layer theories; wheel load stresses, Layer equivalent concepts.

Analysis of Rigid pavement : Stress and deflections for rigid pavements due to load and temperature, influence charts Wheel load stresses, warping stresses, frictional stresses, combined stresses.

Unit III [07 Hours]

Highway Flexible pavement design : Empirical, semi-empirical and theoretical approaches, Triaxial (Kansas state method), Design using the latest IRC code, AASHTO method of design.

Unit IV [07 Hours]

Highway Rigid pavement design : Design of CC pavement for roads and runways as per IRC latest code, design of joint details for longitudinal joints, contraction joints and expansion joints, PCA and AASHTO methods.

Unit V [06 Hours]

Airfield flexible pavement design : Mcleod (Canadian method), FAA, US Corps of engineering, CBR.

Airfield rigid pavement design : Definitions of ACN, PCN, LCN, Calculation of LCN value, Ultimateload analysis and yield lines patterns method, FAA, PCA & LCN methods.

Unit VI [06 Hours]

Pavement testing and evaluation : Pavement Failures in both Flexible Pavement & Rigid Pavement - types and causes, condition surveys and surface evaluation for unevenness, rut depth, profilometers, bump integrators, falling weight deflectometer.

Failures of pavements : Causes and remedies, maintenance and rehabilitation of pavements. **Strengthening of pavements :** Benkleman beam deflection study.

Text Books

1. Pavement Design by Srinivasa Kumar, R, Orient Black Swan, 2013.
2. Pavement Evaluation and Maintenance Management System by Srinivasa Kumar, R, Universities Press (India) Private Limited
3. Pavement Analysis and Design by Yang H. Huang 2nd Edition, Pearson Education, Inc., Pearson Prentice Hall Company.
4. Airport Engineering by G Venkatappa Rao, Tata McGraw - Hill Publishing Company Ltd.
5. IRC-37: (Latest Code) Guide lines for Design of Flexible Pavement
6. IRC-58: (Latest code) Guide lines for Design of Plain Jointed Rigid Pavement for highways

References

1. Principles of Pavement Design by H.J.Yoder and Witczak, John wiley and sons.
2. Pavement Engineering: Principles and Practice, Third Edition Book by Rajib Basu Mallick and Tahar El-Korchi Publisher: CRC press, Taylor and Francis
3. Airport Engineering by Khanna and Arora, Nemchand & Brothers.
4. Highway Engineering by Khanna O.P, Justo C.G., Nem Chand Publishers
5. MOST Specifications for Road and Bridge Works, 1994 (Third Revision)
6. NPTEL Course on Pavement Design.

VI Semester

Department of Civil Engineering

Course Code : CET 358-6

L: 03 Hrs., T : 00 Hrs.,
P : 00 Hrs., Per Week

Course : Advanced Construction Materials (Elective I)Total

Credits: 03

Course Outcomes

1. The students will be able to classify and select advance construction materials on the basis oftheir properties.
2. The students will be able to identify and suggest ceramic and polymeric materials for improvement in functional performance of building components.
3. The students will be able to demonstrate the use of industrial by-products and waste in new buildingmaterials.
4. The students will be able to explore use of new construction chemicals and repairing methods.

Unit I

Construction Materials : Classifications, selection criteria for construction materials. Materials engineering concept: Consideration of physical, Mechanical, thermal, and other Properties. Nature of materials.

Laboratory measuring devices : Introduction of Dial gauge, LVDT, strain gauge, proving ring, load cell

Unit II

Ceramic Materials : Mechanical, thermal and electrical properties. Processing of ceramic, classification, refractories, glass, uses and application

Polymeric Materials : Plastic as engineering material, Thermoplastics, Thermosetting plastic, Elastomers. Properties, additives and compounding of polymers, methods of processing of polymers, uses and application, Scope of polymers in civil engineering

Unit III

Ferro-cement, Fibre reinforced concrete, high performance concrete, special types of concretes. Stucco plaster, new construction materials e.g. cladding, false ceiling and panelling, etc.

Unit IV

Composites : requirements, classification, microscopic composites, macroscopic composites, their applications and properties.

Thermal performance of materials and insulating materials

Acoustics and sound proofing methods and materials **Unit**

V

Engineering wood products

Use of waste products and industrial by-products: Fly ash, micro-silica, GGBFS and other mineral products

Geo-textiles and geo-synthetics, geogrids

Unit VI

Construction Chemicals : Property modifiers, materials for repair and retrofitting, water proofing material and process of construction,

References

1. **Engineering materials:** Polymers, Ceramics and composites, Bhargava A K, PHI Publications, Second edition, 2012
2. Materials for Civil and Construction engineers, Michael S Mamlouk, John P Zeniewski, Pearson Publications, Third edition, 2014
3. Engineering Materials, Rangawala S.C., Chortor Publications
4. Building Materials, S.K. Duggal, New Age International Publications, Fourth edition, 2012
5. Building Materials Technology Structural Performance & Environmental Impact, L. Reed Brantley, Ruth T. Brantley, McGraw Hill Inc Publications
6. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann
7. **Concrete:** Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro,McGrawHill, 2006.

VI Semester

Department of Civil Engineering

Course Code : CET 358-7 | **Course : Biology for Engineers [Elective I]**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits: 03**

Course Outcomes

On successful completion of the course students will be able to;

1. Understand the applicability and importance of biology in various scientific disciplines
2. Understand applicability of genetics, biomolecules, enzymes, informal transfer, macromolecular analysis, metabolism, microbiology.

Syllabus

Module 1. *(2 hours)- Introduction*

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries.

Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2. *(3 hours)- Classification*

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization-Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3. *(4 hours)-Genetics*

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics.

Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4. *(4 hours)-Biomolecules*

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units

and lipids.Module 5. (4 Hours). Enzymes

Purpose : To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6. *(4 hours)- Information Transfer*

Purpose : The molecular basis of coding and decoding genetic information is universal Molecularbasis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code.

Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7. *(5 hours). Macromolecular analysis*

Purpose: How to analyses biological processes at the reductionistic level

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8. *(4 hours)- Metabolism*

Purpose: The fundamental principles of energy transactions are the same in physical and biological world.

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonicand exergoinc reactions. Concept of Keq and its relation to standard free energy.

Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2

+ H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9. *(3 hours)- Microbiology*

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

References

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S.A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wileyand Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

VI Semester
Department of Civil Engineering

Course Code : CET 359-1 **Course : Advanced Concrete Technology (Elective II)**

Total Credits: 03

Course Outcome

1. The students will be able to understand the microstructure of the hydration product of cement.
2. The students will be able to analyse and interpret fresh and hardened properties of concrete.
3. The students will be able to demonstrate different types of concrete with its properties and uses.
4. The students will be able to explore to use methods for concrete mix design with quality control approach.

Unit I

Structure of Concrete : Introduction, Structural Levels, Structure of Concrete in Nanometer Scale: C –S– H Structure, Transition Zone in Concrete, Micro-structural Engineering

Unit II

Fresh Concrete : chemical and physical processes of hydration and interaction; Admixtures: Review of types and classification; chemical composition; origin and manufacture; actions and interactions; usage; effects on properties of concretes, methods of test; applications.

Rheology of concentrated suspensions, pastes, mortars and concretes; workability, segregation and bleeding. Theory and principles governing the correct placing and compaction of concrete.

Unit III

Hardened Concrete: Strengths of Hardened Concrete, Stress – Strain Relationship and Constitutive Equations, Dimensional Stability—Shrinkage and Creep, Durability Impact, Dynamic and fatigue behaviour of concrete, behaviour of concrete under fire.

Unit IV

Fiber-Reinforced Cementatious Composites, High-Strength Cementatious Composites, Polymers in Concrete, Shrinkage-Compensating Concrete, Self-Compacting Concrete, Engineered Cementatious Composite, High-Volume Fly Ash Concrete, Structural Lightweight Concrete, high grade concrete

Unit V

Concrete Fracture Mechanics: Introduction, Linear Elastic Fracture Mechanics, The Crack Tip Plastic Zone, Crack Tip Opening Displacement, Fracture Process in Concrete.

Non Destructive Testing : Rebound hammer, UPV and core test (method of testing, calculation of output and the interpretation of results)

Unit VI

Concrete mix design, Basic considerations and choice a mix proportions, various methods of mix designs including IS Code method.

Quality control and quality assurance of concrete, selection of control procedures, Measures of dispersion, Acceptance criteria, Quality management in concrete construction, probability and sampling theory, tests of significance, curve fitting and regression, repeatability and reproducibility, control charts. Role and limitations of statistics in concrete technology.

References

1. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGrawHill, 2006.
2. Orchard D.F., Concrete Technology -Vol I., Applied Science Publishers (Fourth Edition) 1979.
3. Neville A.M and J.J. Brook; Properties of Concrete, Addison Wesley 1999.
4. Advance Concrete Technology by Zongjin Li, Published by John Wiley & Sons, Inc., Hoboken,New Jersey.

VI Semester
Department of Civil Engineering

Course Code : CET 359-2 | **Course : Open Channel Flow (Elective II)**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits : 03**

Course Outcomes

(1) Identify Hydraulic behaviour of open channel and their causes.

(2) Predict the behaviour of open channel in different situations.

(3) Analyze and design of artificial channels with rigid boundary.

(4) Apply this knowledge in the fields like irrigation, flood control and water shed management.

Unit I

Introduction to Open channel Flow : Review of types of channels and its suitability, Geometrical parameters of channel, Classification of flow, Basics equations and velocity distribution of channel sections.

Unit 2

Uniform Flow in rigid Boundary channels : Characteristics of Uniform Flow, Chezy's formula, Manning's formula , factors affecting roughness coefficient, Most economical section of channels, computation of uniform flow. Design of Rigid boundary channels.

Unit 3

Non Uniform flow (Energy and momentum principles) : Specific energy curve, critical flow computations, first and second hydraulic exponent, specific force.

Measurement of Discharge and velocity:- Venturi Flume , Standing wave flume, Broad crested weir, Current meter.

Unit 4

Gradually Varied Flow Theory : Dynamic equation of GVF, Classification of channels bed slope ,surface profiles for combination of slopes, control sections, transitional depth, analysis of GVF.

Unit 5

Gradually Varied Flow Computation : Computation of water surface profile by numerical and analytical approaches, Direct step method, Direct Integration method. Bresse's method , advanced numerical method.

Unit 6

Rapidly Varied flow- Hydraulic Jump : Theory, Elements and Characteristics of hydraulic Jump in Rectangular channel, Length, Height and Location of jump, types of jump, general equation for jump in Prismatic channels, jump in horizontal and sloping rectangular channel. Energy dissipation and other uses of jump, Ogee spillway, Culverts hydraulics.

Text Books

(1) K. Subramanya, Flow in Open Channels, Tata Mc Graw Hill,2009 and latest edition (4th).

References

(1) V.T.Chow, Open Channel Hydraulics, Tata Mc Graw Hill,2009.

(2) M.H.Chaudhury, Open Channel Flow , Prentice hall of India 2008 and later edition.

(3) NPTEL Web Resources on Open Channel Flow / Hydraulics.

VI Semester
Department of Civil Engineering

Course Code: CET 359-3 | **Course : Solid Waste Management (Elective II)**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week | **Total Credits : 03**

Course Outcomes

The students would be able to;

1. Explain and describe various sources, characteristics, processing methods and disposal methodsof solid waste.
2. Identify and explain necessity of solid waste management, its components and various rules and legislation.

Unit-I

Introduction to solid waste management: necessity, functional elements of solid waste management, Organization structure, Impact of solid waste on environment, MSW rules 2016, Construction and demolition (C&D) waste management rule 2016, Swachh Bharat mission, PPP model.

Unit-II

Characteristics of solid wastes : Classification, sources, composition, quantity, Factors affecting thequantity and per capita contribution of solid waste. Physical and chemical characteristics, samplingand analysis of solid waste.

Unit-III

Segregation, Collection and transportation of solid waste : Segregation methods, methods of collection, equipment's used for collection and transportation of solid waste. Transfer stations and its economic use. Estimation of truck capacity, vehicles routing

Unit-IV

Solid waste processing : Methods of processing like Salvaging, pyrolysis, RDF, biogas recovery, choice of methods and merits and demerits of various processing methods.

Unit-V

Solid waste management : Composting, Principles, methods of composting, factors affecting composting. Design of composting pit, vermi composting.

Sanitary land filling : Site requirement, methods, leachate management. Solid waste mining, designof landfills, bio-gas, bio-mining, fire hazards.

Incineration : Principles, types, merits and demerits.

Text Books

1. Bhide A.D. and Sundaresan B.B. Solid wastemanagement in developing countries by (INSDOC,New Delhi)
2. Sasikumar K. and Gopi Krishna S. Solid waste management, PHI learning pvt ltd, Delhi
3. Bhatia H. S. Environmental Pollution and Control, Galgotia publication, Delhi

VI Semester
Department of Civil Engineering

Course Code : CET 359-4 **Course : Ground Improvement (Elective-II)**

L: 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 03**

Course Outcomes

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

1. Identify problematic soils and their associated issues.
2. Understand the various ground improvement techniques.
3. Propose suitable remedial techniques and their design.

Introduction to ground improvement techniques : Concepts and essential requirements of ground improvement, classification of ground improvement techniques, economic considerations and suitability.

Compaction and Consolidation : Equipments and control of field compaction, surface compaction and deep compaction, vibrofloatation. Preloading and static loads and by vacuum, accelerated consolidation by sand drains, free strain and equal strain cases, design of sand drain layout.

Stabilization : Methods of stabilization, mechanical stabilization, organic and inorganic stabilizing agents and their characteristics - lime, cement, lime, flyash, bitumen and chemicals.

Grouting : Materials and methods of grouting, grout volume and grouting pressure, grout requirements and tests, grouting of rock foundation of dams.

Reinforced earth and Geotextiles : Basic theory of reinforced earth, materials, method, application and design of reinforced earth, characteristics of reinforced earth masses; geotextiles, geogrids and geosynthetics, their basic features, functions and applications.

Stone columns : Application, layout feature, procedures of installation, vibrofloat and rammed stone column, unit cell concept, load transfer mechanism, settlement in stone column, methods of improving the effectiveness of stone column, Design for stone column layout for intended requirements.

Text Book

1. Ground Improvement Techniques : P. P. Raj, Prentic Hall of India (2005)
2. Engineering Principles of Ground Modification : M.R. Housmann, McGraw Hill (1990)
3. Principles of Foundation Engineering: Braja M. Das, Cengage Learning Publications (2011)

References

1. Constructional and Geotechnical Methods in Foundation Engineering : R.M. Koerner, McGrawHill (1985)
2. Design and Construction of Stone Column: FHWA Report No. Rd 83/026, (1983)
3. Advanced Foundation Engineering: V. N. S. Murthy, CBS Publications (2007)
4. NPTEL Course on Ground Improvement
5. Foundation Engineering Manual : Nayak N. V., Dhanpat Rai Publications (2009)

VI Semester
Department of Civil Engineering

Course Code : CET 359-5 **Course : Urban Transportation Planning (Elective II)**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 03**

Course Outcomes

The students will be able to;

1. Explain the characteristic of urban transportation, structure of urban transportation and classification of urban roads.
2. Describe the objectives of transportation planning, data collection for planning and environmental impact analysis.
3. Explain the process of travel demand forecasting & need for interaction in different modes of transportation.
4. Describe the use of intelligent Transport System and need to accommodate non-motorized transports.

Unit I [06 Hours]

Urbanization and Transportation: Importance of urban area, Structure of urban area, urban design, use of road space, classification of urban roads.

Unit II [06 Hours]

Urban Transportation Characteristics : Factors influencing transportation needs, transportation demand, type of trips, mode of travel, urban transportation scene in India. Road congestion, impact of transport on environment.

Unit III [07 Hours]

Urban Transportation Planning Process : Urban transportation planning objectives, urban transportation system, urban transportation planning process, data collection, surveys for data collection, environmental impact analysis.

Unit IV [08 Hours]

Travel Demand Forecasting : Trip generation and attraction analysis, trip distribution models, modelsplit analysis, route assignment analysis.

Unit V [06 Hours]

Public Transportation : Bus transport characteristics, bus route planning, performance indicator, types of rail transit, rail transit system development in Indian cities, Integrated Transport System, Modes of Integrated transport systems.

Unit VI [07 Hours]

Innovations in Urban Transportation : Need for innovative approaches, track guided bus, BRT, GIS, ITS, functional areas of ITS. Non-motorized Urban Transportation : Importance of pedestrian facilities, sidewalks, PUP & POB, bicycle facility planning, types of bicycle facilities, bicycle network planning, bicycle parking, cycle - rickshaws.

Text Books

1. Traffic Engineering and Transport Planning: L R Kadiyali, Khanna Publishers.
2. Urban Transportation: D. J. Victor & S. Ponnuswamy, Tata McGraw – Hill

References

1. Transport Planning and Traffic Engineering: C A O' Flaherty, BUTTERWORTH- HEINEMANN
2. Urban Development and Sustainable Transport P. Anbalagan, Bookwell Publications
3. Urban Transportation Planning 2nd Edition by Michael Meyer, Eric Miller, McGraw - Hill

VI Semester
Department of Civil Engineering

Course Code : CET 359-6 **Course : Repairs & Rehabilitation of Structures (Elective-II)**

L : 03 Hrs.,T : 00 Hrs.,P : 00 Hrs.,Per Week **Total Credits : 03**

Course Outcomes

Student shall be able to

1. visualize and elaborate the root causes of damage and deterioration of structures
2. identify, suggest and explain damage assessment method based on condition of structure
3. aware of different available repairing materials and their specific application
4. aware of different available repairing techniques and case studied

Unit 1

Strength and Durability of structures 10

a. Inspection, identification and diagnosis of common defects and failure with possible cause in buildings and infrastructural utilities

b. Holistic Models of deterioration in RCC

c. Corrosion in RCC: Type of corrosion, causes of corrosion of embedded reinforcement in concrete, effect of reinforcement, corrosion on concrete. Oxidation process between two metals in contacts and its preventive maintenance.

d. Permeability in concrete

Unit 2

Damage Assessment methods 10

a. Concept of structural auditing

b. Condition Survey

c. Non Destructive testing of Structures (UPV, Rebound hammer, Half cell potentiometer, RCPT,Cover meter, Core testing, etc.)

d. Performance evaluation

Unit 3

Repairing materials 10

a. Grouts, FRP wrapping materials, Micro concrete, Adhesives and sealants, Corrosion inhibitors,Special types of concretes etc.

Unit 4

Techniques for Repair and Protection Methods 10

a. Shoring, Underpinning, Jacketing, FRP application, Grouting, Guniting, Case studies

References

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials,Maintenance and Repair”, Longman Scientific and Technical UK, 1991.
2. Shetty M.S., "Concrete Technology -Theory and Practice", S.Chand and Company, 2008
3. Hand Book on repair and rehabilitation of RCC building, CPWD, GOI, New Delhi
4. Ravishankar.K., Krishnamoorthy.T.S, " Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
5. Dov Kominetzky.M.S., "Design and Construction Failures, TMH

VI Semester

Department of Civil Engineering

Course Code: CET 359-7

L: 03 Hrs., T : 00 Hrs.,
P : 00 Hrs., Per Week

Course : Numerical Method for Civil Engineers (Elective - II)

Total Credits : 03

Course Outcomes

1. An ability to apply numerical methods to obtain approximate solutions to mathematical problems involved in civil engineering domain.
2. Ability to analyse and evaluate accuracy of various numerical methods and their applicability incivil engineering.

Syllabus

Solution of algebraic equations : Bisection Method, Regula Falsi Method, Newton-Raphson method

Interpolation & Extrapolation techniques : Newton's Foreword Difference Technique, Newton's Backward Difference Technique

Numerical integration techniques : Simpson's method, Trapezoidal method, Gauss Quadrature method

Solution of linear algebraic equations : Direct methods and iterative methods Eigen values problems: Direct, Jacobi, Givens Method, Householders method.

Text Books

1. S.S.Sastry, Introductory methods of numerical analysis, PHI,4 Edition,2005.
2. Numerical methods, Principles, Analyses and Algorithms: Srimanth Pal, Oxford University Press, New Delhi.
3. Numerical Mehtods: Salvadori M., PHI learning Pvt, ltd., New Delhi, (1987)

VI Semester
Department of Civil Engineering

Course Code: CEP360 **Course Name : Comprehensive Viva**

L: 00 Hrs., T : 00 Hrs., P : 02 Hrs., Per Week **Total Credits : 01**

Course Objective

1. To assess the comprehensive knowledge gained in the core courses relevant to the branch
2. To comprehend the questions asked and answer them with confidence

Course Outcome

1. The students will be confident in discussing the fundamental aspects of any engineering problem / situation and give answer in dealing with them.

Mode of Assessment

Oral examination – To be conducted weekly during the slot allotted for the course in the curriculum for 10 marks.

Written examination – To be conducted by the department as part of internal examination - objective type and multiple choice questions (4 choices) covering all the courses up to and including VI semester (1 hour duration) – 15 marks.

VI Semester
Department of Civil Engineering

Course Code : CET 399-1 **Course : OE-III Metro Systems and Engineering**

L: 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits: 03**

Course Outcome

5. The students will be able to understand design philosophy of metro system.
6. The students will be able to understand necessity of building services at metro.

General: Overview of Metro Systems; Need for Metros; Routing studies.

Unit 1

Civil Engineering : Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

Unit 2

Electronics and Communication Engineering : Signaling systems;

Automatic fare collection; Operation Control Centre; SCADA and other control systems; Platform Screen Doors.

Unit 3

Mechanical & TV + AC : Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators

Unit 4

Electrical : OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

References

1. Manual of specification and standard of Elevated Mass Rapid Transit System.
2. Code for Practice for Project Management for Construction and Development, 5th Edition Wiley Blackwell by CIOB (The Chartered Institute of Building).
3. SP 7 : 2016, National Building Code of India 2016 (NBC 2016),

   https://bis.gov.in/index.php/standards/technical-department/national-building-code/

VI Semester
Department of Civil Engineering

Course Code : CET399-2 **Course : OE-III Intelligent Transport System**

L : 3 Hrs., P : 0 Hrs., Per Week **Credits : 3**

Course Objectives

1. Understand the ITS data collection techniques and importance of telecommunication in ITS
2. Remember the various functional areas of ITS and its application for improving safety and efficiency in Road Transportation System.
3. Understand the importance of ITS in Users need , services and automated highway systems for enhancing safety, security and energy efficiency.

UNIT-I

Introduction 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. Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centers (TMC). Vehicle – Roadside communication – Vehicle Positioning System.

UNIT –II

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-III

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

UNIT-IV

Automated Highway Systems

Vehicles in Platoons – Integration of Automated Highway

Systems. ITS Programs in the World – Overview of ITS implementations in developed Countries, ITS in developing countries.

References

1. Intelligent Transport Systems: P.K.Sarkar& Amit Kumar Jain
2. Intelligent Transportation Systems: Sumit Ghosh
3. Intelligent Transportation System: TeodorPiatek

VI Semester

Department of Civil Engineering

Course Code: CETH61 **Course : Geotechnical Design**

L : 04 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 04**

Course Outcomes

On successful completion of the course students would be able to;

1. Understand the latest trends, modern standards and state-of-the art techniques for solving geotechnical engineering problems.
2. Identify, formulate and solve soil stability related problems.
3. Develop design system to meet the desired need such as economics, environmental and sustainability.

The geotechnical design and constructions to be studied are:

- Diaphragm wall
- Ground (soil and rock) anchors
- Soil nailing
- Stone column
- Gabbion walls
- Deep soil mixing

The state of the art, studying with respect to the following aspects is expected

- Types, uses and applications
- Construction techniques / methods
- General designonsiderations
- Analysis and quantitative designolution
- Important case studies (in India andbroad)

Text Book

1. Construction of Diaphragm wall: I. Hajal, J. Morton and Z. Regals, series in Engineering Publications
2. Foundation Engineering Handbook: Chapter no. 26, H.Y. Fang, CBS Publishers2004)
3. Theory & practice of foundation Design: Som N.N. & Das S.C., Prentice Hall Edn, Asia (2002)

References

1. HWA Reports andublications
2. Relevant IS Codes and papers from various refereed journals and proceedings.

VI Semester
Department of Civil Engineering

Course Code : CETM61 **Course : Basics of Soil Engineering**

L : 04 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **Total Credits : 04**

Course Outcomes

After completion of the course the students will be able to

1. Identify formation and type of soil.
2. Understand various properties of soil.
3. Understand the various applications of soil properties pertaining to field problem.

Unit I

Various types of rock, Formation of soil, Major deposits found in India. Various type of soil, Classification of Soil as per I.S. classification system.

Unit II

Index properties : Classification of soils using various Index properties and its application.

Unit III

Engineering properties : Permeability: factors affecting permeability, its determination method. Shear strength, Concept of Mohr's stress circle, Mohr-Coloumb's theory, and methods of its determination.

Unit IV

Consolidation theory, Compaction : Mechanics of compaction, factors affecting compaction, standard proctor Tests, Soil Stabilization for road construction

Unit V

Principle method of subsurface exploration, open pits and shafts, types of boring, types of soil samples and samplers. Collection & shipments of samples, plotting of bore log and sampling record.

Unit VI

Ground Improvement techniques and its selection for different problematic ground condition

Text Books

1. Soil Mechanics in Theory and Practice: Alam Singh, Asia publisher, 1975 & later.
2. Basic and Applied soil Mechanics: Gopal Ranjan & A. S. Rao, New edge international Ltd.2004
3. Fundamentals of Geotechnical Engg. By B. M. Das, Cengage Publications.

Reference Books

1. Soil Mechanics of By VNS Murthy
2. Geotechnical Engineering: Purushothama Raj, Tata McGraw Hill publishing Co. Ltd. 1995C,MDD, field compaction equipment, quality control, Deep compaction, Vibrofloatation

VII Semester Department of Civil Engineering

Course Code : CET451-1 **Course : Design of Concrete Structures (Elective - III)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcomes

On completion of the course, the students:

1. Will demonstrate the ability to understand the behaviour and modes of failure of reinforced concrete members such as slabs, biaxially bent columns, footings (single and combined) and retaining walls etc.
2. Will demonstrate the ability to analyze and design reinforced concrete members such as slabs, biaxially bent columns, footings (single and combined) and retaining walls etc.
3. Will demonstrate the ability to relate the knowledge and design skills taught in class to real world problems & implement the technique in designing.

Unit - I

Design of RCC two way slab with various end conditions using with IS code coefficient.

Unit - II

Design of RCC retaining wall (Cantilever / Counterfort)

Unit - III Analysis and design of columns subjected to biaxial moments, design of long columns**Unit - IV**

Design of isolated footings for uniaxial and biaxial bending for square, rectangular and circular columns

Unit - V

Design of combined footing (Rectangular footing / Trapezoidal footing)

Unit - VI

Design of raft foundation

Reference Books

1. Illustrated Design of Reinforced Concrete Buildings, V. L. Shah and S. R. Karve, 9th Edition, Standard PublisherDistrinbuters.
2. Reinforced Concrete Design,S. Sinha, 3rd Edition, Tata McGraw Hill Publications.

3. Fundamentals of Reinforced Concrete Design, M. L. Gambhir, 1st Editions, PHI Learning Pvt.Ltd.
4. Limit State Design of Reinforced Concrete, P. C. Varghese, 2nd Edition, PHI Learning Pvt. Ltd.
5. Reinforced Concrete Design, D. Menon andS. Pillai, 3rd Edition, Tata McGraw-Hill publications
6. Limit State Design of Reinforced Concrete (As per IS 456:2000), Dr. B. C.Punmia, A.K. Jain andDr. A. K. Jain, 1st Edition, Laxmi publications.
7. Reinforced Concrete: Limit State Design, Ashok K. Jain, 7th Edition, Nem Chand and Brothers Publishers.
8. Design of Foundation Systems: Principles and Practices, Nainan P. Kurian, 3rd Edition, Alpha Science International Publisher.
9. Practical Design of Reinforced Concrete Structures, Karuna Moy Ghosh, 1st Edition, PHI Learning Pvt. Ltd.
10. Limit State Theory and Design of Reinforced Concrete, Dr. V. L. Shah and Dr. S. R. Karve, 8th Edition, Structures Publications

VII Semester Department of Civil Engineering

Course Code : CET451-2 **Course : Urban Drainage and Sewerage (Elective - III)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcomes

The students will be able to:

1. Understand and apply knowledge about hydrological cycle.
2. Analyse and design the drainage / sewerage system.
3. Understand and apply concepts of operation and maintenance

Unit - I

Urban Hydrological Cycle, Effects of Urbanization on Catchment Hydrology, Need for Urban Drainage System, Planning Objectives.

Approaches to Urban Drainage, Urban Wastes and Urban Runoff Options for Waste Disposal, Separate and Combined Systems open Channels and closed Conduits, Wastewater and Storm water Reuse, Data Requirements, Master Drainage Plans.

Unit - II

Elements of Drainage System Conveyance Elements, Appurtenances, Overflow Structures, Runoff Control, Pumping Stations.

Design Parameters, Design Period, Catchment, Physical Parameters, Process Parameters Rainfall, Water quality Parameters, Instrumentation for Data Collection.

Unit - III

Quantity of Storm water, Rainfall Excess and Abstractions, Calculation of Runoff Volume and Peak Flow.

Hydraulic Design of elements of Conveyance system. Design of Appurtenances, Layout of Road Drainage, Layout of Pumping Stations.

Control of Runoff, On-site Storage and Use of Storm water, infiltration, Detention and Retention Facilities for Storm water Treatment, Erosion Control Measures.

Unit - IV Storm

water Management Models.

Operation and Maintenance of Urban Drainage Systems. Cleansing of Sewers and Drains, Repairs and Maintenance, Planning. Operation and Maintenance of Urban Drainage Projects, Administrative Structure for Drainage Planning, Design and Operation.

Reference Books

1. Hall M.J. (1984), "Urban Hydrology", Elsevier Applied Science Publishers
2. Geiger, W.F. Marsalek, J.Zudima and Rawls, G.J. (1987 "Manual on Drainage in Urban Areas", 2 Volumes, UNESCO,Paris.)
3. Geiger, W.F. and Jayakumar, K.V. (Ed.) (1996) "Lecture Notes of the V International Course onUrban Drainage in Developing Countries", Regional Engineering Collage, Warangal..
4. Wanielista, M.P. and Yousef, Y.A. (1993), "Storm water Management", John Wiley and Songs,Inc., NewYork

VII Semester Department of Civil Engineering

Course Code : CET451-3 **Course : Environment Systems Modelling (Elective - III)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcomes

1. Students will gain knowledge of environmental engineering systems modeling.
2. Students will be able to understand fate and transport mechanism of contaminants.

Syllabus

Unit - I

Definition; Classification; Examples and Models of Environmental Systems. Computational methodsin Environmental Modelling, utility of environmental models for forecasting.

Unit - II

Introduction to Air Quality Models; Metrology; Atmospheric Stability and Turbulence. Gaussian Plume Model and Modifications; global radiation balance and climatic changes.

Unit - III

Introduction to river, estuarine and lake thermodynamics, Stratification and eutrophication of lakes.

Unit - IV

Dissolved Oxygen Model for streams, Temperature Models, transport and fate of pollutant.

Unit - V

Models for predicting water quality changes in water distribution systems.

Reference Books

1. Techobanoglous G. and Schroeder E. D. Water Quality, Addison – Wesley Publishing Company, Reading, Massachusetts.
2. Schnelle K.B. and Dey P.R. Atmospheric Dispersion Modelling Compliance Guide, McGraw-Hill,1999.
3. Schnoor, J.L., Environmental Modelling, , Wiley-interscience.Publ., 1996

VII Semester Department of Civil Engineering

Course Code : CET451-4 **Course : Earth and Earth Retaining Structure (Elective - III)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcomes

On completion of the course, the students will be able to:

1. The graduate will have in-depth knowledge of various failure mechanism related to earth retaining structures
2. Identify, formulate and solve problems related to slope stability.
3. Analyze and design earth retaining structures

Unit - I

Theories of earth pressure, general and local states of plastic equilibrium, Active and passive states in cohesive and cohesion less soils, Rankine's and Coulomb,s approaches, effects of wall movement, uniform surcharge, wall angle, wall friction, back fill slope; lateral pressure on wall due to concentrated construction, Culmann's method; , earth pressure at rest. Introduction to seismic design of retaining wall.

Unit - II

Stability of Earth Retaining Structures:

Types of retaining wall, Stability analysis of rigid type and R. C. cantilever type retaining walls, introduction of Georeinforce wall, Gabion wall, soil nailing.

Unit - III

Sheet pile and cofferdam. Type, material, method of construction, distribution of earth pressure and related approximation. Distinction between Sheet Pile and Retaining wall, analysis and design

Unit - IV

Historical failures of geotechnical structures (finite and infinite slopes, high embankments such as earthen dams, tunnels, excavations, Rockfall, landslides and retaining structures etc.), characterization of failures, Inadequateness of Limit state design, principles and advantages of Mobilize able strength design. [case studies on major failures.]

Unit - V

Effect of water table on slopes, tension cracks, Stability of earth dams during different stages - during and at end of construction, steady seepage, and sudden draw down, estimation of pore water pressure use of stability charts

Unit - VI

Braced Cuts : Sheeting and bracing systems in shallow and deep vertical cuts in different types of soils.Failure modes, lateral pressure distribution on sheeting, stability of bottom of excavation

Introduction to Methods of tunnelling in soft soils.

Text Books

1. Gopal Ranjan & Rao: Basic &Applied Soil Mechanics, New Age International Publisher, 2005
2. Principles of Geotechnical Engineering: Das B.M.,ThomsonBks, Cengage publ.(2002)
3. VNS Murthy: Soil Mechanics & Foundation Engineering, Vol.-1, Saikripa Technical Consultant, Bangalore 1991

Reference Books

1. B. M. Das: Principle of Geotechnical Engineering, Cengage Publications Winterkom H. F & FargH.: Foundation Engineering Handbook
2. Winterkom H.F. and Fang H. - Foundation Engineering Handbook.

VII Semester Department of Civil Engineering

Course Code : CET451-5 | **Course : Railway Engineering (Elective - III)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week | **Total Credits : 03**

Course Outcome

1. Students should be able to explain and describe various terms in railway engineering
2. Students should be able to Explain, Discriminate and design various geometric features of railway track.
3. Students should be able to Define and describe the construction and maintenance steps of railway track.

UNIT - I

Railway track gauge, alignment of railway lines, engineering surveys construction of new lines, tracks and track stresses

UNIT - II

Rails, sleepers; ballast; subgrade and formation, rack fittings and fastenings, creep of rails, geometric design of track, curves and super-elevation

UNIT - III

Points and crossings, track junctions and simple track layouts; rail joints and welding of rails; track maintenance, track drainage

UNIT - IV

Modern methods of track maintenance, rehabilitation and renewal of track; tractive resistance and power, railway stations and yards; Railway tunnelling; signalling and interlocking; maintenance of railways and high speed trains.

Text Books

1. Railway Engineering: Saxena and Arora, DhanpatRai& Sons
2. Railway Engineering : Rangawala

Reference Books

1. Railway Tracks Engineering: J.S.Mundrey, Tata McGraw-Hill Publishing

VII Semester Department of Civil Engineering

Course Code : CET451-6 **Course : Contract Management (Elective - III)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcome

1. The students will be able to understand and assess the tendering process.
2. The students will be able to implement conditions of contract.
3. The students will be able to elaborate dispute resolution methodology in contract.

GENERAL

Overview of Tender; Types of contract; Conditions of contract

Unit - I

Preparation of Tender Documents and its submission, Evaluation of Tender and Award of contract – Letter of Award, Letter of Intent, Issues in tendering process: Pre - Registration, Pre – Qualification, Nominated Tendering, Rejection of Tenders, Repeat Orders, Revocation of Tenders and Unbalanced Bidding.

Unit - II

Bids & Proposals; Bid Evaluation; General Principles of Contracts Management: Indian Contract Act,Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium, Build-Own- Operate & variations; Public- Private Partnerships; International Commercial Terms, Breach of contract.

Unit - III

Essentials for a legally valid contract, Documents for an Engineering Contract; Types of contracts relative merits, general and special conditions, termination of contracts, extra work and Changes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc.

Unit - IV

General, Methods for dispute resolution–Negotiations, Mediation, Conciliation, Dispute Resolution Boards (DRB), Arbitration : – appointment, challenge, jurisdiction, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision.

Unit - V

Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Damage Assessment, and Claims for Damages. Liquidated damages & Penalties; Insurance & Taxation; Introduction to FIDIC.

Text Books

1. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset.
2. L.S. Ranaga Rao Contract Management and Dispute Resolutions Engineering staff College ofIndia January 2008.
3. General Conditions of Contract, Central Public Works Department, New Delhi,2010
4. S. Ranaga Rao,Contract Management & Dispute Resolutions, Engineering staff College of India, January 2008
5. V. K. Raina,Construction & Contract Management Practices, SPD, New Delhi
6. Patil B. S.,(2009) "Civil Engineering Contracts and Estimates", University Press.
7. John G. Betty (1993/ Latest Edition) "Engineering Contracts", McGraw Hills.

Reference Books

1. Dutt (1994), Indian Contract Act, Eastern Law House
2. FIDIC Contract Conditions
3. Prakash V. A.,(1997) "Contracts Management in Civil Engineering Projects", NICMAR
4. Vaid K.N., (1998)"Global perspective on International Construction Contracting Technologyand Project Management", NICMAR, Mumbai
5. Albett Robert W., (1961/ Latest Edition) "Engineering Contracts and Specifications", John Willeyand Sons, New York.
6. Vasavada B. J.,(1997), "Engineering Contracts and Arbitration", (Self Publication by Jyoti B.Vasavada).

VII Semester Department of Civil Engineering

Course Code : CET451-7 **Course : Finite Element Method for Civil Engineering**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **(Elective - III)Total**

Credits : 03

Pre-requisite : Structural Analysis

Course Outcome

1. The student will be able to understand the basics of the Finite Element Analysis method.
2. The student will be able to formulate finite elements for one dimensional and two dimensional linear static structural analysis
3. The student will be able to develop stiffness matrix and force vector for finite element analysis.
4. The student will be able to analyze one dimensional and two dimensional problems.

Syllabus

Introduction : Principles of Finite Element Method, Classification of elements, Element shapes, Nodes, Nodal unknowns, Discretization, Coordinate systems,Advantages of FEA, steps involved in FEA.

Principles of Elasticity : Equilibrium equation, Stress-Strain relationship, Strain-Displacement matrix.

Rayleigh Ritz Method : Principal of minimum potential energy, Analysis of simple axially loaded members and beams.

One dimensional Problem : Shape function, formulation of bar element, Assembly of stiffness matrix,analysis of truss, Lagrange Interpolation Technique, three nodded bar elements, Formulation of beam element, Analysis of continuous beams.

Two dimensional problems : Formulation of CST element, Analysis of Plain Strain, Plane Stress and Axisymmetric problems.

Computer Application : Introduction to commercial package, preprocessor, solver and post processor.

Text Books

1. P. N. Godbole, Introduction to Finite Element Methods, I K International Publishing House, 2013
2. Chandrupatla and Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall of India.
3. C. S. Krishnamoorthy, Finite Element Analysis: Theory & Programming, Tata-McGraw-Hill Publishing Company

Reference Books

1. Y. M. Desai, T. I. Eldho and A. H. Shah, Finite Element Method with Applications in Engineering, Pearson.
2. S. Rajashekaran, Finite Element Analysis in Engineering Design, Wheeler Publishing.
3. C. S. Desai and J. F. Abel, Introduction of Finite Element Method, East–West Press.
4. S. S. Rao, Finite Element Method in Engineering, Pergaman Press.
5. O. C. Zienkiewicz, Finite Element Method, Tata-McGraw-Hill Publishing Company
6. J. N. Reddy, Finite Element Method, McGraw Hill International edition.
7. K. J. Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall of India.
8. R. D. Cook, Concepts and Applications of Finite Element Analysis, John Wiley & Sons.

VII Semester Department of Civil Engineering

Course Code : CET452-1

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Computer Aided Design and Drafting (Elective - IV)

Total Credits : 03

Course Outcomes

1. An ability to understand and apply basic fundamentals of CAD in civil engineering
2. An ability to develop computer model of various components used in civil engineering
3. An ability to develop computer program for analysis and design of various components of civil engineering structures.

Content

Fundamentals of CAD : Computer graphics & its terminology. CAD definition, concept & need.CAD process. Functional areas of CAD. Coordinate systems. Geometric transformation-concept and types.2 dimensional (2D) geometric transformation- translation, scaling, rotation and mirror with numeric examples.

Analysis of building components through computer programs/excel

Designing of building components through computer programs/excel

Generating computer drawing from design output

Introduction to software's for modelling and design various civil engineering structures.

Text Books

1. Ibrahim Zied, CAD / CAM: Theory and Practice, McGraw-Hill
2. Hearn E J and Baker M P, Computer Graphics, Pearson.

VII Semester Department of Civil Engineering

Course Code : CEP452-1 | **Course : Computer Aided Design and Drafting Lab**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week | **(Elective - IV)Total**

Credits : 01

Course Outcomes

1. An ability to use various computer software's for modelling of various components used in civil engineering.
2. An ability to use various computer software's for analysis and design various components used incivil engineering.
3. An ability to develop computer program for analysis and design of various components used incivil engineering.

CE-CAD is a one-credit course that will introduce students to the basics of Computer Aided Design utilizing software to produce engineering designs. The course will also provide an overview of the different disciplines in Civil Engineering including structural, geotechnical, water resources, environmental, transportation, etc.

Content

Modelling using AutoCAD or Context Capture

Analysis and design of various structural components using STAAD/SAP Development of computer program for analysis and design of structural components.

VII Semester Department of Civil Engineering

Course Code : CET452-2 | **Course : Pipe Line Engineering (Elective - IV)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week | **Total Credits : 03**

Course Outcomes

The students would be able to:

Understand the importance of various parameters involved in the analysis and design of water network.

Analyse the water networks using various methods.

Design and optimization of networks.

Unit - I

General layout and components of water supply scheme and appurtenances.

General Hydraulic Principles : Frictional head loss in pipes, different formulae (Darcy, Hazen William & Modified Hazen - William)

Unit - II

Reservoirs : Impounding reservoir, Service and balancing reservoir, three reservoir system, Types of values, Analysis of reservoir system with valves.

Reservoir Capacity : Estimation of minimum required reservoir capacity using analytical method. Design of pumping main: Optimal design of pumping main. Use of Excel in the design of pumping main.

Unit- III

Analysis of water distribution Networks : Types and parameters, Parameter Formulation of equations, Analysis of network using Newton Raphson method.

Extended period analysis (Assignments on Analysis using EPANET)

Unit - IV

Design of Water Distribution Networks : Design of single source branching networks using critical path method. Design of branch network using software.

Unit - V

Optimal Design of Networks : Design of looped network case study based learning. (Assignments based on software using Water GEMS)

Text books:

1. Bhave, P. R. (2003). "Optimal design of water distribution networks." Narosa Publishing House Pvt. Ltd. New Delhi, India
2. Bhave, P. R., and Gupta, R. (2006). "Analysis of Water Distribution Networks."Narosa Publishing House Pvt. Ltd. New Delhi, India
3. Fair G. M., Geyer J. C. & Okun D. A., Water & Wastewater Engg. Vol.I& II, John-Willey & Sons, New York.

Reference Books:

1. CPHEEO, Manual on water supply and treatment, Ministry of urban development, GoI.
2. CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of urban development, GoI.
3. McGhee N. J. & Steel E. W., Water supply and sewerage, McGraw hill publications, 1991
4. Walski. T.M.(1984),'' Analysis of flow in water distribution networks'' Technomic Publishing CO. Lancaster, Pennsylvnia, USA

VII Semester Department of Civil Engineering

Course Code : CEP452-2 **Course : Pipe Line Engineering Lab(Elective - IV)**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week **Total Credits : 01**

Course Outcomes

The students would be able to:

1. Understand the importance of various parameters involved in the study and Methods of analysis of pipe n Network and its component.
2. Apply knowledge in formulating the mathematical equations, models and optimization of networks.
3. Design and evaluate various components of pipe networks.

List of Practical's

Minimum 6 of the following

1. Looped network analysis by Newton Raphson method.
2. Analysis of looped network using EPANET software.
3. Design of Network using critical path method.
4. Design using LP.
5. Design of branched network using BRANCH or any other software.
6. Design of network using software like Loop / Water GEMS /Water CAD.
7. Pressure Dependent Demand (PDD) analysis of water distribution network.

Note: Use python in all or any relevant practical is desirable.

VII Semester Department of Civil Engineering

Course Code : CET452-3

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Water and Waste Water Treatment (Elective - IV)Total Credits : 01

Course Outcomes

The students would be able to,

1. Describe and explain the necessity of water treatment along with the knowledge of various treatment processes, principles, analysis, design parameters and also able to design of variousunits ofwater treatment plant.
2. Describe and explain the necessity of waste water treatment, along with the knowledge of various treatment processes, principles, analysis, disposal methodology, design parameters and also able to design of various units of waste water treatment plant.

Unit - I

Necessity of Water treatment and Aeration : Necessity of water treatment, various treatment processes used in water, flowsheet of treatment plant and site selection for treatment plant.

Gas transfer and Aeration : Gas transfer phenomenon, two film theory of gas transfer. Objective of aeration, types aerators, time of exposure of gravity aerator, design of cascade aerator and design parameters of spray aerator.

Unit - II

Sedimentation with Coagulation : Mixing devices and Flocculation : Necessity and various types of rapid and slow mixing devices, design parameters and design of baffle mixing and flash mixer. Mechanisms of flocculation, types of flocculation, theory of removal of colloidal particles, design parameters and design flocculator.

Sedimentation : Principles sedimentation, types of settling, analysis of discrete and flocculant settlingdesign parameters and design sedimentation tank and clariflocculator

Unit - III

Filtration and Disinfection : Filtration: mechanism of filtration, Theory of rapid sand filters, filter media specifications, selection of filter sand from an available stock sand, design of rapid sand filters.

Disinfection : Method of disinfection, types of disinfectants, disinfecting action of chlorine and various forms of application of chlorine, ionization reaction, Chick's law of disinfection, breakpointchlorination,, factorsaffectingefficiencyofchlorination.

Unit - IV

Characteristics of waste water and disposal methodology : Various characteristics of waste water, BOD curve and its analysis, determination of BOD rate constant by Least square method and Thomasgraphical method.

Disposal of sewage effluent by dilution and by land treatment. Self-purification curve, Streator - Phelps's equation of analysis of oxygen sag curve. Various methods of application of sewage effluent for land treatment.

Unit - V

Preliminary and Primary treatment : Treatment Methods: Waste water treatment flow sheet, preliminary and primary treatment units, design parameters and design of screen and girt chamber. Analysis of sedimentation, design parameters and design of primary settling tank.

Unit - VI

Secondary Treatment : Biological unit processes: principles of biological treatment processes, activated sludge process and its types, trickling filter and its types, process design calculations of activated sludge process and trickling filters. Sludge treatment: aerobic and anaerobic digestion and sludge drying beds.

Text Books

1. Wastewater Engineering by Metcalf & Eddy – Tata McGraw Hill
2. Water supply Engineering Vol-I & Waste water Engineering Vol-II by B.C. Punmia—Laxmi Publication

References

1. CPHEEO Manual of water supply & treatment
2. CPHEEO Manual on Sewerage & sewage treatment.
3. Water treatment by A.G. Bhole –IWWA Publication
4. Water supply & Sewage by M.S. Macghee, -- Tata McGraw Hill

VII Semester Department of Civil Engineering

Course Code : CEP452-3 **Course : Water and Waste Water Treatment Lab**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week **(Elective - IV)Total Credits : 01**

Course Outcomes

The students would be able to,

1. To design the various units of water treatment plant by applying the knowledge of the of various design parameters.
2. To design the various units of waste water treatment plant by applying the knowledge of the of various process parameters.

Students should submit Minimum Ten assignments from the following list.

1. Design of cascade aerator
2. Design of flash mixer
3. Design of rectangular flocculator
4. Design of circular flocculator
5. Design of rectangular sedimentation tank
6. Design of circular sedimentation tank
7. Design of circular clariflocculator
8. Design of Rapid Sand Filter
9. Design of bar screen
10. Design of grit chamber
11. Design of Primary sedimentation tank
12. Process parameters determination of Activated sludge process
13. Process Parameter determination of Trickling filter
14. Analysis of Oxygen Sag curve.

References

1. CPHEEO Manual of water supply & treatment
2. CPHEEO Manual on Sewerage & sewage treatment.
3. Wastewater Engineering by Metcalf & Eddy – Tata McGraw Hill
4. Water supply Engineering Vol-I & Waste water Engineering Vol-II by B.C. Punmia—Laxmi Publication

VII Semester Department of Civil Engineering

Course Code : CET452-4 **Course : Geotechnical Exploration (Elective - IV)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcomes

On successful completion of the course students would be able to;

1. Familiarize the principles of exploration, geophysical methods, modern methods of drilling, sampling of investigation and instrumentation.
2. Determine the properties of soil by laboratory method.
3. Undertake various field techniques used in geotechnical engineering for ascertaining the bearing capacity of soil strata.
4. Prepare and understand the soil investigation report.

Syllabus

Importance and objects of Geotechnical exploration

Principle, methods of subsurface exploration, opens pits and shafts. Types of borings, selection of suitable boring type; stabilization of boreholes; number, location and depth of boring for different structures, and for different nature of ground profile.

Planning of sub-surface exploration program for major civil engineering projects

Indirect methods of exploration

Seismic refraction method, electrical resistivity method, qualitative and quantitative interpretation of test results, limitations

Types of soil samples & the its suitability, precautions in sampling, parameter for sampler design, boring and sampling records handling, preservation & shipment of samples; underwater sampling.

Field investigation

Standard Penetration test, Static Cone and dynamic cone penetration tests, interpretation of test results and correlations for obtaining design soil parameters of cohesive and cohesion less soil, Field vaneshear test, Design value of undrained strength of clays, correction factor; ground water table location.

Plate load test– purposes, procedure, interpretation for bearing capacity and settlement of foundation. Pressure meter test– Principle, equipment, use & interpretation of results

Sub-surface Investigation Report: Salient features and boring logs; Soil

survey and Mapping: methods of soil survey introduction of remote sensing.

Text Book

1. Basic and Applied soil mechanics: Gopal Ranjan & A.S. Rao, New Edge International Ltd., (2004)
2. Soil Mechanics and Foundation Engineering: K.R. Arora, Standard Publisher and Distributor, 1989 and later.
3. Foundation Analysis & Design: Bowles, J.E., McGraw Hill 1996)

Reference Books

1. Soil Mechanics in Theory and Practice: Alam Singh, Asia Publisher and Distributor, 1975
2. Advanced Foundation Engineering: Murthy VNS, CBS publishing, (2007)
3. Foundation Engineering Handbook: Fang, H.Y., CBS publishing, (2004)

VII Semester Department of Civil Engineering

Course Code : CEP452-4 **Course : Geotechnical Exploration Lab (Elective - IV)**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week **Total Credits : 01**

Course Outcomes

1. Student will have an ability to identify geotechnical properties of soil.
2. Student will have an ability to determine the various index and engineering properties.
3. Students will able to conduct various field test and its applications related to geotechnical engineering

Practical work shall comprise of

I) Laboratory test on C- soil (by groups of 2 students)

1. Determination of granulometry by sedimentation analysis.
2. Determination of Relative density of sand
3. To calculate dry density of soil
4. To calculate CBR Value of soil.
5. Flow chart & spreadsheet applications in a soil laboratory test Grain size analysis & Shear Strength

II) Field tests (by group of maximum 4 students) any three from the following.

1. Standard penetration test.
2. Static Cone Penetration test
3. Plate load test. (Demonstration)
4. Pressure meter test
5. Preparation of Detail soil Investigation Report

The test report shall be submitted in the form of the Journal and same shall be assessed by the concerned teacher/s through viva-voce examination

VII Semester Department of Civil Engineering

Course Code : CET452-5

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Traffic Engineering and Management (Elective - IV)

Total Credits : 03

Course Outcomes

1. Students should be able to Define and describe various traffic studies and traffic characteristics
2. Students should be able to describe terms related to highway capacity and have knowledge of statistical tools in traffic engineering
3. Students should be able to explain various theories related to traffic flow

UNIT - I

Traffic Studies and Forecast

Traffic Studies, Traffic Characteristics, General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection; Design Hourly Volume For Varying Demand, Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, demand functions. Determination of design hourly volume; critical hour concept

UNIT - II

Highway Capacity

Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalised intersections. Problems in Mixed Traffic flow; Case studies;

UNIT - III

Accident Analysis

Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions

UNIT - IV

Traffic Flow

Theory : Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications; Probabilistic Aspects Of Traffic Flow: Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models, applications; Simulation: Fundamental principle, application of simulation techniques in traffic engineering - formulation of simulation models, Case studies. Formulation of system models.

Text Books

1. Highway Engineering: (1991) Khanna S.K. and Justo C.E.G.,Nem Chand & Bros.
2. Traffic engineering and transportation planning: (1987) L.R. Kadiyali, Khanna Publications

Reference Books

1. Transport planning and Traffic Engineering, edition Latest, C A O'Flaherty, Butterworth Heinemann Publications.
2. Introduction to Transportation Engineering, edition Latest, James H Bank, Tata McGraw Hill Publications.
3. Transportation Engineering an Introduction, edition C. Jotin Khisty, PHI Publication.

VII Semester Department of Civil Engineering

Course Code : CEP452-5 **Course : Traffic Engineering and Management Lab**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week **(Elective - IV)Total**

Credits : 01

Course Outcomes

On completion of the course, the students will be able to;

1. Carry various traffic studies like speed studies, volume studies and parking studies etc.
2. Design traffic signals and intersections.
3. Carry out road safety audit.

Practicals

1. Speed studies
2. OD studies
3. Design of traffic signals
4. Design of intersection
5. Design of Rotaries
6. Road safety studies
7. Traffic volume studies
8. Parking studies

VII Semester Department of Civil Engineering

Course Code : CET452-6 **Course : Planning of Construction Project Systems (Elective - IV)Total**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week

Credits : 03

Course Outcome

1. The students will be able to implement the project planning parameters to construction projects.
2. The students will be able to analyze the impact of quality and safety on construction projects.
3. The students will able to understand the utility of construction equipments.

GENERAL

Project Planning; Construction Equipment; Construction safety and Quality

Unit - I

Scope, Meaning and Definition of Construction Project, Project Categories, Characteristics of Project, Project Management Functions, Roles of Project Manager, Temporary Structures in Construction; site layout including enabling structures. Stages of project planning: pre-tender planning, pre- construction planning, detailed construction planning, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning. Management Information System.

Unit - II

Work Break down structure, Bar charts, Detailed Bar chart for a Construction Project, CPM and PERT analysis. Application of operations research in construction management.

Unit - III

Equipment Management : Classification, selection, Equipment of major projects: Excavating Machines (Shovels, draglines, Bulldozer, Scrapper), Drilling and blasting, Transporting and Handling equipment Cranes, Hoists, Conveyor belts, Dumpers, Cableways. Concrete equipment: Mixers, vibrators, batch mixing plants, Calculation of Unit rate for Excavating Equipment and Concreting Equipment.

Unit - IV

Quality and Safety : Introduction – Definitions and objectives – Factors influencing construction quality. Quality control: Principles, Measurements and achievements.

Safety management: Planning for safety: safety in construction. National safety council, Safety organization Construction hazards, accidents, its cost, cause, types and preventions, Safety policies, Personal protection equipment (PPEs).

Text Books

1. Sengupta B., Guha M, (1998), "Construction Management and Planning" ,McGraw Hill Companies.
2. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
3. Code for Practice for Project Management for Construction and Development, 5th Edition Wiley Blackwell by CIOB (The Chartered Institute of Building).
4. Construction Equipment and its Planning and Applications, Mahesh Varma, Metropolitan BookCo. (P) Ltd., New Delhi, India.
5. Frank Harris & Ronald McCaffer Modern Construction Management Blackwell science4thEdition.
6. Kumar Neeraj Jha, Construction Project Management, Pearson Publication.
7. Construction Equipment and its Planning and Applications, Mahesh Varma, Metropolitan BookCo. (P) Ltd., New Delhi, India.

Reference Books

1. SP 7 : 2016, National Building Code of India 2016 (NBC 2016), https://bis.gov.in/index. php/ standards/technical-department/national-building-code/
2. Hand Book on Construction Safety Practices, SP 70, BIS 2001 https://law.resource.org/ pub/in/bis/S03/is.sp.70.2001.pdf
3. Grant E.L. and Leavenworth Statistical quality Control McGraw Hill 1984.
4. Levitt, R.E. and Samelson, N.M., Construction Safety Management, Mc. Graw Hill Book Company, Inc., N.Y. 1991.
5. Harold Kerzner Project Management CBS Publisers & Distributors 2ndEdition.
6. Project Management Body of Knowledge, 5thEdition, PMI Global Standard
7. Roy Pilcher Principles of Construction Management McGraw Hill London.

VII Semester Department of Civil Engineering

Course Code : CEP452-6 | **Course : Planning of Construction Project Systems Lab**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week | **(Elective - IV)**

Total Credits : 01

Course Outcome

1. The Students will be able to develop work break down structure of construction projects.
2. The students will be able to plan, schedule and control construction projects with MS Project / PRIMAVERA

Any Five Assignments

1. Prepare WBS and Gantt chart for the project of Brick Masonry boundary wall.
2. Prepare WBS and Gantt chart for the project of Dog-legged staircase construction.
3. Prepare WBS and Gantt chart for the project of two room block and assign resources.
4. Prepare WBS, schedule the project and assign resources and solve a project of single storey tworoom building using Software.
5. Prepare WBS, schedule the project, assign resources and perform resource levelling for a projectof any residential/public/industrial building using Software.
6. Prepare WBS, schedule the project, assign resources and perform resource levelling for a projectof dam construction Software.
7. Prepare WBS, schedule the project, assign resources and perform resource levelling for a projectof flexible / rigid pavement construction using Software.
8. Prepare WBS, schedule the project, assign resources and perform resource levelling for a projectof bridge using Software.

Reference Books

1. Kumar Neeraj Jha, Construction Project Management, Pearson Publication.
2. Sengupta B., Guha M, (1998), "Construction Management and Planning" ,McGraw Hill Companies.
3. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
4. Code for Practice for Project Management for Construction and Development, 5th Edition Wiley Blackwell by CIOB (The Chartered Institute of Building).

VII Semester Department of Civil Engineering

Course Code : CET452-7 **Course : Remote Sensing and GIS (Elective - IV)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcomes

The students should be able to;

1. Identify, describe and explain the fundamental of principles of aerial photography and remote sensing.
2. Apply the basics of raster and vector data formats and able to interpret it.
3. Asses and compare spatial and non-spatial data, projection system, topology, geo referencingwhile using remote sensing data.
4. Collect logical information and apply digital image processing for supervised/un-supervised classification of given data

Unit - I

Definition and scope of remote sensing : electromagnetic energy and its wavelengths. Remote sensing systems, sensors and scanners, resolution of sensors, multi-spectral, thermal and radar scanners, radiometers spectral response curve and spectral signatures.

Unit - II

Elements of sensing system : Terrestrial, airborne and space borne platforms, Sun-synchronous and geo-stationary satellites, advantages and disadvantages. Various earth Resources satellites, Indian remote sensing program. Remote sensing data products and their types: analogues and digital data formats, Thermal and radar imageries.

Unit - III

Interpretation techniques : Elements of aerial photo interpretation and methods, interpretation keys, stereoscope. Relief displacement, image parallax and vertical -exaggeration, Determination and calculation of elevation from RS data.

Unit - IV

Digital image processing : Image rectification and restoration, image enhancement, contrast manipulations, spatial feature manipulation, multi-image manipulation, image classification, supervised and unsupervised classification, accuracy assessments and data merging.

Unit - V

Geographical Information System: Raster and vector data, concepts and basic characteristics of vectorization, topology generation, attribute data attachment, editing and analysis. Global Positioning System: Introduction to Global Positioning System (GPS) - Fundamental concepts, GPS system elements and signals, Classification of GPS receivers.

Unit - VI

Applications : Integrated approach of RS and GIS application: Application in Geological Investigations, water resources management, environmental studies, EIA based studies, Land use planning, soil studies and transportation planning. Application in civil engineering projects damns and bridges, site investigations, landslide studies.

Text Books

1. Remote sensing Geology: Ravi P Gupta, Springer publication
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Remote Sensing: Principles and interpretation, Floyd F .Sabins
4. Higher surveying volume III: Dr. B C Punmia

VII Semester Department of Civil Engineering

Course Code : CEP452-7 **Course : Remote Sensing and GIS Lab (Elective - IV)**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week **Total Credits : 01**

Course Outcomes

The students should be able to;

1. Interpret the aerial photographs based on parameters for of various objects, rocks, drainage roadsetc.
2. Plan and apply decision making using GIS software for proper thematic output. 3. Analyze and compare the raw data, corrected data with field observation.
3. Collect the logical digital data from sensors for its evaluation in various civil engineering fields.

List of Practical's

1. Study of stereoscope.
2. Study of aerial photographs based on elements of interpretation.
3. R S Data format and their study: analogue and digital data products.
4. Geo-referencing of G I S data/ Topo-sheet.
5. Calculations on RS data: elevation, spatial attributes.
6. To Transfer the principal point and draw a flight line on the aerial photographs
7. Assignments based on relief displacement, no. of photographs scale height etc.
8. Calculation of parallax using parallax bar.
9. Calculation of parallax using algebraic definition of parallax.
10. Study of Arc-GIS 10.0 version Software.
11. Study ENVI 5.0 image processing software.
12. Calculation of an area of irregular polygon using digital planimeter.

VII Semester Department of Civil Engineering

Course Code : CET453 **Course : Contract, Accounts and Work Management**

L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 02**

Course Outcome

The students will be able to;

1. Demonstrate entrepreneurship skills to start a business venture in Civil Engineering
2. Exhibit knowledge for formation of business organization and its registration with various government agencies
3. Demonstrate understanding in respect of business laws and different types of taxation which are applicable to civil engineering profession
4. Design and make financial analysis of civil engineering projects

UNIT - I : **Introduction to Accountancy :** Double entry system, ledger and journal, cash book, Trial balance

UNIT - II : Depreciation : straight line, reducing balance, sinking fund, Contract Accounts:, Work certify and payments, work in progress uncertified, profit on incomplete contract, balance sheet.

UNIT - III : Branch and department accounts, Inventory Management - Economic Order quantity, Investment appraisal - payback period method, NPV method and IRR method

UNIT - IV : Types of cost, Standard cost and budgeting, different types of budgets, advantages and problem Variance analysis - labour, material, overheads

UNIT - V : Taxation applicable to construction industry, Introduction to Construction Contract Management and Administration(Different Types of Construction Contracts, Construction Condition of contracts, Contractual documents, Record keeping and Essentials Quality Control).

UNIT - VI : Project financing : Capital costs, working capital, operating costs, Product revenues, Jointventure formation agreement, and Raw materials supply contract, Plants operation / managementcontract, Loan agreement and project loan structure, Money availability.

Text Books

1. Accounting Principles; R N Anthony
2. Cost and Management accountancy: S P Jain
3. Financial Management: M Y Khan
4. Business Laws: P R Chadha
5. Taxman's student guide to company law: A K Mujumdar
6. Taxman's student guide to Financial Management: Ravi Kishore

VII Semester Department of Civil Engineering

Course Code : CET454 **Course : Construction Engineering and Management**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcome

1. The students will be able to understand aspect of construction management.
2. The students will be able to evaluate the effect of implementation of resources.
3. The students will be able to analyze methods of cost control and material management.

General

Construction Economics; Resource levelling, Project Control and Material Management.

Unit - I : Construction Management

Planning for Construction Projects, Principles of Planning, Objectives, construction projects types and features, phases of a project, agencies involved and their methods of execution; role of client and contractor. Process of development of plans and schedules, work break-down structure, activity lists.

Unit - II : Project Planning

Construction Planning, Project planning, milestone schedules, WBS, Concept of productivities, estimating durations, sequence of activities, activity utility data; Gantt Charts, Network techniques, CPM, PERT and Line of Balancing Techniques, Resource Planning, Scheduling, Productivity chart, Project tracking

Unit - III : Resource Planning

Resources leveling and smoothing. Crashing of networks, direct cost, Indirect Cost, Normal cost, crash cost, cost-time optimization, Use of application software for Project Management, Allocation of Resources.

Unit - IV : Construction Project Control

Construction Project Control Methodologies and Productivity Improvement: EVM, BIM, LBM. Earned Value Management- meaning and definition, Earned value, cost performance index, schedule performance index, cost variances, schedule variance, Final Cost, Final Project Duration. Funds: cash flow, sources of funds; Histograms and S-Curves. Common causes of time and cost overruns andcorrective measures.

Unit - V : Material Management

Material Management: Functions, objectives, purchasing, procedures, Material Stock, Storing, Recording, Inventory control, Inventory control techniques, Break even analysis, ABC analysis, andEOQ models.

Reference Books

1. Sengupta B., Guha M, (1998), "Construction Management and Planning" ,McGraw Hill Companies.
2. Construction Project Scheduling and Control, 3rd Edition, by Saleh Mubarak. ISBN : 978-1-118-86400-1
3. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
4. Code for Practice for Project Management for Construction and Development, 5th Edition Wiley Blackwell by CIOB (The Chartered Institute of Building).
5. National Building Code of India 2016 (NBC 2016)
6. K.K. Chitkara, Construction Project Management, 2ndEdition, McGraw Hill Publication
7. Harold Kerzner Project Management CBS Publisers & Distributors 2ndEdition.
8. Frank Harris & Ronald Mc Caffer Modern Construction Management Blackwell science4thEdition.
9. Roy Pilcher Principles of Construction Management McGraw Hill London.
10. Kumar Neeraj Jha, Construction Project Management, Pearson Publication.
11. Project Management Body of Knowledge, 5thEdition, PMI Global Standard
12. Harvey Maylor, Project Management, 3rdEdition, Pearson7.K.K. Chitkara, Construction Project Management, 2ndEdition, McGraw Hill Publication
13. P G. Gahoit & B.M. Dhir, Construction Management, New age international (p) Ltd.
14. Srinath L, CPM & PERT, East-West Press Pvt. Ltd New Delhi.
15. N.D. Vora, Quantitative Techniques in Management, Tata McGraw Hill, New Delhi, 3rdEdition.
16. Daniel Halpin, Construction Management, 3rdEdition, John Wiley & Sons, Inc.

VII Semester
Department of Civil Engineering

Course Code : CEP455 | **Course : Project Phase - I**

L : 0Hrs., T : 0Hrs., P : 12Hrs., Per Week | **Total Credits : 06**

Course Outcomes

The students would be able to;

1. Identify a project topic and to collect relevant data through literature survey.
2. Formulate methodology and identify equipment/software/materials requirement to execute the project work.
3. Demonstrate effective communication skills.

Syllabus

Every student has to undertake a project of professional interest. The project may be related to a theoretical analysis, an experimental investigation, a proto-type design, a new correlation and analysis of data, fabrication and setup of new equipment. Not more than four students may carry out the major project together.

The work includes preparation of preliminaries for the project work to be under taken in 8th Semester.

1. Finalizing the title of the project
2. Literature Survey
3. Collection of Data
4. Scope of the project

Project work shall be evaluated by mid-term seminar/s, the quality of work carried out, project report submission and the viva-voce examination.

VII Semester Department of Civil Engineering

Course Code : CET456 **Course : Industry Internship Evaluaiton**

L : 0Hrs., T : 0Hrs., P : 2Hrs., Per Week **Total Credits : 00**

Course Outcomes

The students would be able to;

1. Acquired the knowledge about construction process and technical information about the execution and maintenance of civil engineering works.
2. Understand the processes and work ethics so as to develop the essential skills.

Students are required to complete minimum six week internship in industry / research organization / IIT / IISc / IIIT / NIT / In-house research internship at RCOEM during the winter/summer vacations prior to the Commencement of Semester-VII.

On completion, the student has to submit the internship report/s and internship completion certificate/s issued by the organization(s) where it was completed, to the department.

The department will evaluate the same by way of Seminar/Viva-voce etc in the department in Semester-VII as an Audit Course. Student shall be required to secure Satisfactory 'SF' grade in it.

VII Semester Department of Civil Engineering

Course Code : CET498-1 **Course : Green Building (Open Elective-I)**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 03**

Course Outcomes

1. Students should be able to describe the importance of green building and rating systems.
2. Students should be able to prepare a preliminary design of green building using shading devices, day-lighting and ventilation design principle.
3. Students should be able prepare green rated building.
4. Students should be able to suggest resources for green building.

Unit - I

a. Introduction to green building concept, History, Need in present scenario, classification and characteristics, difference between green building, sustainable building and eco friendly building.

b. Global Green building rating systems (LEED US, Green Globes, BREEM, CASBEE)

c. Green building rating and assessment system prevailing in country (GRIHA and LEED)

d. Introduction to carbon emission through buildings

Unit - II

a. Elements of design of green building, Climate responsive process of design,

b. Design of shading devices.

c. Day lighting, Design of artificial lighting

d. Ventilation, Natural ventilation design

Unit - III

a. Thermal comfort inside the building: Factors affecting, indices, cooling and heating requirement,

b. Heat flow in buildings, Methods of heat flow calculation,

c. Thermal performance of building sections, simple calculation for U value and insulation thickness.

d. Norms of Energy Conservation Building Code, Concepts of OTTV etc

Unit - IV : Resource conservation

a. Material Conservation: Sustainable construction materials, Embodied, operational and life cycle energy

b. Water conservation: Surface water balance, 3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling

c. Introduction to alternative energy sources.

Text Book

1. Kubba, S, LEED Practices, Certification, and Accreditation Hand book, 1st ed. Elsevier, 2010.
2. Architectural Energy Corporation, Building Envelope Stringency Analysis, International Institute for Energy Conservation, 2004
3. Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1 st ed. Nabhi Publication, 2008.
4. TERI-Griha's Green Design practices (www.teriin.org/bcsd/griha/griha.htm)
5. Leadership in Energy and Environmental Design (https://igbc.in)
6. SP 7 : 2016, National Building Code of India 2016 (NBC 2016), https://bis.gov.in/ index.php/ standards/technical-department/national-building-code/

Reference Book

1. Minsitry of Power, Energy Conservation Building Code 2018, Revised Version, Bureau of Energy Efficiency, 2018,
2. Climate responsive architecture (A design hand book for energy efficient buildings), Arvind Krishnana, Simos Yannas, Nick Baker, S V Szokolay Mc Graw hill Education, Seventh reprint, 2013
3. Renewable Energy and Environment -A Policy Analysis for India H, Ravindranath, K Usha Rao, B Natarajan, P Monga Tata McGraw Hill, 2000
4. Energy and the Environment JM Fowler, McGraw Hill, New York, 2nd Ed 1984

VII Semester Department of Civil Engineering

Course Code : CETH71 **Course : Foundation Design**

L : 4Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 04**

Course Outcomes

1. The graduates will be able to understand basic requirement of IS 456:2000 design specifications.
2. The graduates will be able to design various types of foundation systems like isolated, combined,pile, etc. as per codal provisions.
3. The graduates will be able to prepare drawings and schedules for reinforcement in standard formats.

Syllabus

Design of isolated and combined footings, proportioning of footing for equal settlements. Theory ofsub grade reaction, beam on elastic foundation.

Design of rafts – I. S. code method, introduction to various methods.

Introduction to floating foundation, analysis and design of pile foundations, negative skin friction,group action in piles, design of pile cap.

Foundation subjected to eccentric loads.

References Books

1. Beam on Elastic Foundation: Hetenyi, M., University of Michigan Press, (1946).
2. Foundation Analysis & Design 5th ed.: Bowles J. E., McGraw Hill, (1996).
3. Soil Dynamics and Machine Foundation: Swami Saran, Galgotia Publications (P) Ltd, New Delhi (1999).
4. Handbook of Machine Foundation: Srinivasulu P., Vaidyanathan C. V.
5. Modern Foundations- Introduction to Advanced Techniques: Kurian, N. P.

VII Semester Department of Civil Engineering

Course Code : CETM71 **Course : Plumbing System**

L : 4Hrs., T : 0Hrs., P : 0Hrs., Per Week **Total Credits : 04**

Course Outcomes

On completion of this course the students would be able to;

1. Understand and describe different plumbing practices/ systems including various pipes, fixturesand fittings used their in.
2. Analyse water supply plumbing system and sanitary plumbing system.
3. Design a plumbing and sanitary system for residential building.

Unit - I

a) Introduction : Introduction, Scope, Objective, Building Services, Plumbing codes & Standards, , Plumbing Fixture & Applications such as Symbols, Supply, Installation & Fixture Clearances, Water Closet, Lavatory, Bath Tub, Shower Head, Bidet, Urinal, Floor Drain, Kitchen Sink, Dish Washer, Waste Food Grinder, Drinking Fountain, Laundry Tray, Hose Bib, Flushing Systems, Water Consumption

b) Piping systems : Quality and types of Pipe, Schedule, Grade of pipes, Connections in Piping Systems, Pipe Joining Methods (Threaded, Socket-weld, Butt-Weld, Flanged), Pipe Fittings and fixtrures - Elbows Tee, Reducer like Concentric and Eccentric, FOT, FOB, Couplings, Unions, Plug, Swage, Flanges, Configurations, Types, Valves-Introduction, Function, Components, Locations, Gate, Globe, Butterfly, Ball, Angle, Check, PRV, Drain, Air Vent, Control Valves, Valve Operators, Valve Layout Considerations.

Unit - II

Water supply – cold & potable water systems sources of Water Supply, Requirements, Estimating the Total Demand for Water Supply System, Water Meter- Types, Sizing and Pressure Drop.

Water Supply Systems in Buildings-Direct, Over-Head Tank, Underground- Overhead, Direct Pumping Systems.

Water Distribution System in Building-Up-Feed, Down-Feed, Types, Sizing Underground & Overhead Tank. Booster Pump Requirement,

Estimation of number of Plumbing Fixtures, Fixture Units / Demand Units/ Loading Units, Estimationof Fixture Units, Simultaneous Demand, Hunter Curves, Max, Probable Flow, Sizing

Water Supply Piping- Pressure Drop & Velocity Limitation, Pressure Needed in Different Fixtures, Excessive Water Pressure, Water Hammer.

Unit - III : Hot water supply system

Hot Water Requirement, Hot Water Temperature for Various Services, Components of Hot Water Supply System, Water Heaters, Types, Storage Tanks.

Hot Water Circulation Systems-Up-Feed, Combined, Inverted, Design-Average Hot Water Demand, Water Heater Coil Capacity, Storage Tank Capacity.

Unit - IV : Hydraulics and pumping systems

Introduction, Density, Viscosity, Pressure-Vapor, Atmospheric, Absolute and Gauge, Static Head, Dynamic Head,

Flow under Gravity Conditions-Pipes, sewers and storm water drain, Flow under Pressure, Coefficientof Roughness, Frictional Loss,

Need for Pumping , Pump Types, Pump Application- Booster, Circulation, Submersible, Sewage, andSump Pump,

Pumping Systems- Direct Boosting, Break- Pressure Tank, Hydro-Pneumatic, Pump Characteristics-Capacity, Total Dynamic Head, Efficiency, Power Required, Suction, Cavitations, Net Positive Suction Head.

Unit - V : Sanitary drainage system

Introduction, Waste Water -Black Water, Gray Water; Planning- Layouts, Pipes, Fittings. Grouping of Drainage System-Above Ground, Basement, In Ground, Parts-Trapes, Vents, Drainage Pipe, Building Drain Pipe,

Sewer System Types-One-pipe, Two-Pipe, Single Stack, Waste Stack. Drainage Fixture Units Estimation- Sizing, Horizontal Fixture Branches, Stacks, Branch Intervals, Maximum Capacities, Grading,(sloping)v of Horizontal Pipes, Vent System, Role of Atmospheric Pressure, Types-Wet, Waste Stack, Back-Back, Circuit, Loop, Individual, Vent, Sizing and Length, Sewage Basin,

Sewage Pump: Types-Submersible, Vertical Lift, Self Priming, Simplex, Duplex, Drawdown Capacity,Circular Basin Capacity, Basin Sizing, Sewage Pump Head Calculations.

Unit - VI : Storm water management (Rain water harvesting)

Introduction, Collection, Catchment Areas, Design Considerations-Rain Water Area, Amount of Rainfall, Type of Roof System- Flat Roofs, Sloped Roofs, Catchment Area, Roof Drains, Screening, Gutters, Leader, Horizontal Storm Drain, Sizing, Sloping, Connections.

Reference Books

1. Plumbing design and Practice by Deolalikar, Tata Mcgraw hill education publication, New Delhi.
2. Plumbing Systems: Analysis, Design and Construction by TimWentz, Prentice hall
3. National building code, Part IV – plumbing system, 1982.
4. Standard IS codes of practices.

VIII Semester Department of Civil Engineering

Course Code : CET457-1 **Course : Earthquake Resistant Design of RCC**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **(Elective - V)Total**

Credits : 03

Course Outcomes

1. An ability to understand the necessity and importance of earthquake engineering
2. An ability to understand the provision of IS code used for earthquake resistance design of structure
3. An ability to study of damages caused due to past earthquake in & outside India and remedial measures
4. An ability to understand provision for earthquake resistance design of structures as per Indian standard

Contents

Basic Concepts: Origin of earthquakes, engineering geology, seismicity of the world, faults, earthquake waves, quantification of earthquake (magnitude, energy, intensity of earthquake), measurements of earthquake,

Determination of magnitude, epicentre, epicentre distances, focal depth, seismic zoning, ground motion and their characteristics, factors affecting ground motions, causes or sources of earthquake damages.

Study of IS 1893 (2016): Analysis of buildings for earthquake using seismic coefficient method, concept of earthquake resistant design,

Seismic performance of structures and structural components during past earthquakes. Design philosophy, virtues of earthquake resistant design.

Seismic behaviour and design of linear reinforced concrete elements; codal provisions (IS: 13920-2016) Design philosophy of multi-story buildings with and without Bracings & concept of using Infills.

Text Books

1. Kramer, S.L. " Geotechnical Earthquake Engineering", Prentics Hall, New Jersey 1996.
2. Shrikhande, M. " Earthquake Resistant Design of Structures."
3. Arya A.S., "Introduction to Earthquake Engineering Structures."
4. Jain A.K., "Introduction to Earthquake Engineering Structures."
5. S.K. Duggal, " Earthquake Resistant Design of Structures."

References Books

1. Murthy, C.V.R. "Earthquake Tips." IIT Kanpur Documents
2. Chopra A.K., Dynamics of Structures, Theory & Application to earthquake Engineering, 2nd edition Pearson Education (Sigapore) Pvt, Ltd, New Delhi, 1995.
3. Dowrick, D.J. "Earthquake Resistant Design for engineers and Architects", 2nd Editiion,1987.

Reference Codes

1. IS:1893-2002 and 2016 Part I Earthquake Criteria
2. IS:13920-2016 Ductile Detailing

VIII Semester Department of Civil Engineering

Course Code : CET457-2 | **Course : Planning and Design of Irrigation Water**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week | **(Elective - V)**

Total Credits : 03

Course Outcomes

The students will be able to;

1. Demonstrate about the planning of irrigation projects
2. Apply different methods for estimation of evapo transpiration
3. Plan and design of Irrigation water Networks
4. Undertake water auditing, bench marking and rating the performance of project using evaluation criteria

Unit - I

Irrigation Development in India : National water policy, State water policy, Planning of irrigation Projects, classification of projects, LIS and necessity of moving towards Piped irrigation networks.

Unit - II

Irrigation practices : Water Application Methods, Irrigation scheduling, Rotational water Distribution. Crop water Requirement: Cropping Patterns, methods and determination Evaporation and Evapo transpiration, Determination of Net Irrigation Requirement at the field level and at the head works level. Water Requirements of Crops, Micro Irrigation systems and its importance.

Unit - III

Hydraulic principles, Field layout, Components of Irrigation Networks, dimensioning and Design of Irrigation Networks and its optimization (assignment on design of lift irrigation scheme, Water Network)

Unit - IV

Participatory Irrigation Management, Water users' associations (WUAs), WUA Act and provisions (Assignment: Case study of WUAs)

Unit - V

Diagnostic / Performance analysis of piped Irrigation System, Performance Evaluation criteria and benchmarking of Irrigation project.

Text Books

1. Asawa; G.L. (1996), "Irrigation Engineering", New Age International Pub. Co. NDelhi.
2. Bhave P R and Gupta R (2005) "Analysis and Design of water Networks"
3. Bhave P R (2002): "Water Resources Planning"
4. Water auditing reports of Govt of Maharashtra

Reference

1. Murthy, V. V. N. (1999), "Land and Water Management Engineering", Kalyani publishers, Ludhiana.
2. Scwabe G. O., Fangmeir, D.D. and Elliot W.J. (1996), "Soil and Water Management Systems", John Wiley and Sons, New York
3. Michael, B. A. M (1990), "Irrigation", Vikas Publishing House Pvt. Ltd. New Delhi
4. Suresh, R.L. (1999), "Soil and Water Conservation Engineering", Standard Publishing Co, Delhi.
5. Guidelines for planning and designing of piped irrigation network Part I and II. Central water commission ministry of water resources, river development & ganga rejuvenation government of India new Delhi, July 2017.

VIII Semester Department of Civil Engineering

Course Code : CET457-3
L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Industrial Waste Water Treatment (Elective - V)
Total Credits : 03

Course Outcomes

The students would be able to;

1. Describe and explain the necessity and importance of industrial wastewater treatment along with the basic principles and fundamentals of waste minimization for reuse recycling and recovery, treatment processes and disposal methods in industrial wastewater.
2. Apply the knowledge of various principles, theories and equations in process analysis and in the design of various treatment methodologies for various industrial waste waters.

Syllabus

Unit - I

Necessity and importance of industrial waste water treatment, Generation of Industrial wastewater, characteristics of industrial waste water and its variation, sampling and analysis of wastewater, statistical analysis of data, standards for wastewater disposal, Environmental impacts due to discharge of wastewater on streams, land and sewerage system.

Unit - II

Basic concept of Reuse, Recycling and Resource recovery; Volume and strength reduction; Construction, working, design parameters and design of Equalization, and Neutralization and floatation.

Unit - III

Treatment flow sheet of wastewater from various industries viz. Pulp and paper, tanning, Sugar, Dairy,Cement, Fertilizers, Metal Finishing, textile, Etc. Joint treatment of industrial waste.

Unit - IV

Types of biological processes used in treatment of wastewater. Construction, working and design parameters of Stabilization pond, aerated lagoon, oxidation ditch, biological de-nitrification processes, membrane biological reactors. Anaerobic treatment of industrial wastewater.

Unit - V

Industrial waste survey; Stream sanitation, stream sampling, Stream survey; Principles and techniquesfor Industrial pollution prevention and control.

Text Books

1. Nemerow N. L. Theories and Practices of Industrial Waste Treatment, Addison Wesley Publishing Co. NY. 2nd Edition.
2. W.W. Ecenfelder, Industrial Water Pollution Control Mc-Graw Hill Book Co. 2nd Edition.
3. Freeman H.M., Industrial Pollution Prevention Handbook Mc-Graw Hill 1st Edition.
4. E.B. Bess Elivievre, Treatment of Industrial Waste, Mc-Graw Hill Book Co. 1st Edition.
5. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal And Reuse, 3rd Edition Mc-Graw Hill 1991.
6. A. D. Patwardhan, Industrial waste water treatment, PHI Learning Pvt. Ltd, EEE, 2nd Edition. June 2017

Reference Books

1. Central Pollution Control Board, India, Comprehensive Industry Document Series.
2. Gupta K R, Environmental Legislation of India, Atlantic publishers, 2006.
3. CPHEEO Manual on Sewerage & sewage treatment.

VIII Semester Department of Civil Engineering

Course Code : CET457-4 **Course : Advanced Geotechnical Engineering (Elective - V)Total**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week

Credits : 03

Course Outcomes

On successful completion of the course students would be able to;

1. Understand the various properties of the soils and their determination.
2. Do the settlement analysis in different conditions and design the foundations.
3. Analyse the modern approach for investigations of soil properties.

Syllabus

- General Concepts: Soil Structure, Consistency of Cohesive Soils, plasticity, Clay Activity, Atterberg Limits, USCS and AASHTO Soil Classification.
- Stresses in Soils: Geostatic and External Stresses in Soils, Pore Water Pressure Concept, Boussinesq and Westergaard Relationships for External Stress. Calculations, Effect of Ground Water Table.
- Shear Strength of Soils: Stress Path, Mohr Circle, Mohr-Coulomb Failure Criteria, Shear Strength in the Laboratory (Direct Shear Test, Triaxial Compression Test, CU, UU and CD tests), Skempton's Pore Water Pressure Parameters, Shear Strength in the Field (Vane Shear, CPT, SPT, PMT, CBR)
- Settlement Analysis of Soils: Consolidation Theory, Immediate Settlement in Granular Soils, Primary consolidation, Secondary Compression, Time Rate of Settlement, Methods for Accelerating Consolidation Settlements, Pre-compression.
- Design of Foundations: Introduction, general principles, strip and pad foundations, building on shrinkable soil, building on fill, raft foundation – variable soil and make up gound, pile foundation – choice, types; construction problems.
- Introduction to Unsaturated Soil Mechanics: Types of problems, typical profiles of unsaturated, tropical and residual soil, expansive and collapsing type of soils. Origin and formation, identification and classification of expansive and collapsing soils, Contractile skin.
- Collapse and Heave: Collapse potential and swell potential, importance and their determination by different laboratory methods, Heave prediction based on Oedometer tests, suction tests and empirical procedures, heave and collapse settlement.

- Technical Forensic Investigation: Collection of data, proble characterization, development offailure hypotheses, a realistic backanalysis, field observations and performance monitoring, modelling of failure hypothesis and quality control of formal and technical aspects of the work. Numerical Problems.

Text Book

1. Das, B. M. (2008). Advanced Soil Mechanics. Taylor and Fracis Group, London, Second edition.
2. Murthy, V.N.S. (2002). Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering. CRC Publications
3. Coduto, D. P. (1999). Geotechnical Engineering: Principles and Practices, Prentice Hall
4. Gopal Ranjan, Rao A.S.R. (2007). Basic and Applied Soil Mechanics Foundation Engineering, New Age Publications
5. Som N. N. & Das S.C. (2002): Theory & practice of foundation Design:, Prentice Hall Edn, Asia

VIII Semester Department of Civil Engineering

Course Code : CET457-5 | **Course : Airport Planning and Design (Elective - V)Total Credits : 03**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course Outcome

1. Students should be able to understand and memorize various terms related to airport Engineering
2. Students should be aware of various facilities in terminal building
3. Students should be able to describe and explain various geometric parameters of Runway and Taxiway
4. Students should understand various air traffic management and visual aids

Syllabus

UNIT - I

Aircraft characteristics; Aircraft performance characteristics: Airport planning Airport Site Selection;Wind rose, cross wind component, Runway Orientation and configuration. (10)

UNIT - II

Terminal Building, Facilities for passengers, Aircraft Parking. (10)

UNIT - III

Geometric Design of the Airfield: Determination of Runway Capacity and Delay - Taxiway and Gate Capacity (10)

UNIT - IV

Air Traffic Management: Navigational aids: ground based systems, satellite based systems – Air traffic control and surveillance facilities. Visual Aids: AirPort marking and Lighting for runway, Taxiway and other areas. Air traffic control: Need, network, control aids, instrumental landing systems, advances in air traffic controls. (10)

Text Book

1. Airport Engineering: Khanna and Arora, Nem Chandra & Brothers, Roorkee
2. Airport Engineering: G. Venkatappa Rao, Tata McGraw-Hill Publishing

Reference Book

1. Planning and Design of Airports: Robert Herorjeff, McGraw-Hill Publishing

VIII Semester Department of Civil Engineering

Course Code : CET457-6 **Course : Building Services**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **(Elective - V)Total Credits : 03**

Course Outcome

1. The Students will be able to understand design of plumbing system of building.
2. The Student will be able to analyze HVAC system of building.
3. The Students will be able evaluate fire fighting system of building.

General

Overview of Building Services: Plumbing, Firefighting, Lift, Escalator, HVAC

Unit - I

Water supply and Distribution to Multi-storey buildings, Introduction to De-centralized water Treatment units, Swimming pool, water drainage and Rain Water Harvesting, Solid Waste Disposal System.

Unit - II

Air Conditioning : Definition, Purpose, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, Types of Air Conditioners, (Central type, Window Type, Split Unit) Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

Unit - III

Fire control systems; Causes of fire in buildings – Safety regulations – NBC 2016 – Planning considerations in buildings like non-combustible materials, staircases and lift lobbies, fire escapes and A.C. systems. Heat and smoke detectors – Fire alarm system, Fire lifting pump and water storage – Dry and wet risers – Automatic sprinklers

Unit - IV

Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts - Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Escalators, Freight elevators, Passenger elevators, Hospital elevators.

Unit - V

Requirement of good Acoustic, sound absorbing material, Factors to be followed for noise control in residential building. Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice. Introduction to biometric system.

Text Books

1. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999
2. SP 7 : 2016, National Building Code of India 2016 (NBC 2016), https://bis.gov.in/index.php/standards/technical-department/national-building-code/
3. ISHRAE Handbook
4. Building Acoustics by Tor Erik Vigran, CRC Press; 1st Edition 2008.
5. V.K. Jain, Handbook of Designing and Installation of Services in High Rise Building & Complexes, Khanna Publication, New Delhi.

Reference Books

1. F. Hall, Roger Greeno, Building Services Handbook: Incorporating Current Building and Construction Regulations.
2. Building Services Research and Development Association Staff Building Services Materials Handbook-Heating, Sanitation and Fire Routledge
3. E.C. Butcher and A.C. Parnell. Designing for Fire safety.
4. Peter R. Smith and Warden G. Julian, Building Services.

VIII Semester Department of Civil Engineering

Course Code : CET457-7 **Course : Disaster Preparedness and Planning**

L : 3Hrs., T : 0Hrs., P : 0Hrs., Per Week **(Elective - V)Total**

Credits : 03

Course Outcomes

The student will develop competencies in;

1. The application of Disaster Concepts to Management
2. Analyzing Relationship between Development and Disasters.
3. Ability to understand Categories of Disasters and
4. realization of the responsibilities to society

Unit - I

Introduction - Concepts and definitions : Disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation, Environmental hazards, Environmental Disasters and Environmental stress. Disaster Management Indian scenario, hazard and vulnerability profile of India, Disaster Management Act 2005 and Policy guidelines.

Unit - II

Disasters : Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.);, mountain and coastal areas, ecological fragility.

Unit - III

Disaster Impacts : Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Unit - IV

Disaster Risk Reduction (DRR) : Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles andresponsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Unit - V

Disasters, Environment and Development : Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Text Books

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Reference Books

1. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003

VIII Semester Department of Civil Engineering

Course Code : CET458-1
L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Industrial Structures (Elective - VI)
Total Credits : 02

Course Outcomes

1. An ability to understand the provision of IS code used for design of industrial structures.
2. An ability to estimate various loading coming on industrial structures and understand its behaviour due to its influence.
3. An ability to produce safe and economical design of various industrial structures satisfying codal requirements.

Syllabus

Introduction : Industrial building frames: Types of frames, bracing, gantry girders and columns, workshop sheds, trussed bents. Introduction to Pre Engineered Buildings.

Chimneys : Loads and stresses in chimney shaft, earthquake and wind effect, stresses due to temperature difference, combined effect of loads and temperature, temperature. Design of chimney;

Silos and Bunkers : Jassen's theory, Airy's theory, Shallow and deep bins. Rectangular bunkers with slopping bottom, Rectangular bunkers with high side walls; Steel stacks; introduction, force acting on a steel stack, design consideration, design example of stacks;

Machine foundations : Introduction, machine vibration, structural design of foundation to rotary machines, impact machines, vibration characteristics, design consideration of foundation to impact machine, grillage, pile and raft foundation.

Pre engineered structures.

Text Books

1. Illustrated Design of RC Buildings by V. L. Shah and S. R. Karve, Standard Publisher
2. Limit State Theory and Design of Reinforced Concrete, Karve S.R. and Shah V.L, Structures Publications, Pune. 2007
3. Practical Design of Reinforced Concrete Structures, Ghosh Karuna Moy, PHI Learning Pvt. Ltd.
4. Jain A.K., "Introduction to Earthquake Engineering Structures."
5. S.K. Duggal, "Earthquake Resistant Design of Structures."
6. Design & Construction of Silos & Bunkers: Sargis S. Safarian, Earnest C Harris

References Books

1. Chopra A.K., Dynamics of Structures, Theory & Application to earthquake Engineering, 2nd edition Pearson Education (Sigapore) Pvt, Ltd, New Delhi, 1995.
2. Seismic design of RC & masonry buildings: Paulay & Prestiley, Thomas P. & M. J. N. Prestiley A.Wiley, Inter Science Publication.
3. RCC Design, Menon & Pillai, Tata McGraw-Hill publications
4. Limit state Design of reinforced conc. (As per IS 456:2000), Dr. BC Punmia, A.K. Jain, Laxmi publications.

Reference Codes

1. IS:1893-2002 and 2016 Part I Earthquake Criteria
2. IS:13920-1993 and 2016 Ductile Detailing
3. IS:9178-1979 reaffirmed 1995
4. IS: 4995(Part 1 and Part 2)-1974 5. IS 456-2007 / IS 800 2007
6. ACI 313-77 (1984)
7. BS 5061

VIII Semester Department of Civil Engineering

Course Code : CET458-2
L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Watershed Management (Elective - VI)
Total Credits : 02

Course Outcomes

The students will be able to;

1. Understand the Watershed and its characteristics
2. Understand the importance of watershed in terms of drinking water, irrigation water, increases in ground water.
3. Plan and design of Watershed protection, conservation elements
4. Envisage the management plan of Watershed.

Unit - I

Soil and Water ; Issues related to plant life like composition of soil, water requirement of crops, Soils, their origin and classification. Land classification for WM, Land capability rating, determination of land capability class, land capability and suitability surveys, (Desalination of water logging and its remedial measures).

Unit - II

Watershed Behavior : Physical elements of a watershed, effects of land use changes on hydrological cycle component Concept of vegetative management of water yield and quality. Watershed Experiments, extrapolation of results from representative and experimental basins.

Unit - III

Water conservation and Harvesting : Need of water conservation. Examples and critical reviews. Inventory techniques for precipitation, runoff. Water harvesting techniques – Elements, Development of modern harvesting Techniques Estimation of peak runoff rate.

Unit - IV

Erosion process : Factors affecting erosion, Types of erosion, Assessment of erosion, Control measures for erosion Conservative practices – Objective and general practices, land and soil classification, identification of critical areas, (Catchment area treatment).

Unit - V

Watershed Management : Objectives of Planning Watershed Projects, Guidelines for Project Preparation. Approach in Govt. programmes, people's participation, conservation farming,

watershed management planning, identification of problems, objectives and priorities, socioeconomic survey, use of tools like GIS. Watershed Modeling: Runoff components –Simple parametric models – Curve Number Method.

Text Books

1. J. V. S Murthy, Watershed Management, New Age International Publishers, 1998.
2. Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 2003.
3. V.V. N. Murthy, Land and Water Management, Kalyani Publishers, 1994.
4. Ghanshyam Das, Hydrology & Soil Conservation Engineering ,PHI Publication.

VIII Semester Department of Civil Engineering

Course Code : CET458-3
L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Environmental Impact Assessment (Elective - VI)Total Credits : 02

Course outcomes

At the end of this course students will demonstrate the ability to carry out;

1. Environmental impact and risk analysis.
2. Life cycle assessment

Unit - I

Introduction : Evolution of EIA; EIA at project; Regional and policy levels; EIA process in India andother countries; EIA methodologies; Screening and scoping criteria; Rapid and Comprehensive EIA

Unit - II

EIA methodologies : Baseline data collection; Prediction and assessment of impacts on physical, biological and socio-economic environment.Environmental health Impact assessment

Unit - III

Methods of Impact Analysis : Environmental clearance procedure in India ,Cost benefit analysis& its dimensions, Environmental audit, Role of GIS in EIA-base line study , risk assessment & management,

Unit - IV

Environmental Risk Analysis, Fundamentals of hazards, exposure & risk assessment, Basic Steps in risk management- hazard identification, exposure assessment & risk characterization, Quantified risk assessment for industrial accidents, Design of risk management program , Risk assessment application to environment management problems.

Unit - V

Life cycle assessment, stages in LCA of a product, energy and resource balance, Environmental management systems

Text Books:

1. A.Chadwick, Introduction to Environmental Impact Assessment, Taylor & Francis, 2007.
2. Larry, W. Canter, Environmental Impact Assessment, McGraw Hill Inc. Singapore, 1996.
3. Rau, GJ. And Wooten, C.D., Environmental Impact Analysis Handbook, McGraw Hill 1980
4. CPCB, MoEFCC guidelines for EIA

Reference Books

1. R.Therirvel, E. Wilson, S. Hompson, D. Heaney, D.Pritchard, Strategic Environmental Assessment Earthscan, London, 1992.
2. A.Gilpin, Environmental Impact Assessment-Cutting edge for the 21st century, CUP, London,1994.
3. Paul, A Erickson, A Practical Guide to Environmental Impact Assessment, Academic Press,1994.
4. Suresh, K.D., Environmental Engineering and Management, SK Kataria Publishers, New Delhi,2002.
5. Gupta, K.R., Environmental Legislation of India, Atlantic Publishers, 2006.

VIII Semester Department of Civil Engineering

Course Code : CET458-4 | **Course : Rock Machine (Elective - VI)**

L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week | **Total Credits : 02**

Course Outcomes

On successful completion of the course students would be able to;

1. To make the students understand engineering properties of rock, classification of rocks.
2. Laboratory testing for rocks, failure criteria, tunnelling in rocks.
3. Various techniques to improve the in situ strength of rocks.

Syllabus

Introduction to rock mechanics: Scope and application of rock mechanics, engineering classification of intact and fissured rocks, RQD, rock exploration, geotechnical description of rock mass.

Engineering properties of intact rock: Porosity, void index, permeability, ultrasonic and electrical resistivity, uniaxial compressive strength, Brazilian test, Coulomb's theory, Griffith's theory of failure in tension and compression, elastic and dynamic constants, time dependant behaviour, various creep models, applications in mining works.

Engineering properties of jointed rock: An isotropy, deform ability and shear strength, rock discontinuity, friction along a joints, residual strength, stick-slip theory, Barton's - Chaubey's correlation for shear strength, shear stiffness and dilation.

In-site stress in rock masses : Analysis of stresses, thick wall cylinder formulae, Kreish equation, Green span method, opening in rock mass and stresses around opening, Borehole deformation meters, borehole inclusion stress meters, borehole strain gauge devices. Underground excavation and subsidence, bearing capacity of homogeneous as well as discontinuous rocks, support pressure & slip of the joint, delineation of types of rock failure, unsupported span of underground openings.

Field tests: Plate load test, shear strength test.

Stability of rock slopes: Modes of failure, prevention and control of slope failure, introduction to rockbolting.

Text Book

1. Rock mechanics in engineering practice: Stag and Zienkiewiz, John wiley& sons
2. Fundamentals or rock mechanics : Jagger, J.C. & Cook, N.G.W., Methuen & Co. 1971
3. Rock mechanics & Design of structures :Obert, L & Duvall, W.I., John Wiley & Sons

Reference Books

1. Rock mechanics for engineers : Varma, B.P., Khanna Publishers
2. Introduction to rock mechanics : Goodman, Wiley International

VIII Semester Department of Civil Engineering

Course Code : CET458-5 **Course : Highway Construction and Management**

L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week **(Elective - VI)Total**

Credits : 02

Course Outcome

1. Students should be able to describe and explain design principle of Flexible pavement
2. Students should be able to describe and explain design principle of Concrete pavement
3. Student should be able to explain various material required for construction of roads along withtheir properties
4. Students should be able to describe various evaluation techniques for pavements along with the maintenance measures.

UNIT - I

Flexible Pavement Construction

Earthwork, compaction and construction of embankments, specifications of materials, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers and their choice

UNIT - II

Cement Concrete Pavement Layers

Specifications and method of cement concrete pavement construction; Construction of interlockingblock pavements, Quality control tests; Construction of various types of joints; Soil Stabilized Pavement Layers: Principles of gradation/proportioning of soil aggregate mixes and compaction; Design factors, mix design, construction control and quality control checks for mechanical, soil- cement, soil- bitumen and soil-lime stabilization methods. Use of additives, Numerical problems onmix design and applications

UNIT - III

Pavement Evaluation

Pavement Distress - Functional and structural condition of pavements, Pavement distress survey, Functional condition evaluation of pavements- Roughness, Skid Resistance. Structural evaluation of pavements non-destructive testing, Benkelman beam and Falling Weight Deflectometer, Pavement strengthening based on deflection as per IRC

UNIT - IV

Maintenance and rehabilitation techniques

Pavement Management Systems - Pavement Management Systems- Components, structure, data requirements, Project level and Network level needs, Pavement performance prediction – concepts, modelling techniques– AASTHO, CRRI and HDM models, Budget forecasting for maintenance and rehabilitation, Ranking and optimization methodologies, life cycle costing.

Text Books

1. Highway Engineering : Khanna & Justo
2. A text book of highway engineering: R Srinivas Kumar

Reference Book

1. Pavement Analysis and Design: Yang H Huang

VIII Semester Department of Civil Engineering

Course Code : CET458-6 | **Course : Energy Efficient Buildings**

L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week | **(Elective - VI)**

Total Credits : 02

Course Outcomes

1. The students will be able to exhibit the understanding of the concept and theoretical backgroundof energy efficient building.
2. The students will be able to prepare preliminary designs of building component in energy efficient building.
3. The students will be able to demonstrate their learning about use of simulation tools to achieve energy efficiency.

Unit - I

Solar energy fundamentals & practices in building design- solar astronomical relations and radiation physics and measurements.

Elements of design of energy efficient building, Climate responsive process of design, Climate responsive process of design.

Unit - II

Heating and ventilation design : Human thermal comfort, climatological factors, material specifications and heat transfer principles

Heat loss from buildings, design of insulators, Norms of Energy Conservation Building Code Thermal performance evaluation for energy efficient materials.

Design of artificial ventilation system.

Unit - III

Energy efficient lighting system design : Basic terminologies and standards, Day lighting and artificial lighting design, auditing.

Unit - IV

Renewable energy sources : Solar and wind. Simple design calculations.

Advances in computational energy conservation- implementation of computer energy simulation programs into building designs. e.g. TRNSYS, Design Builder etc.

Text Books

1. Ministry of Power, Energy Conservation Building Code 2018, Revised Version, Bureau of Energy Efficiency, 2018, https://beeindia.gov.in/ news-events/energy-conservation-building-code-rules- 2018
2. Handbook of functional requirement of buildings, SP: 41:1987.
3. Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1 st ed. Nabhi Publication, 2008.
4. Energy and the Environment JM Fowler, McGraw Hill, New York, 2nd Ed 1984

Reference Books

1. Climate responsive architecture (A design hand book for energy efficient buildings), Arvind Krishnana, Simos Yannas, Nick Baker, S V Szokolay Mc Graw hill Education, Seventh reprint, 2013
2. Renewable Energy and Environment -A Policy Analysis for India H, Ravindranath, K Usha Rao, B Nataraja n, P Monga Tata McGraw Hill, 2000
3. http://www.trnsys.com/
4. https://designbuilder.co.uk/

VIII Semester Department of Civil Engineering

Course Code : CET458-7

L : 2Hrs., T : 0Hrs., P : 0Hrs., Per Week

Course : Reuse of Industrial Wastes (Elective - VI)

Total Credits : 02

Course Outcomes

The students would be able to:

1. Describe and explain the necessity and importance of waste management techniques through Prevention, Minimization, Reuse, Recycling, Energy Recovery and Disposal.
2. Apply the knowledge of various principles, theories and techniques that include prevention and minimization through smart product and production process design, reuse, recycling, and energy recovery.

Syllabus

Unit - I

Current waste handling scenario in industries in India, Sources of hazardous, non-hazardous industrial waste, Overview of industrial waste management techniques in India, Schemes, incentives, policies on industrial waste management.

Unit - II

Hierarchy of waste management : Prevention, Minimization, Reuse, Recycling, Energy Recovery, Disposal, management and treatment options for various types of wastes for reuse and recycle, Overview of treatment methods for reuse, recycle, disposal such as combustion, bio-methanation, acid treatments, combustion and gasification, composting, fermentation etc.

Unit - III

Overview of product design for waste minimization, Cost benefit analysis of different waste management techniques, Waste management techniques which address business profitability, environmental regulations and economic viability

Unit - IV

Introduction to new technologies, Overview of (e-waste, biomedical, construction and demolition) waste- handling and management, Overview of Central Pollution Control Board and State Pollution Control Board guidelines, Global best practices on waste management in industries such as cement, pulp and paper, metal, plastic, fly ash.

Unit - V

Financial, technical, government schemes on industrial waste management in India. Opportunities for public- private partnerships (PPP) in industrial waste management and solid waste management, Incentives, financial assistance and technical assistance for power generation from waste in India, Monitoring and evaluation procedures of waste management in industry

Text books

1. Nemerow N. L. Theories and Practices of Industrial Waste Treatment, Addison Wesley Publishing Co. NY. 2nd Edition.
2. W.W. Ecenfelder, Industrial Water Pollution Control Mc-Graw Hill Book Co. 2nd Edition.
3. E.B. Bess Elivievre, Treatment of Industrial Waste, Mc-Graw Hill Book Co. 1st Edition.
4. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal And Reuse, 3rd Edition Mc-Graw Hill 1991.
5. John Pichtel, Waste Management Practices: Municipal, Hazardous, and Industrial, Second Edition CRC Press,2005

Reference Books

1. Central Pollution Control Board, India, Comprehensive Industry Document Series.
2. Gupta K R, Environmental Legislation of India, Atlantic publishers, 2006

VIII Semester Department of Civil Engineering

Course Code : CEP459

L : 0Hrs., T : 0Hrs., P : 12Hrs., Per Week

Course : Project Phase-II / One Semester Industry Project / Incubation

Total Credits : 06

Course Outcomes

The students would be able to;

1. Demonstrate conceptual and technical knowledge for understanding and analyzing the problems.
2. Solve the problems using modern tools and technique.
3. Work in a team and communicate technical details. 4. Draft technical report on a project.

Syllabus

- Every student has to undertake a project of professional interest. The project may be related to a theoretical analysis, an experimental investigation, a proto-type design, a new correlation and analysis of data, fabrication and setup of new equipment. The students will carry out the Project work in a group which is finalized in VIIth semester and submit a project report at the end of the semester.
- Each group shall deliver seminar/seminars on the project work done during the semester.
- Students can undertake six months industry project during the internship. This scheme will provide students to undergo internship with stream majors at industry / well known academic institutions /R&D Laboratory premises and earn real world exposure.

VIII Semester Department of Civil Engineering

Course Code : CETH81-1 | **Course : Design of Environmental Structures**

L : 4Hrs., T : 0Hrs., P : 0Hrs., Per Week | **Total Credits : 04**

Course Outcomes

1. The graduates will be able to understand the basic principles used in the design of environmental structures like water tanks, pump house, water treatment units, etc.
2. The graduates will be able to understand the behavior of structural components of various environmental structures under standard loading conditions and design them as per codal provisions.

Syllabus

Introduction to water treatment, Characteristics of raw water, various treatment processes used inwater treatment, treatment flow sheet and site selection for water treatment plant.

Hydraulic design of various units of Water Treatment Plant. Design of Circular Cascade Aerator Design of

Flash Mixer

Design of Circular Sedimentation tank and Clariflocculator Design of Underground Water Tanks

Text Books

1. Water supply Engineering Vol-I by B.C. Punmia (Laxmi Publication)
2. CPHEEO Manual of water supply & treatment
3. Guidelines for seismic design of liquid storage tanks: Jain, S. K., Jaiswal, O.R., NICEE, IITK, 2004.
4. Design of liquid retaining concrete structure: Anchor, R.D., Edward Arnold, London, 1992.
5. Ghali, A, "Circular Storage Tanks and Silos", E & F N Spon, London, 1979.

References Books

1. BIS, IS 3370 (2009), "Indian Standard code of practice for concrete structures for the storage of liquids", Part I and Part II.
2. BIS, IS 3370 (1967), "Indian Standard code of practice for concrete structures for the storage of liquids", Part III and Part IV.
3. BIS, IS 1893 (1984), "Indian Standard criteria for earthquake resistant design of structures".

VIII Semester Department of Civil Engineering

Course Code : CETH81-2 | **Course : Geometric Design of Highways**

L : 4Hrs., T : 0Hrs., P : 0Hrs., Per Week | **Total Credits : 04**

Course Objectives

1. Understand objectives, requirements and various terms related with geometric design and remember various traffic characteristics and traffic studies to be used in planning and design of various cross section elements.
2. Apply the knowledge of sight distances horizontal alignments and vertical alignment for geometric design of safe, efficient and economical road network.
3. Apply the knowledge of IRC standards for design of expressways and National highways and remember the philosophy of various traffic designs.

UNIT – I

Introduction

Classification of rural highways and urban roads. Objectives and requirements of highway geometric design; Design Controls, Design speed, Topography, Traffic characteristics, Environmental factors, traffic studies. (06)

UNIT- II

Cross Section Elements

Right of way and width considerations, roadway, shoulders, kerbs, traffic barriers, medians, frontage roads; facilities for pedestrians, bicycles, buses and trucks, Pavement surface characteristics - types, cross slope, skid resistance, unevenness, speed arresters. (06)

UNIT- III

Sight Distance and design of Horizontal alignments

Sight distances, Horizontal alignment - design considerations, stability at curves, super elevation, widening, transition curves; curvature at intersections. (06)

UNIT- IV

Vertical alignment

Grades, ramps, design of summit and valley curves, combination of vertical and horizontal alignment, and design of hair pin bends. (06)

UNIT- V

Geometrics of National Highways &Expressways

Design of expressways, National Highways, IRC standards and guidelines for design. (06)

UNIT- VI

Traffic Designs

Various types of Intersections, Interchanges, Designs of Signals, Traffic Rotary, Design of Parking lot, Capacity & Level of Service. (10)

Text Book

1. Highway Engineering : Khanna & Justo
2. Principle and Practice of Highway Engineering: S.K.Sharma
3. Traffic Engineering : L.R.Kadiyali
4. IRC Codes

Reference Book

1. Geometric Design Projects for Highways, John G. Schoon, (American Society Civil Engineers)
2. Freeway Geometric Design for Active Traffic Management in Europe (Create Space Independent Publishing Platform)

VIII Semester
Department of Civil Engineering

Course Code : CETM81-1 | **Course : Instrumentation**

L : 4Hrs., T : 0Hrs., P : 0Hrs., Per Week | **Total Credits : 04**

Course Outcomes

1. The graduates will be able to understand the principles of operation and characteristics of instrumentation and integrated sensor systems
2. The graduates will be able to understand right use of sensors and instruments for differing applications along with limitations
3. The graduates will be able to recognize and apply measurement best practice and identify ways to improve measurement and evaluation.

Syllabus

Fundamentals of Measurement, Sensing and Instrumentation covering definition of measurement and instrumentation, physical variables, common types of sensors.

Sensor Installation and Operation, Differentiate between types of sensors and their modes of operation and measurement.

Study of various transducers & Principle of their working, displacement velocity acceleration.

Stress-strain measurement, strain gauges static and dynamics strain measurement, Calculation of stresses from measurement of strain, deflections etc.

Non-destructive testing of concrete / steel / ultrasonic techniques, use of UPV, rebound hammer, rebar locator, cover meter, etc

Introduction and use of digital hydraulic measurement devices Introduction to instruments used in traffic Engineering. Introduction to instruments used in Geotechnical Engineering Introduction to instruments used in Environmental Engineering

Text Books

1. Experimental Stress Analysis: Singh, Sadhu Khanna Publishers.
2. Instrumentation in Industry: Soisson, H. E. John Willey & Sons, NY, 1975
3. Corrosion of Steel in Concrete: Boon Field, J. P. E & FN SPON, 1997.
4. Modal Analysis of Structures: Ganesan, T. P., University Press, 2000

Reference Books:

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press
3. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis

VIII Semester Department of Civil Engineering

Course Code : CETM81-2 | **Course : Rural Water Supply and Sanitation**

L : 4Hrs., T : 0Hrs., P : 0Hrs., Per Week | **Total Credits : 04**

Course Objectives

Students would be able to;

1. Understand the basic knowledge about the various programs and schemes used in rural water supply.
2. Understand the basic knowledge about the various methodology and schemes used in rural sanitation system

Unit - I

National Water Policy, Status of Rural water supply in India, National and State level programs of RWS, Planning and implementation of rural water supply, problem in villages, Source development,springs, dug wells, infiltration wells etc. Package water treatment plants, appropriate technology for removal of excess iron and manganese, fluoride, arsenic for drinking water

Unit - II

Surface water treatment, slow sand filtration, disinfection in RWS. Guidelines for Design of RWS, Types of RWS systems and their components, types of pipes, pumps used in RWS, Community participation in planning, design, O and M of RWS.

Unit - III

Low cost sanitation methods, centralised and decentralised methods of rural sanitation, pit privy, aqua privy, water seal latrine, bore-hole latrine, bucket latrine, trench latrine, overhung latrine, compost privy, chemical toilet, double pit latrine, pour flush latrine, improved double pit pour flush latrine, septic tank, design of septic tank, disposal of septic tank effluent.

Unit - IV

Water carried methods of excreta disposal for rural areas, excreta disposal programs for rural areas composting, methods of composting, Indore method, Bangalore method, Nadep method, Vermicomposting method, bio dung vermicomposting, gobar gas plant, sulabh sauchalaya. role of ngo's and go's in rural sanitation community participation in rural sanitation.

Reference

1. E.G. Wagner and J.N. Lanoix, Excreta Disposal for Rural Areas and Small Communities.
2. B.C.Punmia Environmental Engineering – II, Laxmi Publication, 2002.
3. Garg S.K; Environmental Engineering – II Standard Publication 2002.

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