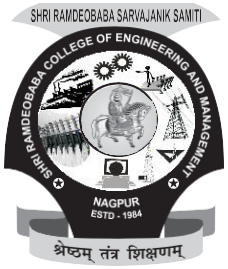

SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

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

PROGRAMME SCHEME & SYLLABI
2020 – 2021

B. E. (CIVIL ENGINEERING)

Published By
Dr. R. S. Pande
Principal
Shri Ramdeobaba College of Engineering & Management
Ph. : 0712-2580011 Fax : 0712 - 2583237
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 objectives:

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

Sr. No.	Code	Course	Branches	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PHT157	Mechanics	Civil, Industrial	3	1	0	4	40	60	100	03
		Oscillations, waves & Optics	Electrical								
			Mechanical								
		Semiconductor Physics	Electronics, EDT, Electronics & Comm.								
			Computer Science Engg, information Tech.								
2.	PHP157	Mechanics Lab	Civil Industrial	0	0	3	1.5	25	25	50	–
		Oscillations, Waves & Optics Lab	Electrical								
			Mechanical								
		Semiconductor Physics Lab	Electronics, EDT, Electronics & Comm.								
			Computer Science Engg, Information Tech.								
3.	MAT152/ MAT151	Differential Equations, Linear Algebra, Statistics & Probability/ Calculus	All Branches	3	0/1	0	3/4	40	60	100	03
4.	MAP151	Computational Mathematics Lab	All Branches	0	0	2	1	25	25	50	–
5.	EET151	Basic Electrical Engineering	All Branches	3	1	0	4	40	60	100	03
6.	EEP151	Basic Electrical Engineering Lab	All Branches	0	0	2	1	25	25	50	–
7.	MET151	Engineering Graphics & Design	All Branches	1	0	0	1	40	60	100	03
8.	MEP151	Engineering Graphics & Design Lab	All Branches	0	0	4	2	50	50	100	–
9.	HUT152	Consultation of India	All Branches	2	0	0	0	–	–	–	–
10.	PEP151	Yoga / Sports	All Branches	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	Branches	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	CHT151	Chemistry	All Branches	3	1	0	4	40	60	100	03
2.	CHP151	Chemistry Lab	All Branches	0	0	3	1.5	25	25	50	–
3.	MAT151/ MAT152	Calculus/Differencial Equations, Linear Algebra, Statistics & Probability	All Branches All Branches	3	1/0	0	4/3	40	60	100	03
4.	CST151	Programming for Problem Solving	All Branches	4	0	0	4	40	60	100	03
5.	CSP151	Programming for Problem Solving Lab	All Branches	0	0	2	1	25	25	50	–
6.	IDT151	Creativity, Innovation & Design Thinking	All Branches	1	0	0	1	20	30	50	1.5
7.	INT151	Workshop/Manufacturing Practices Lab	All Branches	1	0	0	1	20	30	50	1.5
8.	INP151	Workshop/Manufacturing Practices Lab	All Branches	0	0	2	1	25	25	50	–
9.	HUT151	English	All Branches	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 Engineering
III 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	CET254	Engineering Mechanics	3	1	0	4	40	60	100	3
9	CET255	Solid Mechanics	3	0	0	3	40	60	100	3
10	CEP255	Solid Mechanics	0	0	2	1	25	25	50	--
			19	**1**	**8**	**24**				

Scheme of Teaching & Examination of Bachelor of Engineering
IV 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	1	0	4	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	CET299	Open Elective I	3	0	0	3	40	60	100	3
10	HUT260	Effective Technical Communication	3	0	0	3	40	60	100	3
			18	**3**	**8**	**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 Engineering
V Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	EndSem 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 Engineering
VI Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	EndSem 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 Engineering
VII Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	EndSem 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 Engineering
VIII Semester B.E. (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	EndSem 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 / One Semester Industry Project / Incubation	0	0	12	6	100	100	200	--
			5	**0**	**12**	**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	EndSem 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 Engineering
Minors Specialization (Civil Engineering)

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
			L	T	P		Continuous evaluation	EndSem 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.

List of Electives

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 & 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 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 and 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	CET458-5 Highway Construction & Management
Construction Engineering	CET358-6 Advanced Construction Materials	CET359-6 Repairs & Rehabilitation of Structures	CET451-6 Contracts Management	CET452-6/ CEP452-6 Construction Project Planning and 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 Industrial Engineering

Course Code: PHT157 **Category : Basic Science Course**

Course : PHYSICS : Mechanics (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 classical mechanics
2. To enhance the ability to use the mathematical techniques in its applications

Course Outcomes

The successful completion of the course will enable the students to,

1. Solve the problems in kinematics and dynamics
2. Apply concepts of oscillatory motion in solving engineering problems
3. To understand the motion in two and three dimensions
4. To understand the central forces and conservation laws

Module 1: Vectors Calculus

Vectors: Algebra and Calculus, Unit Vectors, Directional Cosines, Vector Differential Operators, Coordinate Transformations

Module 2: Newton's Laws and Applications

Introduction to Newtonian Mechanics: Newton's Laws, Intertial and Non-intertial Systems, Simple applications of Newton's laws, Circular Motion and Gravitation

Particle Dynamics in One Dimension:

Constant Applied Force, Time Dependent Force, Velocity Dependent Force, Position Dependent Force, Conservative Forces, Potential Energy, Motion under a Linear Restoring Force, Gravitational Field

Module 3: Oscillators

Linear and Nonlinear Oscillations, Linear Harmonic Oscillator, Damped Oscillator, Forced Oscillator, Resonance, Applications, Oscillators in Electrical circuits, Non-linear Oscillating Systems

Module 4: Motion in 2-D and 3-D

Different Coordinate Systems, Kinematics in Cylindrical and Spherical Coordinates, Potential Energy Function, Torque, Dynamics in 3-dimensions, Harmonic Oscillators in 2 and 3-dimensions, Applications, Projectile motion

Module 5: Central Force

Central Force and Potential Energy, One-body problem involving central force, General properties and Equations of motion, Orbits in an Inverse Square Force Field, Applications,Kepler's laws of Planetary Motion

Module 6: Conservation Laws

System of Particles and Center of Mass, Conservation of Linear and Angular Momentum, Conservation of Energy, Two body problem in center of mass coordinate system, Applications, Rocket propulsion, Conveyor belt

Text Books

1. Introduction to Classical Mechanics, Atam P. Arya, 2nd Edition (McGraw-Hill)
2. Analytical Mechanics, Grant R. Fowles, George L. Cassiday, 7th Edition (Thomson Brooks/Cole)

Reference Books

1. An introduction to Mechanics, Daniel Kleppner, Robert J. Kolenkow, 2nd Edition (Cambridge University Press)
2. Theory and Problems of Theoretical Mechanics, Murray R. Spiegel, Schaum's Outline Series (McGraw-Hill)
3. Engineering Mechanics (Second Edition), M K Harbola, Cengage publications, New Delhi, 2013.

II Semester

Department of Civil Engineering

Course Code : PHP157 **Course : Mechanics Lab**

L:0 Hr., T:0Hrs., 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 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 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 experiments based on the following list:

1. Error analysis and graph plotting
2. g by free fall
3. To determine acceleration due to gravity by compound pendulum
4. To determine the moment of inertia of a body using torsion pendulum
5. Young's modulus by bending of beam
6. Young's modulus by vibrational method
7. To study damping of a bar pendulum
8. Fixed pulley, loose pulley, and block and tackle as simple machine
9. Static friction, sliding friction, and rolling friction
10. Force oscillation and resonance
11. To study the oscillation of a mass in combinations of two springs and hence determination of force constant
12. Measurement of linear expansion of solid as a function of temperature
13. Determination of thermal conductivity of building materials using single plate model or heat flux plate principle
14. Thermal diffusivity Used for measuring the thermal diffusivity and thermal conductivity of brass.
15. Thermal conductivity of a bad conductor by Lee's disc method.
16. Data analysis using Mathematica.

Suggested References

1. Physics Lab Manual written by the Teaching Faculty of Physics Department, RCOEM. A minimum of 8 experiments to be performed from the following 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: Calculus: (7 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin's series expansions; Indeterminate forms and L'Hospital's rule; radius of curvature (Cartesian form), evolutes and involutes

Module 2:Multivariable Calculus (Differentiation) (8 hours)

Limit, continuity and partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 3 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: Multivariable Calculus (Integration) (7 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: areas and volumes by double integration Center of mass and Gravity (constant and variable densities).

Module 6 : Vector Calculus (7 hours)

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

Topics for self learning

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. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, 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 would be 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 variation of 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 Lab**

L: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 compare the 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.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

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

Course Outcomes

At the end of this course, students will demonstrate the ability CO1: To understand and analyze basic electric and magnetic circuits.

CO2: To study the working principles of electrical machines and power converters. CO3: To study the working principles of power converters.

CO4: To introduce 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 presentation only. 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.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

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

Course Outcome

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

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

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

CO3: **Write report** based on the performed experiments (journal) with effective presentation or diagram characteristics / graphs.

CO4: Carry out **survey of electrical energy consumption at home** and calculate monthly energy bill as per 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 circuit (s.c.) tests.
8. To determine regulation and efficiency of a single phase transformer by direct loading test.

Demonstration / Study Experiment

1. To study B-H curve for different magnetic material
2. To study Buck converter
3. To study Boost converter

Syllabus of Department of Mechanical 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. Floor plans 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) Narayan K. L. & P. Kannalah (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.

Syllabus of Department of Mechanical Engineering

Course Code: MEP151 **Course : Engineering Graphics & Design Lab**

L: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, Floor plans 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)

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 practic 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.

Syllabus for B.E. Semester I Department of Humanities

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

Syllabus for B.E. Semester I Department of Humanities

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:

- Rationaliseperiodic properties such as ionization potential, electro-negativity, oxidation states and electron affinity.
- 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) Periodic properties (6 Lectures)

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, Effective nuclear charge, atomic and ionic sizes, ionization energies, electron affinity, electronegativity, and polarizability, Fajan's rule, Hard soft acids and bases theory and its applications.

(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 and benzene.

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 Electrochemistry (8 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of real gases and critical phenomena.

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies.

The Nernst equation and applications, Corrosion – Basic principle and mechanism of corrosion.

(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, etc.

(1) 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.

Suggested Text Books

(i) A Textbook of Engineering Chemistry by Dr. Rajshree Khare, S. K. Kataria and Son's Publisher.

(ii) Selected topics in Inorganic Chemistry by W. U. Malik, R. D. Madan & G. D. Tuli, S. Chand Publications.

(iii) Engineering Chemistry by A. Pahari, B. Chauhan, Firewall Media, Infinity Science Press LLC.

(iv) A Textbook of Engineering Chemistry by S. S. Dara, S. Chand Publications.

(v) Applied Chemistry by V. K. Walekar, A. V. Bharati, Tech-Max Publications.

(vi) Organic Chemistry by R. L. Madan, Mc-Graw Hill Publications.

(vii) Elementary Organic Spectroscopy, Revised Edition by Y. R. Sharma, S. Chand Publications.

(viii) Organic Chemistry – Reactions and Reagents by O. P. Agrawal, Goel Publishing House Publications.

(ix) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Reference Books

(i) Physical Chemistry, by Robert G. Mortimer, Elsevier Academic Press Publications.

(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane, Mc-Graw Hill Publications.

(iii) Organic Chemistry by Paula Y. Bruice, Pearson India.

(iv) Physical Chemistry, Third Edition by Gilbert W. Castellan, Adison-Wesley Publishing company.

(v) Physical Chemistry, by P. W. Atkins, Oxford University Press Publications.

(vi) Chemical Principles, Eight Edition, Steven S. Zumdahl, Donald J. DeCoste, Cengage Learning Publications.

(vii) Chemistry – The Molecular Nature of Matter and Change, Fifth Edition by Martin S. Silberberg, Mc-Graw Hill Publications.

(viii) Chemistry, An Introduction to Organic, Inorganic and Physical Chemistry, Third Edition by Catherine E. Housecroft, Edwin C. Constable, Pearson Prentice Hall Publications.

(ix) Organic Chemistry, Third Edition, William Kemp, Palgrave Publications.

(x) Concise Inorganic Chemistry, Fourth Edition by J. D. Lee, Chapman and Hall Publications.

Syllabus for B.E. Semester I / II

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.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CST151 **Course : Programming for Problem Solving**

L: 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

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CSP151 **Course : Programming for Problem Solving Lab**

L: 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.

CREATIVITY INNOVATION AND DESIGN THINKING
COURSE SYLLABUS

Course Code: IDT151 **Credits: 1**

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

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 ®, Trade Secret, 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

Syllabus Department of Industrial 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 metal cutting, fitting operations, and associated measuring and marking tools

Unit-2 Introduction to pattern making for metal casting, different types of carpentry tools, measuring tools 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 of joints.

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.

Syllabus Department of Industrial 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, Pearson India Education2008
2. Roy A. and Lindberg, “Process and Materials of Manufacture", Prentice hall India 1998.

Syllabus for B.E. Semester I / II Dept of Humanities Humanities and Social Sciences

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 well as 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

1.1. The concept of Word Formation

1.2. Root words from foreign languages and their use in English

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

1.4. Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Redundancies
3.6 Cliches

1. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence

2. Writing Practices

5.1 Comprehension
5.2 Precis Writing
5.3 Essay Writing
5.4 Letter Writing
5.5 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

Syllabus for B.E. Semester I

Humanities and Social Sciences including Management courses

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 Laurent series.

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, rocks and 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 and building.

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 loading method.

Non-destructive test: Significance, surface hardness test, pulse velocity method, semi destructive tests, x ray method, neutron tomography method.

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 & reinforcement

Shrinkage: Mechanism of shrinkage, types, Factor affecting it.

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 of concrete, 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.

b. Buoyancy and Floatation : Buoyant force and center of buoyancy, Archimedes principle, meta centre Stability of floating bodies.

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. Stream function and velocity potential function, free and forced vortices.

Unit IV : 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.

Unit V

a) **Orifice and Mouth piece :** definition, types, Hydraulic coefficients. Large orifice and submerged orifice. External and internal mouthpiece, running free and running full Mouthpiece.

b) **Notches and Weirs :** Definition, types, effect of end contraction, measurement of discharge. Cipolletti's weir, broad crested and submerged weirs.

Unit VI :

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

b. **Theory of model :** Similitude, geometric, kinematic and dynamic similarities, Reynolds and Froude model laws & its significance.

Text Books

1. Hydraulics and fluid mechanics by Dr. P. N. Modi and S. M. Seth, latest edition, Standard book house.
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 and mouthpiece.
2. Determination of coefficient of discharge of Notches (Rectangular and Triangular)
3. Determination of minor losses for G I pipe various sections.
4. Determination of coefficient of discharge for Venturi meter.
5. Determination of coefficient of discharge for Orifice meter.
6. Determination of Meta-centric height of ship model.
7. Verification of Bernoulli's Theorem.
8. Measurement of velocity and discharge of flow through pipe using ultrasonic flow meter.
9. Any other experiment employing self learning and other tools.
10. Determinate of fractional loss in pipes.

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 Conductivity
3. Determination Chlorides
4. Determination of Solid's
5. Determination of Turbidity
6. Determination of Alkalinity
7. Determination Dissolved Oxygen
8. Determination Hardness
9. Determination Available Chlorine in bleaching powder
10. Determination of Residual Chlorine (Titrating method/coloroscope method)
11. Jar Test
12. Study practical of MPN and plate count tests.
13. Study practical of BOD test.
14. Determination of Sulphate
15. Determination of Nitrate

Reference

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

III semester
Department of Civil Engineering

Course Code: CET 254 **Course : Engineering Mechanics**

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

Course Objectives

1. Apply basic knowledge of forces, moment and couples to create free body diagrams and solve equilibrium problems.
2. Apply knowledge of friction, simple machine, centroid and moment of Inertia to advanced courses of engineering.
3. Understand and analyse the problems based on Dynamics of Particles and Vibrations.

UNIT 1: Introduction to Engineering Mechanics

Force Systems, Basic concepts, System of Forces, Coplanar Concurrent Forces, Components in Space - Resultant - Moment of Forces and its Application; Couples and Resultant of Force System.

UNIT 2: Equilibrium

Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Virtual displacements, principle of virtual work for particle and system of rigid bodies, Analysis of truss using different methods.

UNIT 3: Friction

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; simple lifting machines.

UNIT 4: Centroid and Moment of Inertia

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.

UNIT 5: Mechanical Vibration

classification of vibration, damping and vibration, features of vibrating system, free vibration without damping, free vibration with damping, forced vibration without damping, forced vibration with damping, pendulum motion.

UNIT6: Particle dynamics

Kinematics and Kinetics of particles, rectilinear motion, curvilinear motion, D'Alemberts principle and its application in connected system of particles, Impulse Momentum, Collision of bodies, Work Energy Method.

Text Books

1. Engineering Mechanics: F.L.Singer (Harper & Row Publication)
2. Fundamentals of Engineering Mechanics: A.K.Sharma, Sai Publication
3. Engineering Mechanics: A.K.Tayal, Umesh Publication
4. Engineering Mechanics: Basudeb Bhattacharya,(Oxford University Press)

Reference

1. Engineering Mechanics: Timoshenko & Young, Tata McGraw Hill
2. Engineering Mechanics: Bear Johnston, Tta McGraw Hill
3. Engineering Mechanics: I.H.Shames, Phi Pvt. Ltd.

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, Shear flow in thin walled sections, concept of shear center of thin walled section.

Introduction of theories of failures.

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.

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 steady state 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

Laminar Flow in Circular Pipes: Laminar flow in circular pipes and parallel plates; Velocity and shear stress distribution; Hagen-Poiseuille equation, concept of drag & lift and its simple applications.

Unit II

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. Pipes in series and parallel, branched pipe and looped networks, Analysis of looped networks using Hardy-Cross method. Water hammer pressure, three reservoir problem, flow through siphon; hydraulic transmission of power through pipe.

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.

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

Unit IV

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

Hydraulic Machines

1. Pumps:- Basics, operating characteristics, pump head curve, system head curve, pumps in series & parallel, common problems and remedies; heads and efficiencies; specific speed; multistage pump for high head and large discharge; model testing of pump with applications of dimensional analysis .
2. Turbines : General introduction to turbines, Classification, types, draft tube.

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 Practicals

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 water distribution system using Hardy Cross (ΔQ)Method.
7. Analysis of water distribution network using water GEMS
8. Any other experiments employing self learning and other tools.
9. Use of softwares or freewares like LOOP/BRANCH/EPANET for pipe flow analysis
10. Study of pelton wheel
11. Study of Francis turbine

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, soil structure

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

Unit –II

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

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

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 Identification 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 | **Course : Computer Aided Civil Engineering Drawing Lab**

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

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 Hall of 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 along with 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 constructed wet 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"

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- up letters, 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., **Total Credits: 03**
P : 00 Hrs., Per Week

Course Outcomes

1. Able to understand various structures
2. Able to understand components of building with its utility.

4. 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 proofing of 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, New age 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., **Total Credits: 03**

P : 00 Hrs., Per Week

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, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

Syllabus

Module 1: Introduction to Surveying (8 hours): Principles, Linear, angular methods, Survey stations, Survey lines- ranging, Bearing of survey lines.

Levelling : Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning.

Digital and Auto Level, Errors in levelling;

Contouring : Characteristics, methods, uses, Triangulation theories Plane Tabling : Intersection / Resection methods

Triangulation and Trilateration (3 Hours),:

Theodolite survey : Measurement of horizontal and vertical angle; vernier theodolite Trigonometric leveling

Module 2: Curves (8 hours) Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Elements of transition curve - Vertical curves

Design of curves : Horizontal / Vertical with alignment

Module 3: Modern Field Survey Systems (9 Hours): Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat.

Total Station : Parts of a Total Station – Accessories –Advantages and Applications, Procedure for total station survey, Errors in Total Station Survey;

Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Introduction to Co-ordinate transformation, accuracy considerations.

Module 4: Photogrammetry Surveying (8 Hours): Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements.

Introduction to Drone surveying, flight planning, analysis of drone data

Module 5: Remote Sensing (9 Hours): Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, platforms and sensors, remote sensing data acquisition; digital image processing, Introduction to visual image interpretation.

Text/Reference Books

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote 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
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001
6. Arora, K.R., Surveying, Vol-I, 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. Measurement of horizontal and vertical angles by Mechanical Vernier Theodolite
4. Measurement of coordinates by Total Station
5. Location survey by Total Station
6. Measurement of Latitude and Longitude using hand held GPS
7. Demonstration of drone flying and surveying
8. Drone data analysis

Two day survey camp on any one using advanced survey instruments

- Contouring
- RoadSurvey
- Layouting
- Location of Boundary and areaalculation

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- legged Staircases.

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

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 by 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 Practicals

Practical shall consist of minimum 4 design assignments as mentioned below with detailed design calculations manually/ design software/excel sheets and reinforcement detailing on A-2 size sheets(Manually/AUTOCAD).

1. One-way slab, cantilever slab and continuous slab.
2. Rectangular pad / sloped footing.
3. Dog- legged / Staircases(Reinforcement detailing in AUTOCAD).
4. Single span prestressed concrete rectangular beam.
5. One field visit and its report in the journal.

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 methods and 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 subgrade soils, 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 Engineering and 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 relationships for 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 work place.

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. Mc Grath, 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 hose reel 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., **Total Credits : 04**

P : 00 Hrs., Per Week

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, Booking of 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. Sathikumar and 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 of building and roadorks.
- RateAnalysis: 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. Remaining three questions set on units III, IV and V with internal choice for 10 marks each. Duration of question paper 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 roadAnand.
- 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, laced and 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

Minimum five design examples.

Minimum two design assignments based on above topics along with the detailed structural drawings.

Practical Examination shall be based on the abovementioned .work alongwith fabrication drawings

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. Describe importance of water resource management, groundwater and recharging techniques to evaluate the yield of various water sources

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. Φ-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.

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.

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

Analysis of continuous beams, portal frames with and without sway by **Kani's Method.**

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 Hall of 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 Publishing Co. Ltd.

VI Semester
Department of Civil Engineering

Course Code : CET 358-2 **Course : Irrigation Engineering (Elective I)**

L : 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **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,blmethods; 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, grip length. 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. They will be able to conduct field tests and can analyze, apply and evaluate the design 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, Stress and deflections for rigid pavements due to load and temperature, influence charts

Analysis of Rigid pavement : 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, Ultimate load 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 | **Course : Advanced Construction Materials (Elective I)**

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

Course Outcomes

1. The students will be able to classify and select advance construction materials on the basis of their 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 building materials.
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.
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

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,McGraw Hill, 2006.

VI Semester
Department of Civil Engineering

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

L : 03 Hrs., T : 00 Hrs., **Total Credits: 03**

P : 00 Hrs., Per Week

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 Molecular basis 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 endergonic and 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, McGraw Hill, 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., | **Total Credits : 03**

P : 00 Hrs., Per Week

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., **Total Credits : 03**

P : 00 Hrs., Per Week

Course Outcomes

The students would be able to;

1. Explain and describe various sources, characteristics, processing methods and disposal methods of 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 the quantity and per capita contribution of solid waste. Physical and chemical characteristics, sampling and 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, design of 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, McGraw Hill (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., **Total Credits : 03**

P : 00 Hrs., Per Week

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, model split 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, BUTTER WORTH- 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 andRehabilitation 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 **Course : Numerical Method for Civil Engineers**

L: 03 Hrs., T : 00 Hrs., P : 00 Hrs., Per Week **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 in civil 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)nchors
- Soil nailing
- Secant pilealls
- Gabbion walls
- Deep soil mixingalls

The state of the art, studying with respect to the following aspects is expected

- Types, uses andpplications
- 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