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SCHOOL OF ENVIRONMENTAL AND CONSTRUCTION TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

B.Tech. Civil Engineering

CURRICULUM and SYLLABUS

(Regulation-2018)

Revision 1

(CHOICE BASED CREDIT SYSTEM)

INSTITUTE VISION

> To be a Centre of Excellence of International repute in education and research

INSTITUTE MISSION

To produce technically competent, socially committed technocrats and administrators through quality education and research

DEPARTMENT VISION

To be a Centre of Excellence in Civil Engineering through Quality Education and Research

DEPARTMENT MISSION

- To make the students excel in core civil engineering principles, develop professional leadership qualities, and
- > To encourage need-based research with an emphasis on societal considerations.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO-1: Successful careers

Graduates would have embarked on successful careers as Civil Engineers in consulting or constructing firms, government organizations and academia.

PEO-2: Higher studies

Graduates would have pursued or been pursuing higher studies and research program.

PEO-3: Leaders

Graduates would be entrepreneurs and leaders facing market challenges, and lifelong learners for their professional advancement.

PROGRAM OUTCOMES

PO1 -- Engineering Knowledge: Apply the knowledge of Mathematics, Science, Engineering Fundamentals, and an Engineering Specialization to the solution of complex engineering problems.

PO2 -- Problem analysis:Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of Mathematics, Natural Sciences, and Engineering Sciences.

PO3 -- **Design/development of solutions:**Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 -- Conduct investigations of complex problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 -- **Modern Tool Usage:**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 -- **The Engineer and Society:**Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 -- Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 -- **Ethics:**Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 -- Individual and Team Work:Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 -- Communication:Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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PO11 -- Project Management and Finance:Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 -- Life-long learning:Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES:

PSO1 -- Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of Civil Engineering infrastructure.

PSO2 -- Graduates shall have a broad understanding of environment, health and safety factors involved in infrastructural development and using modern tools.

PSO3 -- Graduates will be motivated for continuous self-learning in professional practice, pursue research in advanced areas of Civil Engineering, and involve to offer engineering service to the society, ethically and responsibly

S. No	Curriculum Components		Credits		
Ι	Basic Science and Mathematics		25		
	Humanities and Social Science	3			
II	Soft Skills	3	12		
	Humanities Elective	6			
III	III Basic Engineering				
	Program Core				
	a) Core Courses	48	(1		
IV	b) Community Service Project	3	61		
	c) Project Work	10			
	Elective Courses				
V	a) Professional Elective	18	36		
	b) Open Elective	18			
VI	VI Internship / Industry Training				
VII					
Total Credi	160				

CURRICULUM STRUCTURE

SCHEME OF INSTRUCTIONS

S.No.	Course Code	Course Name	Course Type	L	Т	Р	C
1	PHY18R172	Introduction to Mechanics	IC	3	1	2	5
2	CHY18R171	Chemistry	IC	3	1	2	5
3	MAT18R101	Calculus and Linear Algebra	TP	3	0	2	4
4	MAT18R102	Multiple Integration, Ordinary Differential Equations and Complex Variable	TP	3	0	2	4
5	MAT18R205	Transforms and Discrete Mathematics	TP	3	0	2	4
6	BIT18R101	Biology for Engineers	Т	3	0	0	3

BASIC SCIENCES AND MATHEMATICS COURSES

HUMANITIES AND SOCIAL SCIENCE COURSES

S.No.	Course Code	Course Name	Course Type	L	Т	Р	С
1	HSS18R151	English for technical	ТР	2	0	2	3
1	1155161151	communication	11	-	5	-	5

SOFTSKILL COURSES

S.No.	Course Code	Course Name	Course Type	L	Т	Р	С
1	HSS18R101	Soft skills-I	Т	3	0	0	1
2	HSS18R102	Soft skills-II	Т	3	0	0	1
3	HSS18R201	Soft skills-III	Т	3	0	0	1

S.No.	Course Code	Course Name	Course Type	L	Т	Р	С
1	HSS18R001	Management Concepts and Techniques	Т	3	0	0	3
2	HSS18R002	Marketing Management	Т	3	0	0	3
3	HSS18R003	Organizational Psychology	Т	3	0	0	3
4	HSS18R004	Project Management	Т	3	0	0	3
5	HSS18R005	Stress Management and Coping Strategies	Т	3	0	0	3
6	HSS18R006	Engineering Economics	Т	3	0	0	3
7	HSS18R007	Human Resource Management and Labour Law	Т	3	0	0	3
8	HSS18R008	Entrepreneurship Development	Т	3	0	0	3
9	HSS18R009	Cost Analysis and Control	Т	3	0	0	3
10	HSS18R010	Product Design and Development	Т	3	0	0	3
11	HSS18R011	Business Process Reengineering	Т	3	0	0	3
12	HSS18R012	Political Economy	Т	3	0	0	3
13	HSS18R013	Professional Ethics	Т	3	0	0	3
14	HSS18R014	Operations Research	Т	3	0	0	3
15	HSS18R015	Total Quality Management	Т	3	0	0	3

HUMANITIES ELECTIVE COURSES

S.No.	Course Code	Course Name	Course Type	L	Т	Р	С
1	EEE18R171	Basic Electrical and Electronics Engineering	IC	3	1	2	5
2	MEC18R151	Engineering Graphics and Design	TP	3	0	2	3
3	MEC18R211	Engineering Mechanics	Т	3	1	0	4
4	CSE18R171	Programming for Problem Solving	IC	3	1	2	5
5	MEC18R152	Engineering Practice	TP	3	0	2	3
6	CIV18R101	Introduction to Civil Engineering	Т	3	1	0	4

BASIC ENGINEERING COURSES

PROGRAM CORE COURSES

S.No	Course Code	Course Name	Course Type	L	Т	Р	С	Pre- requisite
1	CIV18R251	Engineering Geology	TP	3	0	1	3.5	NIL
2	CIV18R271	Fluid Mechanics	IC	3	0	2	4	NIL
3	CIV18R201	Solid Mechanics	Т	3	0	0	3	NIL
4	CIV18R272	Surveying & Geomatics	IC	3	0	2	4	NIL
5	CIV18R281	Computer-Aided Civil Engineering Drawing	L	0	0	3	2	NIL
6	CIV18R273	Strength of Materials	IC	3	0	2	4	CIV18R201
7	CIV18R252	Channel Hydraulics and Hydrology	TP	3	0	1	3.5	CIV18R271
8	CIV18R274	Geotechnical Engineering	IC	3	0	2	4	NIL
9	CIV18R301	Structural Analysis	Т	3	0	0	3	CIV18R273

10	CIV18R302	Construction Engineering & Management	Т	3	0	0	3	NIL
11	CIV18R351	Transportation Engineering	TP	3	0	0	3	NIL
12	CIV18R371	Environmental Engineering	IC	3	0	2	4	NIL
13	CIV18R303	Design of Structures	Т	3	0	0	3	CIV18R273
14	CIV18R372	Estimation & Costing	IC	3	0	2	4	CIV18R303

COMMUNITY SERVICE PROJECT

S.No.	Course Code	Course Name	Course Type L		Т	Р	С
1.	CIV18R399	Community Service Project	Project		0	6	3

MAIN PROJECT

S.No.	Course Code	Course Name	Course Type L		Т	Р	С
1.	CIV18R499	Project work	Project	0	0	20	10

PROFESSIONAL ELECTIVE

Structural Engineering Stream

S.N 0.	Course Code	Course Name	Course Type	L	Т	Р	С	Pre- requisite
1	CIV18R352	Concrete Technology	TP	3	0	0	3	NIL
2	CIV18R353	Advanced Structural Analysis	TP	3	0	0	3	CIV18R301
3	CIV18R401	Design of Masonry and Timber Structures	Т	3	0	0	3	CIV18R303
4	CIV18R402	Earthquake resistant design of structures	Т	3	0	0	3	CIV18R303
5	CIV18R403	Forensic Engineering And Rehabilitation of Structures	Т	3	0	0	3	NIL
6	CIV18R404	Prefabricated Structures	Т	3	0	0	3	NIL
7	CIV18R405	Pre-stressed Concrete Structures	Т	3	0	0	3	CIV18R303
8	CIV18R406	Finite Element Techniques	Т	3	0	0	3	CIV18R353
9	CIV18R407	Experimental Stress Analysis	Т	3	0	0	3	NIL

S.N 0.	Course Code	Course Name	Course Type	L	Т	Р	С	Pre-requisite
1	CIV18R304	Planning and Design of Building Services	Т	3	0	0	3	NIL
2	CIV18R305	Professional Practices in Civil Engineering	Т	3	0	0	3	NIL
3	CIV18R306	Housing Planning And Management	Т	3	0	0	3	NIL
4	CIV18R307	Construction Planning and Management	Т	3	0	0	3	NIL
5	CIV18R308	Construction Techniques And Practices	Т	3	0	0	3	NIL
6	CIV18R408	Contract Laws And Regulations	Т	3	0	0	3	NIL

Construction Engineering & Management Stream

Transportation Engineering Stream

S.N o	Course Code	Course Name	Course type	L	Т	Р	С	Prerequisite
1	CIV18R309	Total Station and GPS Surveying	Т	3	0	0	3	NIL
2	CIV18R310	Highway And Airport Pavement Systems	Т	3	0	0	3	NIL
3	CIV18R311	Traffic Engineering	Т	3	0	0	3	NIL
4	CIV18R409	Bridge Planning and Design	Т	3	0	0	3	NIL
5	CIV18R410	Pavement Management System	Т	3	0	0	3	NIL
6	CIV18R411	Pavement Evaluation & Management	Т	3	0	0	3	NIL
7	CIV18R412	Pavement Materials and Construction	Т	3	0	0	3	NIL
8	CIV18R413	Intelligent Transport Systems	Т	3	0	0	3	NIL
9	CIV18R414	Highway Safety and Safety Audit	Т	3	0	0	3	NIL

S. No	Course Code	Course Name	Course Type	L	Т	Р	С	Prerequisite
1	CIV18R312	Urban Hydrology	Т	3	0	0	3	CIV18R252
2	CIV18R313	Introduction to Climate Change	Т	3	0	0	3	NIL
3	CIV18R314	Application of Soft Computing Techniques In Water Resources Engineering	TP	3	0	0	3	NIL
4	CIV18R315	Irrigation Engineering	TP	3	0	0	3	CIV18R252
5	CIV18R316	Coastal Engineering	Т	3	0	0	3	CIV18R252
6	CIV18R317	Advanced Remote Sensing Techniques	Т	3	0	0	3	NIL
7	CIV18R318	Geographic Information Systems	Т	3	0	0	3	NIL

Water Resources Engineering Stream

Environmental Engineering Stream

S.N o	Course Code	Course Name	Course Type	L	Т	Р	С	Prerequisite
1	CIV18R319	Solid Waste Management	Т	3	0	0	3	NIL
2	CIV18R320	Ecological Engineering	Т	3	0	0	3	NIL
3	CIV18R321	Environmental Management	Т	3	0	0	3	NIL
4	CIV18R322	Geo-Environment Engineering	Т	3	0	0	3	NIL
5	CIV18R415	Advance Technology For Water And Wastewater Treatment	Т	3	0	0	3	CIV18R37 1

S.N o	Course Code	Course Name	Course Type	L	Т	Р	С	Prerequisite
1	CIV18R416	Rock Mechanics	Т	3	0	0	3	CIV18R274
2	CIV18R417	Soil Dynamics And Machine Foundations	Т	3	0	0	3	CIV18R274
3	CIV18R418	Reinforced Soil Structures	Т	3	0	0	3	CIV18R274
4	CIV18R419	Ground Improvement Techniques	Т	3	0	0	3	CIV18R274
5	CIV18R420	Marine Foundation Engineering	Т	3	0	0	3	NIL

Geotechnical Engineering Stream

OPEN ELECTIVES OFFERED FOR OTHER DEPARTMENTS

S.N 0	Course Code	Course Name	Course Type	L	Т	Р	С	Prerequisite
1.	CIV18R421	Building Services	Т	3	0	0	3	Nil
2.	CIV18R422	Disaster Management	Т	3	0	0	3	Nil
3.	CIV18R423	Irrigation Water Management	Т	3	0	0	3	NIL
4.	CIV18R424	Industrial Waste Water Management	Istrial Waste Water T 3 0 0 3		Nil			
5.	CIV18R425	Environmental Impact Assessment	T 3 0 0 3		3	Nil		
6.	CIV18R426	Smart City	Т	3	0	0	3	Nil
7.	CIV18R427	Introduction to Remote Sensing	Т	3	0	0	3	Nil
8.	CIV18R428	Repair and Rehabilitation of Structures	Т	3	0	0	3	Nil
9.	CIV18R429	Corrosion Engineering	Т	3	0	0	3	Nil
10.	CIV18R430	Air Pollution And Control	Т	3	0	0	3	NIL

MANDATORY COURSES

S.No	Course Code	Course Name
1.	MAN18R001	Environmental Science

2.	MAN18R002	Indian Constitution
3.	MAN18R003	Essence of Indian Traditional Knowledge

ONLINE COU	RSES
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S.No	Course Code	Course Name
1.	CIVX001	Composite Materials
2.	CIVX002	Durability of Concrete Structures
3.	CIVX003	Corrosion of Steel in Concrete
4.	CIVX004	Project Management and Quality in control Construction sites
5.	CIVX005	Sustinability for Engineers
6.	CIVX006	Road Safety in India
7.	CIVX007	Data Acquistion and Signal Conditioning
8.	CIVX008	Remote Sensing and GIS Applications in Water Resources Management
9.	CIVX009	UAV Remote Sensing and Application
10.	CIVX010	Foundation Design
11.	CIVX011	Integrated Waste Management for a Smart City
12.	CIVX012	Principle of Construction Management
13.	CIV0008	Integrated Water Management for a Smart City
14.	CIV0007	Waste Water Treatment and Recycling
15.	CIVX18R012	Foundation Engineering
16.	CIVX18R013	Advanced Concrete Technology

B.TECH. CIVIL ENGINEERING DETAILED SYLLABUS

BASIC ENGINEERING COURSE

DUV19D172	Introduction to Machanica	L	Т	Р	С
FILLOR1/2	The oduction to weenances	3	1	2	5
Pre-requisite: Nil Course Categ			Bas	ic Sci	ence
Course '	Type: Integrated Course				

Course Objectives

- To understand the basic concepts of mechanics and apply it to various physics problems.
- To give fundamental knowledge in of fluid, its properties and behavior under various conditions.

Course Outcome

Upon successful completion of this course, students will be able to

- CO1: Acquire fundamental knowledge in Newtonian mechanics
- **CO2:** Understand the basic concepts of potential energy function and gain knowledge in satellite.
- CO3: Understand the concepts of rigid body
- **CO4:** Understand the concept of non-inertial frame systems.
- **CO5:** Gain the idea of Harmonic Oscillations.

UNIT1: Basic Concepts of Mechanics

Transformation of scalars and vectors under Rotation transformation- Inertial frames-Newton's laws of motion-Galilean transformation-Forces in Nature-Newton's laws and its completeness in describing particle motion- Form invariance of Newton's Second Law - Cylindrical and Spherical coordinates

UNIT2: Orbital Motion and Energy

F = - Grad V- equipotential surfaces and meaning of gradient-Conservative and non conservative forces- curl of a force field-Central forces-Conservation of angular momentum- Energy equation and energy diagrams-Elliptical, parabolic and hyperbolic orbits-Kepler problem-Application- Satellite in circular orbit and applications-Geosynchronous orbits.

UNIT3: Rigid Body

Definition and motion of a rigid body in the plane-Rotation in the plane-Kinematics in a coordinate system rotating and translating in the plane-Angular momentum about a point of a rigid body in planar motion- Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion- Examples-Introduction to three- dimensional rigid body motion-Three-dimensional motion of a rigid body wherein all points move in a coplanar manner: e.g. Rod executing conical motion with center of mass fixed.

UNIT4: Non – Inertial Systems

Concepts of inertial frames, force and mass – Galilean transformations and Galilean invariance, Non-inertial frames of reference, equations of motion with respect to a uniformly accelerating frame, a uniformly rotating frame-Rotating coordinate system, Applications.

UNIT5: Oscillations

SHM: Simple Harmonic Oscillations. Linear Harmonic Oscillator. Free and forced oscillations of a Harmonic oscillator, Damping, Resonance, Sharpness of resonance. Damped harmonic motion – over damped, critically damped harmonic and lightly damped oscillators. Transient and Steady states.Generation of harmonics and phaseshift.

Textbooks

- 1. S.L.LoneyAn Elementary Treatise on the Dynamics of particle and of Rigid Bodies, , Cambridge University Press, 2017.
- 2. D. Kleppner, R.J. KolenkowAn Introduction to mechanics, ,McGraw-Hill.1973

Reference Books

1. C.Kittel, W.Knight, et.al Mechanics, Berkeley Physics, vol.1,.,Tata McGraw-Hill,2007.

List of Experiments

- 1. Determination of Moment of Inertia and rigidity modulus of the given material by torsional oscillations.
- 2. Determination of 'g' using compound pendulum.
- 3. Determination of the frequency of an electric tuning fork by Melde's experiment and verify λ^2 –T law.
- 4. Determination of the frequency of the motion of coupled oscillators.
- 5. Determination of Young's modulus using Uniform bending method
- 6. Determination of Young's modulus using Non Uniform bending method
- 7. Determination of Young's modulus using single optic lever by Non Uniform bending method.

CUV19D171	Chomietry	L	Т	Р	С
	Chemistry	3			5
Pre-requisite: 1	Vil Course Categor	y: Ba	isic So	cience	;
	Course Type: Integrated Course				

UNIT1: Atomic and Molecular Structure

Schrodinger wave equation: Derivation of time independent Schrodinger wave equation, Representation of Schrodinger wave equation in polar coordinates - Radial distribution function graphs of s, p, d and f orbitals. Molecular Orbital Theory: MOT concept, MO diagrams of homo-nuclear diatomic molecules (hydrogen, nitrogen and oxygen) and hetero- nuclear diatomic molecules (carbon monoxide and nitric oxide). Crystal field theory: CFT concept, weak and strong ligands, energy level diagrams of transition metal ions (Fe²⁺& Fe³⁺) in octahedral and tetrahedral complexes and their magnetic properties. Intermolecular forces - Ionic, dipolar and van der Waalsinteractions.

UNIT2: Periodic Properties

Effective nuclear charge - Factors affecting effective nuclear charge: Penetration or shielding of orbitals - Variation of s, p, d and f orbital energies of atoms in the periodic

table - Aufbau principle (Building-up principle): Application of Aufbau principle in writing electronic configuration, Deviation from Aufbau principle - Periodicity of properties in a periodictable- Periodic properties: Atomic and ionic sizes, ionization energies, electron affinity and electronegativity - Variation of periodic properties in the periodic table - Hard soft acids and bases: Concept and examples.

UNIT3: Free Energy and Chemical Equilibria

Thermodynamic functions: Definition and mathematical expression for Work, Energy, Enthalpy, Entropy and Free energy - Nernst equation: Derivation, apply Nernst equation to determine of solubility product, pH (glass electrode). Potentiometric titrations: Acid-Base, Redox and precipitation reaction - Water analysis: Hardness by EDTA method and chloride ion by Argentomentric method - Corrosion: Definition, types (dry & wet) and mechanism. and control of Dry and Wet corrosion.

UNIT4: Organic Reactions

Nucleophilic substitution reactions: Definition, types and examples of nucleophile, Compare nucleophilicity and basicity of a nuceophile - Types of nucleophilic substitution (case RX and ArX): Mechanism of $S_N 1$, $S_N 2$, $S_N i$ and Benzyne. Electrophilic substitution reactions: Definition, types and examples of electrophile - Electrophilic substitution reactions of hydrocarbons: Halogenation, sulphonation, nitration. Friedel crafts alkylation and acylation reaction. Nucleophilic addition reactions (case aldehydes Andketones):PolarityofC=Obond.Generalmechanismofnucleophilicadditionreactionsonal dehydesandketones:HCN,HOH, ROH and NaHSO3 addition. Electrophilic addition reactions (case alkenes): General mechanism of electrophilic addition reactions on alkene - Addition of HBr [Markownikoff& Anti-Markownikoff (peroxide effect)] - Addition of alkene (polymerization of ethylene). Elimination reactions: Types of elimination reactions (case alkyl halides): Dehydrohalogenation of alkyl halides - E_1 and E_2 mechanism - Dehydration of alcohols to alkene and ethers. Greener synthesis of drug molecules (Aspirin and Ibuprofen)

UNIT5: Stereochemistry & Spectroscopic Techniques

Stereochemistry - Definition with examples: Geometrical isomers (alkene) and stereoisomers, symmetry, chirality, enantiomers, diastereomers, meso and racemic mixture. Representation of 3D structures: Wedge formula, Fischer projections, Newmann and Sawhorse formula (upto 2 carbons) - Conformational analysis: Ethane, butane and cyclohexane - Configurational analysis: Rules of RS nomenclature and application of RS nomenclature to molecules containing one chiral centre. Electronic spectroscopy: Principle, instrumentation, selection rules and medicinal application of fluorescence spectroscopy. Nuclear magnetic resonance spectroscopy (¹H-NMR): Principle, instrumentation, chemical shift, coupling constant and application (structural identification of the compound C_3H_6O from ¹H-NMR data). X-ray diffraction: Principle, instrumentation and applications X-ray diffraction.

List of Experiments (Any 10)

- 1. Determination of Viscosity by Ostwald Viscometer.
- 2. Determination of surface tension by stalagmometer.
- 3. Adsorption of acetic acid by charcoal.
- 4. Determination of chloride content of water.
- 5. Estimation of hardness of water by EDTA method.
- 6. Determination of the rate constant of a reaction

- 7. Thin layer chromatography.
- 8. Determination of the partition coefficient of a substance between two immiscible liquids
- 9. Determination of Saponification /acid value of oil.
- 10. Preparation of Aspirin
- 11. Potentiometric titration of strong acid vs strongbase.
- 12. Potentiometric titration of weak acid vs strongbase.
- 13. Determination of cell constant and conductance of solutions.

Text Books

- 1. Engineering Chemistry, 2nd Edition, Wiley India (P) Ltd., 2018.
- 2. Ernest L. Eliel, Samuel H. Wilen Student edition, Stereochemistry of Organic Compounds, Wiley India (P) Ltd., 2017.
- 3. B. M. Mahan and R.J.Mayers University Chemistry, , Pearson Publishers, 11th Edition, Noida,2017.
- 4. Chemistry Laboratory Manual, Department of Chemistry, Kalasalingam University, 2018.

Reference Books

- 1. C. N. Banwell and E.M. McCashFundamentals of Molecular Spectroscopy, , Tata McGraw-Hill Publishers, 4th Edition, New Delhi,2008.
- 2. P. W. Atkins and J.D. Paula, Physical Chemistry, W H Freeman & Co Publishers, 10th Edition,2014.
- 3. R. D. Madan Modern Inorganic Chemistry, , 4th Edition S. Chand & Company Ltd., 2009.
- 4. Paula Y. BruiceOrganic Chemistry, , 7th Edition, Pearson (Dorling Kindersley India (P) Ltd.)2014.
- 5. B. R. Puri, L. R. Sharma, M. S. PathaniaPrinciples of Physical Chemistry, , 47th Edition, Vishal Publishing Co.,2017.

		L	Т	Р	С
MAT18R101	AT18R101 Calculus and Linear Algebra			0	4
Course Categor					
Pre-requisite: Nil Course Type: The			ith Pra	actice	

Course Objective:

To enable the students to acquire knowledge and skills in basic components of calculus, to handle the situations involving multivariable calculus, and to diagonalize a symmetric matrix using eigen values and eigen vectors.

Course Outcomes:

- **CO1**Know the fundamental theorems such as Rolle 's Theorem, Mean value theorem, Taylor's theorem and its applications.
- **CO2** Understand the basic concepts of limit, continuity, derivative, partial derivative and total derivative and Its applications.
- CO3 Solve the real world problems using differentiation and integration.
- **CO4** Understand the concepts of sequence, convergent of sequences, series and testing of convergent of series using different methods.
- **CO5** Find the solution of simultaneous linear equations using matrices and to find the eigen values and eigen Vectors of a matrix, Cayley-Hamilon theorem and

orthogonal transformations.

UNIT 1: Calculus

Rolle's Theorem- Mean value theorems - Taylor's and Maclaurin theorems with remainders -indeterminate forms and L'Hospital's rule - Maxima and minima.

UNIT 2: Multivariable Calculus (Differentiation)

Limit, continuity and partial derivatives - directional derivatives - total derivative - Maxima, minima and saddle points - Method of Lagrange multipliers.

UNIT 3: Calculus (Applications)

Curvature (Cartesian coordinates) - Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT 4: Sequences and Series

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions;

UNIT 5: Matrices

System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Cayley-Hamilton Theorem - Diagonalization of matrices-Orthogonal transformation-Reduction of Quadratic form to Canonical form.

TEXT BOOKS:

1. Grewal, B.S., Grewal, J.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi,43rd Edition, 2015.

REFERENCE BOOKS:

- 1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore , 10th Edn., 2001.
- 2. Ramana B. V., Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited, New Delhi, Edition 2005.
- 3. Veerarajan, T., Engineering Mathematics (For First Year), Tata McGraw-Hill publishing company Limited, 2008.

	Multiple Integration Ordinary Differential	L	Т	Р	С
MAT18R102	Equations and Complex Variable	3	1	0	4
Pre-requisite: Ni	1 Course Category: Basic Science				
Course Type: T	heory with Practice				

Course Objective:

To enable the students to understand the concepts of multiple integrations, their applications, and to handle analytic functions on complex plane and perform complex integration.

Course Outcomes:

Upon successful completion of this course, students will be able to

- 1. Understand the concepts of double and triple integral and its applications.
- 2. Know about the applications of double and triple integral in vector calculus.
- 3. Know the methods of solving differential equations of first and second orders.
- 4. Understand the concepts of analytic functions, conformalmappings and bilinear transformations.
- 5. Understand the concepts of singularity, residues and evaluation of certain improper integrals.

UNIT 1: Multivariable Calculus (Integration)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volume; Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds;

UNIT 2: Integral Theorems

Gradient, curl and divergence. Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

UNIT 3: Ordinary Differential Equations

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. Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equations.

UNIT 4: Complex Variable – Differentiation

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNIT 5: Complex variable – Integration

Contour integrals, Cauchy Integral formula (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (Integration around small semicircles and rectangular contours).

TEXT BOOKS:

1. Grewal,B.S., Grewal,J.S., HigherEngineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition,2015.

REFERENCE BOOKS:

- 1. Kreyszig, E, Advanced Engineering Mathematics , John Wiley and Sons (Asia) Limited, Singapore , 10th Edn., 2001.
- 2. RamanaB.V.,Engineering Mathematics, Tata Mc Graw- Hill Publishing Company Limited, New Delhi, Edition2005.
- 3. Veerarajan, T., Engineering Mathematics (ForFirstYear), Tata Mc Graw-Hill

publishing company Limited, 2008.

MAT18R205 Pre-requisite: Ni	Transforms and Disprets Mathematics	L	Т	Р	С
MA 1 10K205	Transforms and Discrete Mathematics	3	1	0	4
Pre-requisite: Ni	1 Course Category	: Basi	c Scie	ence	
Course Type: T	heory with Practice				

Course Objective:

To enable the students to understand the concept of sets, relations, functions, logic, and to solve differential equations and difference equations using transform techniques.

Course Outcomes:

Upon successful completion of this course, students will be able to

- 1. Know the method of solving first and second order partial differential equations.
- 2. Know about Laplace transform and its application in solving ODEs and PDEs.
- 3. Know about the Z transforms and its application in solving difference equations.
- 4. Understand the concepts of sets, relations and functions.
- 5. Understand the concepts of logic.

UNIT 1: Partial Differential Equations

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method.

UNIT2: 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.

UNIT3:Z Transform

Z-transform - Elementary properties - Inverse Z - transform - Convolution theorem – Formation of difference equations - Solution of difference equations using Z - transform.

UNIT4: Sets, Relations and Functions

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

UNIT5: Logic

Introduction – TF(True/ False) Statements – Connectives – Atomic and Compound statements – Truth table of a formula – Tautology – Tautological implications – Equivalence of formulae – Normal forms – Principal normal forms – Theory of Inference.

TEXTBOOKS:

- 1. Veerarajan T., Engineering Mathematics (for semesterIII), Tata McGraw-Hill, New Delhi, 2010.
- 2. Dr. M.K. Venkataraman, Dr. N. Sridharan and N. Chandrasekaran, Discrete

Mathematics, National Publishing Company, May2009.

REFERENCE BOOKS:

- 1. Kreyszig, E, Advanced Engineering Mathematics, John Wiley and Sons (Asia) Limited, Singapore, 10th Edn., 2001.
- 2. Grewal,B.S.,Grewal,J.S.,Higher Engineering Mathematics, Khanna Publishers, NewDelhi, 37th Edition, 5th Reprint2004.
- 3. Rosen, K.H., Discrete Mathematics and its applications, Tata McGraw-Hill Publishing Company Limited, New Delhi, 4th Edn.,1999.
- 4. Grimaldi, R.P., Discrete and Combinatorial Mathematics An Applied Introduction, Pearson Education Asia, Delhi, Fourth Edn, 2002.

DIT19D101	Diology for Engineers	L	Т	Р	С
DITIORIUI	biology for Engineers	3	0	0	3
Pre-requisite: N	il Course Cate	gory:	Basi	c Sci	ence
	Course Type	: The	ory		

Course outcomes

- **CO1:** Describe the fundamentals of cell structure and cell cycle
- **CO2:** Understand the classification and functions of biomolecules
- CO3: Elaborate the basic cellular mechanisms such as replication, transcription and translation
- **CO4:** Describe the underlying concepts of infection and immunity.
- CO5: Explain various applications of biology

UNIT 1: Introduction

Fundamental difference between science and engineering- comparison between eye and camera, Bird flying and aircraft; major discoveries in biology- ; Classification based on: Cellularity- Unicellular and Multicellular; Ultra structure - prokaryotes and eukaryotes; three major kingdoms of life; Cell structure, intracellular organelles and their functions, comparison of plant and animal cells- Overview of Cell cycle and cell division

UNIT 2: Biomolecules

Chemistry of biomolecules: Carbohydrates, Lipids, Proteins; classification of amino acids; classification of proteins based on structure and functions; Nucleic acids -types, structure and function of DNA and RNA

UNIT 3: Genesto Proteins

Gene, Genome and chromosome; Central dogma of molecular biology; Classical experiments of DNA: Griffith and, Avery, McCarty and MacLeod, Meselson and Stahl - DNA replication, Transcription and Translation

UNIT 4: Microbiology

Microscopy; Microbes as infectious agents - malaria, tuberculosis, typhoid, polio, dengue, AIDS;; cultivation of bacteria. Immunity - innate and acquired immunity - organs and cells of the immune system - classification of antibodies - types of T cells - transplantation, autoimmunity overview

UNIT 5: Applications of Biology

Healthcare-antibiotics, vaccines, monoclonal antibodies, insulin and interferons;

Beneficial bacteria - probiotic bacteria, nitrogen fixing bacteria, fermentation and fermented foods and products Environmental - waste water treatment, bioremediation; Biomaterials and biopolymers for medical and environmental applications; Biosensors;

TEXTBOOKS

- 1. De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology-Lippincott Williams & Wilkins- Philadelphia- USA- 8th Edition-2010.
- 2. Voet, D., Voet, G., Biochemistry John Wiley and Sons, Singapore 3rd Edition- 2001.
- 3. Pelczar MJ, Chan ECS and Krieg NR Microbiology Tata McGraw Hill, India-7th Edition-2010

REFERENCES

- 1. Friefelder. D. -Molecular Biology- McGraw-Hill Companies- New York, USA-5th Edition-2013.
- 2. Determination of Young's modulus using single optic lever by Uniform bending method.
- 3. Determination of frequency of tuning fork by Transverse mode using Sonometer
- 4. Determination of frequency of tuning fork by Longitudinal mode using Sonometer.

		L	Т	Р	С				
HSS18R151	English for Technical Communication	2	0	2	3				
Total Hours: 60	Hours Course Category: Humanities a	Course Category: Humanities and Social Science							
Pre-requisite: N	il Course Type: Theory with Prac	Course Type: Theory with Practical							

UNIT 1: Vocabulary Building

The concept of word formation -Root words from foreign languages and their use in English -Prefixes and suffixes; word derivatives using them -Synonyms, Antonyms and standard Abbreviations

UNIT 2: Basic Writing Skills

Sentence structures-Use of phrases and clauses in sentences-Creating Coherence Techniques for Writing Precisely

UNIT3: Identifying Common Errors in Writing

Tenses -Subject – verb agreement -Noun –Pronoun Agreement -Verbs – Transitive-Intransitive-Misplaced Modifiers -Articles -Prepositions -Redundancies and Clichés --Direct, Indirect speech -Infinitives, Gerunds-Comparison of adjectives

UNIT4: Nature and Style of Sensible Writing

Describing -Defining -Classifying -Providing examples or evidence Writing introduction or conclusion

UNIT5: Writing Practices

Comprehension -Precise writing-Essay writing-Letter writing -Instructions Paragraph development

UNIT6: Oral Communication

Listening comprehension -Pronunciation, intonation, stress and rhythm Common

everyday situations: Conversations and dialogues-Interviews Formal presentations

	MANAGEMENT CONCEPTS AND	L	Т	Р	С
HSS18R001	TECHNIQUES	3	0	0	3
Pre-requisite: Nil	Course Category:	Hum	anitie	s Ele	ctive
Course Type: Theor	У				

Course Objective(s):

To introduce students about the definition of management, its characteristics, evolution and importance as well as the functions performed by managers-planning, organizing, directing and controlling in order to achieve the organizational goals; To illustrate students about the applications of management functions in various enterprises in the field of marketing, finance, personnel, production, etc.

Course Outcome(s):

After completion of the course the student -

- **CO1:** Explains the historical backdrop and fundamentals of management thoughts vital for understanding the conceptual frame work of Management as a discipline.
- **CO2:** Enables to apply various concepts of planning, decision making and controlling to help solving managerial problems
- **CO3:** Explaining concepts of Ethics, Delegation, Coordination and Team work
- CO4: Explain the management concepts and styles in Global context
- CO5: Explains about emerging concepts in management thought and philosophy

CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							L				М	
CO2		Μ				Н	Н	Н		М		
CO3								Н		L	Н	
CO4						Μ		L	L	L		Н
CO5											Н	

Mapping of Course Outcome(s):

UNIT I: DEVELOPMENT OF MANAGEMENT THOUGHTS

Scientific Management Movement - Administrative Movement - Human Relations Movement - Decision Movement - Behavioral Science Movement - Systems Movement -Contingency Movement.

UNIT II: ESSENTIALS OF PLANNING

Planning Objectives – Goals - Programmed Decisions and Unprogrammed Decisions; Decision – Making - Creativity in Decision - Making, Forecasting and Strategy to Formulation.

UNIT III: EFFECTIVE ORGANIZING

Span of Control – Departmentation - Authority; Responsibility - Bureaucracy and Adhocracy; Group Dynamics.

UNIT IV: STAFFING AND DIRECTING

Staffing: Manpower Planning - Recruitment Sources - Selection Procedure - Training

Methods – Performance Evaluation Methods – Executive Development Programs - Directing: Communication Process and Barriers – Motivation Techniques – Financial and Non – Financial Motivation- Leadership Qualities and Styles.

UNIT V : CONTROLLING ANDRECENTCONCEPTS

Controlling: Meaning and Process - Requisites of Effective Control - Control Techniques. Emerging Issues in Management: Japanese and American Management – Management by Objectives – Knowledge Management – Technology Management – Business Process Outsourcing- Social Responsibility and Business Ethics.

Text Book(s):

- 1. Harold Koontz & Heinz Weihrich, Essentials of Management: An International, Innovation and Leadership Perspective, 10th Edition, McGraw Hill Education (India) Private Ltd. New Delhi,2016.
- 2. Stephen P.Robbins, Mary A. Coulter, Management, 13th Edition, Pearson Education Limited, New Delhi,2016

Reference Book(s):

- C.B.Gupta, Management Theory and Practice, 19th Revised Edition, Sultan Chand& Sons, NewDelhi.2017.
- 2. L.M.Prasad, Principles and Practices of Management, 9th Edition, Sultan Chand and Sons Private Limited,2015.
- 3. K.Aswathappa, Essentials of Business Environment: Text Cases and Exercises 12th, edition, Himalaya Publishing House, Mumbai,2014.
- 4. Tripathi & Reddy, Principles of Management, 5th Edition, Tata McGraw Hill publishing company Ltd, New Delhi,2012.

HSS18R002	MARKETING MANAGEMENT	L	Т	Р	Credit
		3	0	0	3
Pre-requisite: Nil Course Type: Theo	Course Category:	Hum	anitie	es Ele	ctive

Course Objectives:

To develop students explaining the gap between how organizations match the requirements of consumers in competitive environments, and develop strategies to create the competitive edge; To familiarize students with analysis, planning, implementation, and control, as well as the marketing mix, exportation, and the social aspects of marketing.

Course Outcomes:

CO1: Explain marketing concepts, philosophies and historical background.

- **CO2:** Explain of marketing operations and complexities for students to apply in practical business situations.
- **CO3:** Explain concepts related to segmentation, targeting and positioning, product attributes, and pricing strategies prevalent in domestic and international scenario.
- CO4: Study various tools and techniques of promoting the products in ethical manner.
- CO5: Explain emerging concepts of marketing in the emerging global markets

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Η	Н		L	М	М	L
CO2						Η			М	Η		
CO3						L	Н	Н	L	Η	М	L
CO4						Н	Н		L	М	М	L
CO5						Η				Η		

Mapping of Course Outcome(s):

UNIT 1: Marketing

Meaning - concept - functions - marketing Planning & implementation marketing Programmes - Marketing environment – Market Segmentation and consumer behaviour – Influencing factors, Decision process –Marketing mix – Marketing department.

UNIT 2: Product

Meaning - Product planning - policies - positioning - New product development Product life cycle – BCG Matrix - branding. Packing, labeling.

UNIT 3: Pricing

Pricing objectives – Setting and modifying the price – Different pricing method Product line pricing and new product pricing.

UNIT 4: Distribution

Nature of Marketing channels - Types of Channel flows – Channel functions - Channel co- operation, conflict and competition - Direct Marketing Telemarketing, Internet shopping.

UNIT 5: Promotion

Promotion Mix - Advertisement - Message - copy writing – Advertisement - budgeting - Measuring advertisement effectiveness - Media strategy - sales promotion - Personal selling steps, publicity and direct marketing.

Text Book(s):

- 1. Philip.T.Khotler, Kevin Lane Keller, Marketing Management, 15th Edition, Pearson Education, New Delhi,2016.
- 2. Ramaswamy.VS&Namakumari. S, Marketing Management Global Perspective,

IndianContext,McGrawHillEducation(India)PrivateLimited,NewDelhi,2013.

Reference(s) :

1. Rajan Saxena, Dorector, Jain S.P., Marketing Management, 1st edition, Tata McGraw Hill, New Delhi,2006.

2. K.S.Chandrasekar, Marketing Management, Text & Cases, 1st edition, Tata McGraw hill Education Pvt. Ltd.2013.

3. TapanK.Panda, Marketing Management Text and Cases, 2nd Edition, Excel Books.2008.

HSS18R003	ORGANIZATIONAL PSYCHOLOGY	L	Т	P	Credit
		3	0	0	3
Pre-requisite: Ni Course Type: The	Course Category:	Hum	anitie	es Ele	ctive

Course Objectives:

To clarify the principles and basic concepts of organizational psychology based on efficiency and quality of employee life. It also aims at enhancing the quality of life of employees; To make students to understand organization's aspects in terms of psychological assessment, personnel decisions inline with training and development, organizational change and organizational health in specific the intrinsic problems

Course Outcomes:

CO1: Explain basic concepts of industrial and organizational psychology

- **CO2:** Illustrate different ways of achieving organizational effectiveness through individual behavior.
- **CO3:** Examine the concepts relating to individual behavior to achieve group target and achieve leadership position inorganization.
- **CO4:** Explain the organizational changes and means to evaluate based on nature of organizations.
- **CO5:** Analyze implications of changes aligning the interest of individual, group and organization as a whole.

CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						М		Н		Н		М
CO2						L	Н		М		L	
CO3						М		L				
CO4						Μ		Н		М		
CO5						L	Н		Н		L	M

Mapping of Course Outcome(s):

UNIT I: FOCUS AND PURPOSE

Organizational Behavior - Need and importance, nature and scope, framework.

UNIT II: INDIVIDUAL BEHAVIOUR

Personality – types – factors influencing personality – theories – learning – types of learners

learning theories – organizational Behavior modification. Attitudes – characteristics – components – formation – measurement. Perceptions – importance – factors influencing perception – interpersonal perception.

UNIT III: GROUP BEHAVIOUR

Organization structure – formation – groups in organizations – influence – group dynamics – emergence of informal leaders and working norms – group decision making techniques – interpersonal relations –communication process and Group Communication.

UNIT IV: LEADERSHIP

Leadership styles – theories – Qualities - leaders Vs managers – sources of power – power centers – power and Organizational Politics- Motivation.

UNIT V: ORGANISATIONAL DEVELOPMENT

Organizational development - Importance, characteristics, objectives, stability Vs change, proactive vs reaction change , the change process, resistance to change, managing change, team building - Organizational effectiveness, perspective, effectiveness Vs efficiency, approaches, the time dimension, achieving organizational effectiveness

Text Book(s):

- 1. Stephen P.Robins and Timothy A . Judge, OrganisationalBehavior, Peason Education, 17th edition, 2017.
- 2. Fred Luthans, Organisational Behavior, McGraw Education, 12th Edition, 2010.

Reference Book(s):

- 1. Aswathappa, Organisational Behavior, Himalaya Publishing House, 12th edition, 2016.
- 2. P.Subba Rao, Management and Organisational behavior: Text, Cases and Games, Himalaya Publishing House, 1st edition,2010.
- 3. Mullins, Organisational Behavior, Pearson Education Limited, 9th edition, 2010.
- 4. L.M.Prasad, OrganisationalBehaviour, 5th edition, Sultan Chand and Sons, New Delhi, 2014.

HSS18R004 Pre-requisite: Nil		L	Т	Р	Credit
H5518K004	PROJECT MANAGEMENT	3	0	0	3
HSS18R004 Pre-requisite: Nil Course Type: Theory	Nil Course Category:	Hum	anitie	s Ele	ctive
Course Type: T	heory				

Course Objectives:

To describe concepts relating to project management and enable students to evolve project objectives appropriately with relevance to business proposals; To make students to understand about evaluation of project by testing the technical feasibility, financial viability, market acceptability and social desirability of projects; To give an account on risk and profitability analysis that facilitates the making of the effective project proposal and guides learners in project planning, implementation and control and also emancipates the scope of project management in undertaking foreign collaboration projects

Course Outcomes:

- **CO1:** Explain and have clarity about the concept of project and steps in project management.
- CO2: Explain the basics stages involved in preparing business proposals.
- **CO3:** Evaluate the technical feasibility, financial viability, market acceptability and social desirability of projects.
- **CO4:** Analyze the Risk and profitability of the project proposals
- **CO5:** Empathize oneself as a project manager and also as part of project teams and enable effective decision making.

CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							М				Н	
CO2						L		Н	Н	L		Н
CO3											М	
CO4						М		L				М
CO5										М	Н	L

Mapping of Course Outcome(s):

UNIT I: INTRODUCTION TO PROJECT MANAGEMENT

Projects - Project ideas and preliminary screening. Developments - Project planning to Project completion - Pre-investment phase, Investment phase, operational phase -Governmental Regulatory framework. Capital Budgeting.

UNIT II: STAGES OF PROJECT MANAGEMENT

Opportunity studies - prefeasibility studies, functional studies or support studies, feasibility study expansion projects, data for feasibility study. Market and Technical Appraisal : Market and Demand analysis, Market Survey, Demand forecasting. Technical analysis- Materials and inputs, Choice of Technology, Product mix, Plant location, capacity, Machinery and equipment.

UNIT III: APPRAISAL PROCESS

Concepts. Time value of money - Present and future value. Appraisal criteria - Urgency, Payback period, Rate of return, Debt service coverage ratio, Net present value, Benefit cost ratio, Internal rate of return, Annual capital charge, Investment appraisal in practice.

UNIT IV: RISK AND PROFITABILITY ANALYSIS

Risk analysis- Measures of risk, Sensitivity analysis, and Decision tree analysis. Means of financing, Term Loans, Financial Institutions. Cost of capital. Profitability - Cost of Production, Break-even analysis. Assessing the tax burden and financial projections.

UNITV: PROJECT PLANNING, IMPLEMENTATION, AND CONTROL

Forms of Project Organization, Project Planning, Implementation, and Control - Network construction, CPM, PERT, Development of Project schedule, Crashing of Project Network. Introduction to Foreign collaboration projects - Governmental policy framework, Need for foreign technology, Royalty payments, Foreign investments and procedural aspects.

Text Book(s):

- 1. Prasanna Chandra, Projects: Planning, Analysis, Selection, Financing, Implementation, 8th Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi,2014.
- 2. M.R. Gopalan, Project Management Core Textbook, (Paper Back) 2nd edition, Wiley India, 2015

Reference Book(s):

- 1. Harold Kerzne, Project Management Best Practices: Achieving Global Excellence, 3edition, Wiley Publications, 2013
- 2. George Ritz, Sidney Levy, Project Management in Construction, Sixth Edition, Mc.

Graw Hill Education, 2011.

- 3. Gary Heerkens, Project Management, Second Edition, Mc. Graw Hill Education, 2013
- P.Gopalakrishnan and V.E.Rama Moorthy Text Book of Project Management,1st Edition, Macmillan India Ltd., New Delhi,2014.
- 5. John M. Nicholas, Herman Steyn, Project Management for Engineering, Business and Technology, 5th Edition, Routledge,2016.

	STRESS MANACEMENT AND CODINC	L	Т	Р	Credit
HSS18R005	STRESS MANAGEMENT AND COTING STRATEGIES	3	0	0	3
Pre-requisite: Ni	Course Category:	Hum	anitie	s Ele	ctive
Course Type : Th	eory				

Course Objectives:

To make students to approach stress and its effect in the right manner and to develop the skills required to understand and to overcome the same; To make them to be aware of the intricacies of stress and overcoming it through appropriate approaches.

Course Outcomes:

- CO1: Explain the responsibility of tackling stress
- **CO2:** Identify and modify the approaches of stress accordingly while dealing with team in workplace.
- **CO3:** Analyze to tackle stress appropriately without ignoring who are prone to face high- pressure working conditions.
- **CO4:** Implement a stress-free work environment.
- **CO5:** Explain the way of behavior and personality as a whole and ensure Humanities working condition and balanced quality of life.

CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								М		М		
CO2						Н			М			
CO3							L	Н		L		
CO4								Η		Н		Н
CO5						L		М	L	L	L	Н

Mapping of Course Outcome(s):

UNIT I – Understanding Stress

Meaning - Symptoms: Biological and Behavioural - Work Related Stress - Individual Stress - Reducing Stress - Burnout.

UNIT II - Common Stress Factors Time

Common Sources of Stress Biological, Personality and Environmental – Time Management – Techniques – Importance of planning the day – Time management schedule – Developing concentration – Organizing the Work Area - Prioritizing – Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say'No'.

UNIT III -Crisis Management

Implications – People issues – Structure issues, environmental issues, psychological fall outs – Learning to keep calm – Preventing interruptions – Controlling crisis – Importance of good communication – Taking advantage of crisis – Pushing new ideas – Empowerment

UNIT IV – Work Place Humour

Developing a sense of Humour – Learning to laugh, role of group cohesion and team spirit, using humour at work, reducing conflicts with humour. Coping Styles Defensive Behaviours and Problem-Solving

UNIT V –Self Development

Improving Personality – Leading with Integrity, enhancing creativity – Effective Decision Making – Sensible Communication – The Listening Game – Managing Self - Meditation for Peace – Yoga for Life

Text Book(s):

- 1. D.Girdano and G.Everly., "Controlling Stress and Tension", 9 th Edition, Prentice-Hall,2013.
- 2. Greenberg Jerrold S., Comprehensive Stress Management, 14th Edition, McGraw Hill Education, 2017.

Reference(s):

- 1. Dr. P.K.Dutta, "Stress Management" Himalaya Publishing House, First Edition 2010.
- 2. Schafer, Stress Management, 4th Edition, Cengage Learning, Delhi, 2008
- 3. Wolfgang Linden, Stress Management, Sage Publication, 1st Edition 2005.
- **4.** Daniel Girdano, Dorothy Dusek and George S. Everly, Controlling Stress and Tension, 8th Edition, Pearson Education,2009.
- **5.** Brian Luke Seaward, Essentials of managing Stress, 1st edition, Jones & Bartlett Publishers, 2013.

USS18D006	ENCINEEDING ECONOMICS	L	Т	Р	Credit
H5516K000	ENGINEERING ECONOMICS	3	0	0	3
Pre-requisite: N	NilCourse Category:	Hum	anitie	s Ele	ctive
Course Type: T	heory				

Course Objectives:

To introduce students to a broad range of economic concepts, theories and analytical techniques by considering both microeconomics and macroeconomics; To analyze demand and market structure at the firm level by understanding government policies and market failures in various levels using case studies.

Course Outcomes:

CO1: Identify and learn economic concepts into market economies.

- **CO2:** Explain the pricing methods; interpret the market factors to determine the price for products or services and to making decisions based on demand factors.
- **CO3:** Explain the major characteristics of different market structures and the implications for the behavior of the firm.

- **CO4:** Measure living standards, inflation, and unemployment for use as economic indicators.
- **CO5:** Explain the role of international trade; analyze the determinants of the relative strengths of monetary policy for sustainable growth of our nation and International Trade

Mapping of Course Outcome(s):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Н		М		М		Μ
CO2							L	М			Н	М
CO3						Н			М			L
CO4							L	М			L	М
CO5						L		Μ		М		Μ

UNIT I : DEFINITION AND SCOPE OF ECONOMICS

Definitions by A. Smith, A. Marshal and L. Robbins, P.Samuels on and their critical examination - Nature and scope of Economics - Micro-economics in relation to other branches of Economics.

UNIT: II PRICING AND LAW OF DEMAND

Demand, Factors influencing demand, Elasticity of demand - price, income and cross, concepts and measurement - Break Even Analysis – Law of Demand - Price, income and substitution effects - Giffen goods- Pricing Methods.

UNIT III: MARKET STRUCTURE

Definition of market.Concepts of product and factor markets. Different types of market: perfect competition, monopoly, imperfect competition, monopolistic, competition and oligopoly. Demand and Supply schedules. Price determination under perfect competition in long and short run. Price determination under monopoly.Discriminating monopoly.

UNIT IV: MACRO-ECONOMICS

Meaning, Macro-economic Policy and Its Objectives and Instruments - National Income and Social Accounting - Concepts, components, and measurement - Basic circular flow of income model, Unemployment, trade cycle, Inflation - causes, types, effects and control.

UNIT V: COMMERCIAL AND CENTRAL BANKS

Credit creation, monetary policy and tools - Balance of payments - Items in the balance of payments account, equilibrium in the balance of payments.

Text Book(s):

- 1. Gupta, S.B., Monetary Economics, S. Chand & Co., New Delhi, 2nd Edition, 2009.
- 2. RuddarDatt and K.P.M.Sundharam, Indian Economy, 70th Edition, S.Chand& Company Ltd., New Delhi,2013.

Reference Book(s):

- 1. D.N.Dewedi, Managerial Economics, 8th Edition, S.Chand& Company Ltd., New Delhi, 2005.
- 2. Gupta, G.S. Macroeconomics, Theory and Applications, 2nd edition, Tata McGraw-

Hill publishing company Ltd., New Delhi,2004.

3. Macroeconomic –Theory and policy, 3rd Edition, Tata McGraw-Hill publishing company Ltd., New Delhi,2010.

		L	Т	Р	Credit
HSS18R007	HUMAN RESOURCE MANAGEMENT AND LABOUR LAW	3	0	0	3
Pre-requisite: Ni Course Type: The	Course Category:	Hum	anitie	s Ele	ctive

Course Objectives:

To explore key issues related to the management, performance, and development of human resources in the workplace; To emphasis on making decisions and developing plans that will enable managers to make the best possible use of their human resources; To gain knowledge about manpower planning, analysis and evaluation, recruitment and selection, wages and salaries, training and management development, performance appraisal, and industrial relations.

Course Outcomes:

- **CO1:** Explain basic knowledge on developing the employment relations and knowledge to resolve the issues.
- **CO2:** Design an appropriate and suitable role of HR specialist for implementing Human Resource Management policies.
- **CO3:** Manage the manpower to motivate and attract them to retain in the organization.
- **CO4:** Develop the skills necessary to hold responsibility of employer and legal system to manage the employment relations
- **CO5:** Explain the applicability of business law on various functional domains this in turn enhancing a strong human relation.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Η	L		L	L	L	
CO2							L	М	Η	Η	L	
CO3							Η					М
CO4						L			М	L	М	
CO5									Н	М		L

Mapping of Course Outcome(s):

UNIT – I FUNDAMENTALS OF HRM

Human Resource Development Systems-HR environment in India-Functions and Operations of a Personnel Office - Emerging HR Trends - HR information system

UNIT – II HRM FUNCTIONS

Job analysis and job design - HR planning – Recruitment - selection and induction- Staff Training and Development-Career planning and Development- Job Evaluation-Performance Appraisal and Potential Evaluation-Wage determination; salary structure-Wage policies and Regulations-Employee benefits and services

UNIT – III MOTIVATING HUMAN RESOURCES

Team and Team work - Collective Bargaining Employee Morale – Participative Management–Quality Circle – Empowerment –counseling and mentoring.

UNIT – IV MAINTENANCE OF WORKERS

Compensation Management- Reward system – Labour relations –Employee Welfare, Safety and Health – Employee benefits and services – Promotion, Transfers and separation – Ethical issues in HR Management and International Human Resource Management - Legal Aspect of Labour

UNIT – V BUSINESS LAW

Factories Act, 1948 - Industrial Dispute Act, 1947 – Industrial employment – Standing Orders Act, 1946 – Trade Union Act, 1926 - Workmen Compensation Act, 1923, Employees State Insurance Act, 1948, Employees Provident Fund and Miscellaneous Provision Act, 1952, Payment of Gratuity Act, 1972. Payment of Wages Act 1936, Minimum wages Act, 1948– Payment of Bonus Act, 1965.Tamil Nadu Shops and Establishments Act.

Text Books:

- 1. Decenzo and Robbins, Human Resource Management, Wilsey, 12th edition, 2015.
- 2. Prasad L.M., Human Resource Management, 3rd edition, Sultan Chand, New Delhi, 2014.

Reference Book(s):

- 1. BiswajeetPattanayak, Human Resource Management, 3rd edition, Eastern Economy Edition, New Delhi,2010.
- 2. C.B. Gupta, Human Resource Management, 13th Edition, Sultan Chand, New Delhi 2011.

		L	Т	Р	Credit
HSS18K008	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	3
Pre-requisite: Ni	Course Category:	Hum	anitie	s Ele	ctive
Course Type: The	ory				

Course Objectives:

To focus on the entrepreneurial process and the different kinds of entrepreneurial outcomes by making students to understand about opportunity identification through analysis of industry niches, skills needed in order to turn an opportunity into reality, business plans, launch decisions, and obtaining risk capital; To deal with the problems and challenges facing the management of businesses in raising funds, marketing products and services, improving effectiveness and flexibility, and achieving growth.

Course Outcomes:

- **CO1:** Explain the concept of entrepreneurship and which in turn leads to think creatively for new business opportunities to sustain individual as well as social goals.
- **CO2:** Realize entrepreneurial spirit and provide a framework of successful business world with relation to agencies to promote employment opportunities.
- **CO3:** Explain women entrepreneurship and promote a successful business models and explains operational implementations for investment details.

- **CO4:** Explain the role of government in promoting the entrepreneurship among the individuals and organizations as a whole
- **CO5:** Explain emerging concepts of marketing in the emerging global markets and provide more insights into project management and venture promotion

CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Н		Н		Н		Н
CO2						Μ	L	Н		L	Μ	L
CO3						L	L	М	Н	L		Н
CO4						Μ		М			Μ	Н
CO5										L		

Mapping of Course Outcome(s):

UNIT –I Introduction

Concepts of entrepreneur, entrepreneurship and entrepreneur - Characteristics and competencies of a successful entrepreneur - General functions of an entrepreneur - Type of entrepreneurs - Role of entrepreneur in economic development - Distinction between an entrepreneur and a manager - Entrepreneur and Intrepreneur.

UNIT – II Growth of Entrepreneurship

Emergence of entrepreneurship - Economic and non economic factors for stimulating entrepreneurship development - Obstacles to entrepreneurship development in India - Growth of entrepreneurship in India

UNIT – III Women and Entrepreneurship

Concept of women entrepreneurship - Reasons for growth of woman entrepreneurship - Problems faced by them and remedial measures.

UNIT – IV Role of The Government In Entrepreneurship Development

Concept and meaning of entrepreneurship development - Need for entrepreneurship development programmes (EDPs) - Objectives of EDPs - Organizations for EDPs in India; NIESBUD, SISI – their roles and activities.

UNIT – V Venture Promotion and Project Formulation

Concept of projects classification of projects and project report - Project identification and selection - Constraints in project identification - Techniques of Project Identification, Significance - contents - formulation of project report - Need for Project Formulation - Elements of project Formulation

Text Book(s):

1. Michael H Morris, Corporate Entrepreneurship and Innovation in Corporations, 7th Edition, CENGAGE Learning, Delhi,2010

2. Jerry Katz, Entrepreneurship Small Business, 5th edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.

Reference(s) :

1. Khanka S.S., Entrepreneurial Development, 1st edition, S.Chand and Company Limited, New Delhi,2013.

2. Prasama Chandra, Projects: Planning, Analysis, Selection, Implementation and Reviews, 2nd edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1996.

3. Robert D. Hisrich, Entrepreneurship, 10th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2017.

HCC10D000		L	Т	Р	Credit
HSS18R009	COST ANALYSIS AND CONTROL	3	0	0	3
Pre-requisite: N	Nil Course Category:	Hum	anitie	s Ele	ctive
Course Type: Th	neory				

Course Objectives:

To exhibit the concepts on costing by describing its elements, types and cost sheet preparation; To encompasses the analytical framework that can be applied in cost analysis like Marginal costing, CVP analysis, Break even analysis, etc enabling the students to make decisions on cost parameters; To enable students to apply techniques like standard costing, activity based costing, etc to manage and control cost effectively.

Course Outcomes:

CO1: Explain the basics of Costing and preparation of Cost sheet.

- **CO2:** Analyze the cost by applying tools like marginal costing, CVP analysis and other applications.
- **CO3:** Evolve budgets for controlling cost in manufacturing or production centers.
- **CO4:** Define cost standards and critically examining the application of standard costing in a production Centre.
- **CO5:** Explain the application of various strategic cost alternatives including Activity based costing.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						М		Η			L	Н
CO2							М		Η			L
CO3						L				Η		М
CO4						М		Η			L	Η
CO5							М		Η			L

Mapping of Course Outcome(s):

UNIT I INTRODUCTION TO COSTING

Costing, Elements of costing, Types of cost, Preparation of cost sheet.

UNIT II COST ANALYSIS

Marginal costing, Cost - volume – Profit analysis, Break-Even- Analysis, Break – Even - Chart, Applications.

UNIT III CONTROL TECHNIQUES

Budgeting and Budgetary control, Types of Budgets, Preparation of purchase Budget, Flexible budgets, Cash Budget, Sales Budget, Materials Budget, Master Budget, Zero based Budgeting.
UNIT IV STANDARD COSTING

Types of Standards, Setting up of standards, Advantages and Criticism of Standard Costing – Control through variances

UNIT V ACTIVITY BASED COSTING

Transfer Pricing, Target costing, Life Style Costing, Activity Based Costing (only theory).

Text Book(s):

- K.Saxena& C.D. Vashist, Advanced Cost Accounting and Cost Systems, 2nd Edition, V.Sultan Chand & Sons Publishers.2014
- 2. S.P. Jain &K. L. Narang, Advances Cost Accounting Kalyani Publishers, 1st Edition, 2017.

Reference Book(s):

- 1. J. Blocher, K. H. Chen, G. Cokins and T. W. Lin., Cost Management: A Strategic Emphasis, Irwin/McGraw-Hill, 3d edition,2008
- 2. Don R. Hansen, Maryanne M. Mowen, Cornerstones of Cost Management, 6thEdition,Cengage Learning,2015

HSS18R010	PRODUCT DESIGN AND	L	Τ	P	Credit		
	3	0	0	3			
Pre-requisite: Nil	Course Category: Humanities Elective						
Course Type: Theory							

Course Objectives:

To understand the principles and basic concepts of product design and development; To study about product's mechanical architecture, selection of materials and production processes and engineering the various components necessary to make the product work; To make students to identify market opportunity, creation of product to appeal to the identified market, and finally, testing, modifying and optimizing the product until it is ready for production.

Course Outcomes:

- **CO1:** Explain about the basic concepts related to design and development of New product
- **CO2:** Explain the structured approach towards incorporating quality, safety, and reliability into design.
- **CO3:** Analyze concepts relating to simulating product performance and manufacturing processes.
- **CO4:** Discover the technologies related to computer aided group technology
- **CO5:** Correlate implications of changes related to Economic analysis.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Η	М	L	М		М	L
CO2						Η	Η		Η	М		М
CO3						Н	М					Н
CO4							М					М
CO5							М	Н		L		М

Mapping of Course Outcome(s):

UNIT – I NEW PRODUCT IDEA

Definition – Design by Evolution and by Innovation - factors to be considered for product design – Production-Consumption cycle – The morphology of design – Primary design Phases and flowcharting. Role of Allowance, Process Capability, and Tolerance in Detailed Design and Assembly Product strategies, Market research – identifying customer needs – Analysis of product – locating ideas for new products, Selecting the right product, creative thinking, curiosity, imagination and brain storming – product specification.

UNIT – II NEW PRODUCT DESIGNING

Task - Structured approaches – clarification – search – external and internal – systematic exploration – conception, selection - methodology benefits. The value of appearance - principles and laws of appearance – incorporating quality, safety, and reliability into design. Man-machine considerations – Designing for ease of maintenance.

UNIT – III ROLE OF TECHNOLOGY IN DESIGNING

Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing process – Needs for industrial design-impact – Industrial design process – Technology driven products - user driven products – assessing the quality of the product.

UNIT – IV METHODS AND PRINCIPLES OF DESIGNING

Methodologies and tools - Design axioms - Design for assembly and evaluation - Minimum part assessment - Taguchi Method - Robustness assessment - Manufacturing process rules - Designer's tool kit - Computer aided group process rules - Designer's tool kit - Computer aided group technology - Failure Mode Effective Analysis – Design for minimum number of parts – Development of modular design – Minimising part variations – Design of parts to be multifunctional, multi-use, ease of fabrication – PokaYoka principles.

UNIT – V FEASIBILITY ANALYSIS

Estimation of manufacturing cost – cost procedures – Value Engineering - reducing the component cost and assembly cost – minimizing the system complexity – Basics and Principals of prototyping – Economic Analysis: Break even analysis. Classes of exclusive rights – Patents – Combination versus aggregation – Novelty and Utility – Design patents – Patent disclosure – Patent application steps - Patent Office prosecution - Sales of patent rights - Trade marks – copy rights.

Text Book(s):

- 1. Karl.T.Ulrich, Steven D.Eppinger, Product Design and Development, McGraw Hill International, 6th Edition, 2016.
- 2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 3rd edition, Prentice Hall of India Private Limited, New Delhi,2005.

Reference Book(s):

- 1. Richard Crowson, Product Design and Factory Development, 2nd Edition, crc Press,2005.
- 2. Thomke, Stefan, and Ashok Nimgade. "IDEO Product Development." Boston, MA: Harvard Business School Case 9-600-143, June 22,2000.

HSS18R011	BUSINESS PROCESS	L	Т	P	Credit
	REENGINEERING	3	0	0	3
Pre-requisite: Nil	Course Categor	y: H	uman	ities]	Elective
Course Type: Theory					

Course Objectives:

To clarify the principles and basic concepts of Business Process Engineering by focusing on both quantitative and qualitative analytical skills and models essential to operations process design, management, and improvement in both service and manufacturing oriented companies; To prepare the students to play a significant role in the management of a world class company which serves satisfied customers through empowered employees, leading to increased revenues and decreased costs.

Course Outcomes:

- CO1: Explain the basic concepts related to Business Process Reengineering.
- CO2: Explain the methodologies and tools used for Business Process Reengineering.
- **CO3:** Analyze the concepts relating to benefit/cost analysis and its impact on the business organizations.
- **CO4:** Explain the need for assessment of business re-engineering and the factors contributing to its success.
- **CO5:** Identify the best practices used in Business Process Reengineering with illustrations from corporate world.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Η	М		L	М	L	М
CO2						L		L	Μ	М	Н	Н
CO3							Η	L	L	L		
CO4						Η	L			М		
CO5						Η	М	L	М	М	М	L

Mapping of Course Outcome(s):

UNIT – I BASIC CONCEPTS

Introduction to BPR Definition; the paradigm shifts in production; the positioning concept; the re-engineering visions; the benefits of business re-engineering

UNIT – II METHODOLOGIES FOR BPR

Methodologies and Tools for BPR, Process management; dynamic business reengineering change framework; steps to reengineer the process

UNIT – III MODELLING THE BUSINESS

Tools used in Modelling the Business: flow-charting, business activity maps, relational diagrams, benefit/cost analysis. The enabling role of information technology in business re- engineering

UNIT – IV CHANGE MANAGEMENT

Change Management, Planned changes in business re-engineering projects; challenges of business change; business change development. Success factors in re-engineering. The assessment of business re-engineering

UNIT – V BEST PRACTICES IN BPR

Best Practices in BPR, Case studies: Bell Atlantic, Nissan, Chrysler, Xerox, and Hewlett Packard etc.

Text Books:

1. Ali K. Kamrani, Maryam Azimi (2011). New Methods in Product Design: New Strategies in Reengineering (Engineering and Management Innovation). CRC Press. 1^{st} ed.

Reference Books:

1. Harmon, P. (2007), Business Process Change : A Guide for Business Managers and BPM and Six Sigma Humanities, Elsevier/Morgan KaufmannPublishers.

UCC10D017	DOLITICAL ECONOMY	L	Т	Р	Credit
HSS10KU12	POLITICAL ECONOMI	3	0	0	3
Pre-requisite: Nil	Course Catego	ry: H	umar	ities	Elective
Course Type: Theory					

Course Objectives:

This course provides an introduction to the political economy of India. It examines the interplay of politics and economics. Some of the key themes to be explored are globalization, economic reform, poverty, redistribution, federalism, political protest, public goods delivery, gender, and ethnic politics. Although this class focuses specifically on India, a number of the themes discussed in this course are functions of institutions, rights, Party Systems and challenges.

Course Outcomes:

- **CO1:**Explain the key concepts of political economy analyse the significant developments in the political ideologies.
- **CO2:** Describe the salient features of the constitution of India and its functions and also interpret, integrate and critically analyze the fundamental rights duties and responsibilities.
- CO3: Explain the Political party system their evolution and role in the economy
- **CO4:** Explain the various ideological of Indian Political Thoughts
- **CO5:** Explain and appreciate situations of India undergoing major economic and social transformation

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Mapping of (Course Outcome(s):	
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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Н	Н		L	М	М	L
CO2						Н				Н		
CO3						L	Н	Н	L	Н	Μ	L
CO4						Н	Н		L	М	М	L
CO5						Н				Н		

UNIT I -INTRODUCTION TO POLITICAL ECONOMY

Political Economy as a Method, perspectives, Politics as Reproduction of Social Relations, State and Social Opportunity, Politics of Rent Seeking -Evolution of State in India: Historical Roots of planning, Redistribution.

UNIT II – INDIAN CONSTITUTION

The Pre-ample- Fundamental rights and duties, Directive Principles- Offices of the President, Prime Minister, Cabinet Government, Chief Election Commissioner, and Governor – Parliamentary system and Procedures - The Judiciary system.

UNIT III – PARTY SYSTEM

National and regional political parties, ideological and social bases of parties; patterns of coalition politics; Pressure groups, trends in electoral behaviour; changing socio-economic profile of Legislators

UNIT IV – INDIAN POLITICAL THOUGHT:

Political Ideologies: Liberalism, Socialism, Marxism, Fascism, Gandhism and Feminism - Dharamshastra, Arthashastra and Buddhist traditions; Sir Syed Ahmed Khan, Sri Aurobindo, M.K. Gandhi, B.R. Ambedkar, M.N. Roy.

UNIT V-CHALLENGES TO INDIAN DEMOCRACY

Uneven Development of Regions in India – Communalism – Regionalism – Violence – Corruption – environmental degradation- illiteracy –Population.

Text Book(s):

- 1. Charles Sackrey, Geoffrey Schneider, Janet Knoedler, Introduction to Political Economy, Dollars & Sense, 8th Edition,2016.
- 2. Robert.S.Dimand, Review of Political Economy: An Introductory Text, 1st Edition, Routledge,2008.

Reference Book(s):

- **1.** Barry R. weingast and Donald a.Wittman, Handbook of Political Economy, 1st Edition, Oxford University Press, New York,2006.
- **2.** Ed. Sanjay Ruparelia; Sanjay Reddy; John Harriss& Stuart Corbridge, Understanding India's New Political Economy: A GreatTranformation, Routledge 1st Edition edition2011.
- 3. M.Laxmikanth, Indian Polity, 4th Edition, McGraw Hill Education, NewDelhi,2017.

1100100013		L	Т	P	Credit						
HSS18K013	PROFESSIONAL ETHICS	3	0	0	3						
Pre-requisite: Nil	Course Category:	Course Category: Humanities Elective									
Course Type: Theory											

Course Objectives:

To have an understanding of the ethical problems and principles through theory, historical case studies and research and presentation; To allow students to explore the relationship between ethics and engineering and apply classical moral theory and decision making to engineering issues encountered in academic and professional careers.

Course Outcomes:

CO1: Students will be able to comprehend the importance of balancing professional and personal commitments.

- CO2: Students will be able to understand the importance of avoiding conflicts of interest at the workplace
- CO3: Students will be able to analyze how ethical theories help in resolving moral Dilemmas confronting professionals.
- CO4: Students will be able to discern the dividing line between loyalty to employers and commitments to public welfare.
- CO5: Students will be able to realize the need to avoid gender bias and related discrimination at the workplace.

CO/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
0												
CO1						L		Н	М	М		L
CO2									Н	М	М	L
CO3						М		L		L		
CO4							Н			М		
CO5								Μ		М		

Mapping of Course Outcome(s):

UNIT I – ENGINEERING ETHICS

Functions of Being a Manager – Stock holder and stakeholder management – Ethical treatment of employees - ethical treatment of customers- supply chain management and other issues.

UNIT II - ENGINEERING ASSOCIAL EXPERIMENTATION

Senses of Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professiona and Professionalism – Professional ideals and virtues – Theories about right action – Self-interest – Customs and religion – Use of Ethical Theories.

UNIT III - ENGINEER RESPONSIBILTY FOR SAFETY

Corporate social responsibility - Collegiality and loyalty - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights -Discrimination.

UNIT IV - RESPONSIBILITY AND RIGHTS

Moral imagination, stake holder theory and systems thinking - One approach to management Decision – making Leadership.

UNIT V – GLOBAL ISSUES

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample code of conduct.

Text Book(s):

- 1. Mike Martin and Roland Schinzinger, Introduction to Engineering Ethics, 2nd Edition, McGraw Hill Higher Education, New Delhi,2010.
- 2. Charles D Fledderman, Engineering Ethics, 4th Edition, Pearson Education, Delhi,2011.

Reference Book(s):

- 1. R.S.Naagarazan, Text book on Professional Ethics and Human Values, New Age International,2007.
- 2. Gail Baura, Engineering Ethics- An Industrial Perspective, 1st Edition, Academic Press, 2006.
- 3. Charles e. Harris , Michael s. Pritchard and Michael J. Rabins Texas , Engineering Ethics- Conecpts and Cases, 4th Edition, Cengage Learning,2009.

		LTPCr3002Humanities Elective					
HSS18K014	OPERATIONS RESEARCH	3	TPC00es Elective	3			
Pre-requisite: Nil Course Type: Theory	Course Category: Hum	naniti	es Ele	ective	1		

Course Objectives:

To provide students with ability to understand and analyze managerial problems in industry so that they are able to use resources like capitals, materials, staffing, and machines more effectively; To provide the knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry; To enhance the skills in the use of operations research approaches and computer tools in solving real problems in industry.

Course Outcomes:

- **CO1:** Identify and develop operational research models from the verbal description of the real System.
- CO2: Build and solve Transportation Models and Assignment Models
- **CO3:** Evolve mathematical software to solve the proposed models.
- **CO4:** Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision making processes in Management Engineering.
- **CO5:** Design new simple models, like: CPM, MSPT to improve decision –making and develop critical thinking and objective analysis of decision problems.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						Η	М		Н			Н
CO2						L		L		Н		L
CO3					М	М				Н		L
CO4						Н	М		Η	Н		М
CO5						Н	М		H			Н

Mapping of Course Outcome(s):

UNIT I - INTRODUCTION TO LINEAR PROGRAMMING

Introduction to applications of operations research in functional areas of management - Linear Programming - formulation, solution by graphical and simplex methods (Primal - Penalty, Two Phase), Special cases - Dual simplex method.

UNIT II- TRANSPORTATION MODELS AND ASSIGNMENT MODELS

Transportation Models (Minimising and Maximising Cases) – Balanced and unbalanced cases – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation ethods - Check for optimality - Solution by MODI / Stepping Stone method - Cases of degeneracy - Transshipment Models - Assignment Models (Minimising and Maximising Cases) – Balanced and Unbalanced Cases - Solution by Hungarian and Branch and Bound Algorithms - Travelling Salesman problem - Crew Assignment Models.

UNIT III- INTEGER LINEAR PROGRAMMING AND GAME THEORY

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms - Game Theory - Two person Zero sum games - Saddle point, Dominance Rule, graphical and LPsolutions.

UNIT IV - REPLACEMENT MODELS AND DECISION THEORY

Replacement Models-Individuals replacement Models (With and without time value of money) – Group Replacement Models - Decision making under risk – Decision trees – Decision making under uncertainty.

UNIT V-PROJECT MANAGEMENT METHOD AND SIMULATION

PERT / CPM – Drawing the network, computation of processing time, floats and critical path. Resource leveling techniques - Application of simulation techniques for decision making.

Text Book(s):

- 1. Kalavathy S, Operations Research, Vikas Publishing House, 4TH Edition, 2013.
- 2. Paneerselvam R., Operations Research, Prentice Hall of India, 2ND Edition,2006.
- 3. Tulsian P.C, Vishal Pandey, Quantitative Techniques (Theory and Problems), Pearson Education, Asia, First Indian Reprint2002.

Reference Book(s):

- 1. D.S.Hira, Problems in Operations Research, Kindle Edition, S.Chand, 2010.
- 2. Prem Kumar Gupta and D.S. Hira, Operations Research, S.Chand, 2016.
- 3. R.C.Mishra,Principles of Operations Research, 1st Edition, New Age International2011.

		L	Т	Р	Credit
HSS18K015	TOTAL QUALITY MANAGEMENT	3	0	0	3
Pre-requisite: Nil	Course category: Hu	mani	ties E	lecti	ve
Course Type: Theor	y				

Course Objectives:

To provide students with the knowledge to understand the philosophy and core values of Total Quality Management (TQM; To determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization; apply and evaluate best practices for the attainment of total quality; To make students to critically appraise management techniques, choose appropriate statistical techniques for improving processes and write reports to management describing processes and recommending ways to improve them.

Course Outcomes:

- **CO1:** Explain the role and nature of quality in evolving international economic conditions
- **CO2:** Apply the Principles of Quality Management for real time problems.
- **CO3:** Analyze the quality encounter process, including supporting facilities and customer requirements/characteristics
- **CO4:** Classify quality measurement methods and continuous improvement process
- **CO5:** Design Management strategy methods, including identification, development, implementation and feedback processes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L					Η				L	L	
CO2	М						L			L		М
CO3						М	М	L	L	L	L	
CO4	Η	L							Η	L	М	Η
CO5							М	L	L	L	L	L

Mapping of Course Outcome(s):

UNIT I - INTRODUCTION TO QUALITY MANAGEMENT

Definitions – TOM framework, benefits, awareness and obstacles - Quality – vision, mission and policy statements - Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.

UNIT II -PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi, Shingeo and Walter Shewhart - Concepts of Quality circle, Japanese 5S principles and 8D methodology.

UNIT III-STATISTICAL PROCESS CONTROL AND PROCESS CAPABILITY

Meaning and significance of statistical process control (SPC) – construction of control charts for variables and attributed - Process capability – meaning, significance and measurement – Six sigma concepts of process capability - Reliability concepts –

definitions, reliability in series and parallel, product life characteristics curve – Business process re-engineering (BPR)– principles, applications, reengineering process, benefits and limitations.

UNIT IV-TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT

Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability, failure rate, FMEA stages, design, process and documentation

UNIT V-TAGUCHI TECHNIQUES

Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio - Seven old (statistical) tools - Seven new management tools - Bench marking and POKAYOKE.

Text Book(s):

- 1. Poornima M.Charantimath., Total quality management, Pearson Education, 2ND Edition, 2011.
- 2. Dale H.Besterfield et al, Total Quality Management, Perarson Education, Thrid edition, (First Indian Reprints2004).

Reference Book(s):

- 1. Shridhara Bhat K, Total Quality Management Text and Cases, Himalaya Publishing House, First Edition, 2002.
- 2. Jams R. Evans, Total Quality: Management, Organisationand strategy, 4th Edition, South- Western College,2004.
- 3. Vincent K.Omachonu, Joel E.Ross, Principles of Total Quality, 3rd Edition, CRC Press, 2004.
- 4. S.Rajaram, M.Sivakumar, Total Quality Management, Wiley Publishers, 1st Edition,

EEE18R171	71 Basic Electrical and Electronics Engineering					С
			3	1	2	5
Pre-requisite:	Nil	Course Category: B	asic	Engi	neer	ing
		Course Type: Integra	ated	Cou	rse	

Course Objective(s):

To focus the fundamental ideas of the Electrical and Electronics Engineering by providing wide exposure to the basic concepts of Electrical and Electronics Engineering such as DC Circuits, AC Circuits, electrical machines, measuring instruments, electrical installation, Basic Electronic Devices and various electronic circuits such as rectifiers, amplifiers, oscillators, etc.,

Course Outcome(s):

After completing this course, the student will be able to:

CO1: Apply the basic laws of electricity in DC and AC circuits

CO2: Describe the construction and operation of static and rotating electrical machines **CO3:** Explain the functioning of measuring instruments and Low Voltage Electrical Installations

CO4: Describe the constructional features and operation of fundamental electronic devices

CO5: Explain the characteristics of electronic circuits

CO /]	PO						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	Μ		Μ	М	L		L	Μ	L			Μ		
CO2	Μ	Μ		Μ	М	L		М	L	М			Μ		
CO3	Μ			Μ	М	L		L	Μ	L			S		
CO4	S	Μ											Μ		
CO5	S	S	L	Μ	Μ	L	Μ	Μ	L	Μ			М		

Mapping of Course Outcome(s):

UNIT 1: DC Circuits and AC Circuits

Electrical quantities - resistors - inductors - capacitors - Ohm's Law - Kirchhoff's Laws - series and parallel circuits - analysis of DC circuits - mesh, nodal - simple problems-Sinusoidal functions - phasor representation - RMS and Average values - form and peakfactors - RLC series circuits - power and power factor-concept of three phase

system.

UNIT 2: Electrical Machines

Construction and principle of operation of DC machines – DC generator – EMF equation – Types – DC motor – Types - single phase transformer – Construction and operation – EMF equation - Alternator - three phase induction motor – Construction – Types - single phase induction motor – Construction – Types - single phase induction motor – Construction – Working - types.

UNIT 3: Measuring Instruments and Electrical Installation

Moving coil and moving iron instruments - dynamometer type wattmeter - Induction type energymeter

Electrical Installation: Components of LT Switchgear - Switch Fuse Unit (SFU) – MCB - ELCB - MCCB - Domestic wiring - accessories - types - staircase wiring - fluorescent tube circuits – Earthing

UNIT 4:Electronic Devices

Basic concepts of PN junction diodes - Zener diode - bipolar junction transistor -Unipolar devices - FET, MOSFET, UJT - Thyristor–SCR and Triac, Photoelectric Devices-Photo diode and Phototransistor

UNIT 5:Electronic Circuits

Half wave and full wave rectifier –Transistor as an amplifier –RC- phase shift oscillator -RC integrator and differentiator circuits - diode clampers and clippers - multivibrators -Schmitt trigger

Text Book(s):

- 1. V.K. Mehta, "Principles of Electrical Engineering and Electronics", S. Chand & Company Ltd,2012
- 2. Kothari D P and Nagrath I J, "Basic Electrical Engineering", McGraw Hill, 2009.
- 3. Mithal G K, Electronic Devices & Circuits, Khanna Publications, 1997

Reference(s):

- 1. T. Thyagarajan, "Fundamentals of Electrical and Electronics Engineering", SciTech publications (Ind.) Pvt. Ltd., 3rd Edition,2015.
- 2. Muraleedharan K.A, Muthususbramanian R and Salivahanan S, "Basic Electrical, Electronics and Computer Engineering" Tata McGrawHill,2006.
- 3. Shantha kumar S.R.J, Basic Mechanical Engineering, Third Revised Edition (Reprint 2009), Anuradha Publications, Kumbakonam, 1999.
- 4. Rajput R. K., Basic Mechanical Engineering, Fourth edition, Tata McGraw Hill Publishing Co., New Delhi,2007.

LIST OF EXPERIEMENTS:

- 1. Verification of Kirchoff's Laws.
- 2. Verification of Mesh and Nodal analysis
- 3. Measurement of electrical quantities-voltage current, power &power factor in RLC circuit
- 4. Open circuit characteristics of Separately excited DC Generator
- 5. Draw the characteristic between output power versus efficiency of DC shunt motor
- 6. Verification of turns ratio on single phase transformer
- 7. Study of basic electrical installation components for LT switchgear
- 8. Residential house wiring using fuse, two way switches and lamp
- 9. Wiring layout for Fluorescent lamp
- 10. VI characteristics of PN junction diode
- 11. VI Characteristics of Zener diode
- 12. Construct and demonstrate the Light sensor using PhotoTransistor
- 13. Design a diode based Half wave and Full wave rectifier
- 14. Study of Zener diode as voltage regulator
- 15. Study of Clipping & Clamping circuit

MEC18R151	ENGINEERING GRAPHICS & DESIGN	Т	Р	С
		0	TP02neering	3
Pre-requisite	: Nil Course Category: Basic Er	ngineeri	ng	
	Course Type: Theory with	Practica	ıl	

Course Objective(s):

This course aims to introduce the concept of graphic communication, develop the drawing skills for communicating concepts, ideas and designs of engineering products, Demonstrate skills in interpreting, and producing engineering drawings accurately and to give exposure to national standards relating to engineering drawing

Course Outcome(s):

After completing this course, the student will be able to:

CO1: Create the projection of points in all quadrants and straight lines

CO2: Construct the projections of planes and solid objects with refer to reference planes **CO3:** Illustrate the true shape of truncated solids in both the manual and computerized manner

CO4: Develop surfaces of truncated solids in both the manual and computerized man **CO5:** Apply orthographic and isometric projections in both the manual and computerized man

CO/							PO						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М		М												
CO2		S										L			
CO3	М		S		S		S					М			
CO4	L	М			S		S					S			
CO5	S		S		S		S					S			

Mapping of Course Outcome(s):

UNIT 1: Projection of Points and Straight Lines

Importance of graphics – use of drafting instruments – BIS conventions and specifications – size, layout and folding of drawing sheets– lettering dimensioning and scales-Projection of points, located in all quadrants - projection of straight lines located in the first quadrant, determination of true lengths and true inclinations

UNIT 2: Projection of Planes and Solids

Projection of polygonal surface and circular lamina located in first quadrant inclined to one or both reference planes-Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method

UNIT 3: Section of Solids

Section of simple solids like prisms, pyramids, cylinder and cone in vertical position by cutting planes inclined to any one of the reference planes, obtaining true shape of section

UNIT 4: Development of Surfaces

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones

UNIT 5: Orthographic and Isometric Projection

Orthographic principles – missing view - free hand sketching in first angle projection from pictorial views. Principles of isometric projection – isometric view and projections of simple solids, truncated prisms, pyramids, cylinders and cones. Introduction to CAD software – menus and tools – drafting platform demonstration

Practical Modules

- 1. Construction of conic sections using CAD software
- 2. Construction of simple planes using exclusive commands like extend, trim etc.,
- 3. Construction of 3D model solids and sectional views
- 4. Generating 2D orthographic blue prints from 3D part models
- 5. Vectorization of simple building plan and elevation

Text Book(s):

1. Basant Aggarwal and C. Aggarwal, Engineering Drawing, McGraw-Hill, 2013.

- 2. N.S. Parthasarathy, Vela Murali, Engineering Drawing, Oxford University Press, 2015.
- 3. K. Venugopal, Engineering Drawing + AutoCAD, New Age; Fifth edition, 2011.

Reference(s):

1. Shah, M.B., and Rana, B.C., Engineering Drawing, Pearson2009

- 2. Natarajan, K.V., A Text Book of Engineering Graphics, 21st Edition, Dhanalakshmi Publishers, Chennai, 2012.
- 3. Paul Richard, Jim Fitzgerald., Introduction to AutoCAD 2017: A Modern Perspective, Pearson, 2016.

MEC18R211	ENGINEERING MECHANICS	L	Т	Р	С
		3	1	0	4
Pre-requisite:	Nil Course Category: Basic Engined	ering			
	Course Type: Theory	_			

Course Outcome(s):

CO1: Explain the vectorial and scalar representation of forces and moments of particles and rigid bodies both in two dimensions and in three dimensions.

CO2: Apply the knowledge of trusses in frames, beams and machine components.

CO3: Contrast the effect of friction on equilibrium.

CO4: Illustrate the importance of properties of surfaces and solids.

CO5: Demonstrate the dynamic equilibrium equation.

Mapping of Course Outcome(s):

CO /		PO													
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	S	S	М	L											
CO2	S	Μ	Μ	L											
CO3	S	S	М	L											
CO4	S	Μ	Μ	L											
CO5	S	L	L	L											

UNIT 1: Statics of Particles and Rigid Bodies

Six Fundamental principles and concepts - vector algebra - Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D - System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant - Equations of Equilibrium of Coplanar Systems and Spatial Systems.

Rigid Body equilibrium in 2-D & 3-D - Moment of Forces and its Application - Couples and Resultant of Force System - Equilibrium of System of Forces, Free body diagrams - Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT 2: Analysis of Trusses

Basic Structural Analysis- Equilibrium in three dimensions - Method of Sections-Method of Joints- How to determine if a member is in tension or compression- Simple Trusses- Zero force members- Beams & types of beams- Frames & Machines.

UNIT3: Friction

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction -Motion of Bodies, simple contact friction, sliding block, wedge friction, screw jack & differential screw jack, rolling resistance.

UNIT 4: Properties of Surfaces and Solids

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 (T section and I section) - Mass moment inertia of circular plate, Cylinder, Cone, Sphere-Principal moment of inertia.

UNIT5: Dynamics

Review of particle dynamics - Displacements, velocity and acceleration, their relationship - Equations of motions - Rectilinear motion - Plane curvilinear motion - Newton's 2nd law- Impulse, momentum, impact - D'Alembert's principle and its applications in plane motion and connected bodies - Work energy principle and its application in plane motion of connected bodies - Virtual Work and Energy Method - Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies.

Text Book(s):

1. Beer, F.P., and Johnson, E.R., Vector Mechanics for Engineers – Statics and Dynamics, McGraw Hill, Tenth Edition in SI units

Reference(s):

1. Merriam, J.L., Engineering Mechanics, Volume I – Statics, and Volume – II, Dynamics 2/e, Wiley International, Seventh Edition.

2. Irving, H., Shames, Engineering Mechanics, Statics and Dynamics, Prentice Hall of India Ltd., Fourth Edition

CSF18D171	PROCRAMMING FOR PROBLEM SOLVING	L	Т	Р	С							
CSEI0KI/I	I KOGRAMINING FOR I KODLEM SOL VING	3	1	2	5							
Pre-requisite	:: NIL Course Category :Basic Engine	Course Category : Basic Engineering										
1	Course Type : Integrated Co	ourse	:									

Course Objectives

To make the students to understand the basic concepts of programming language, rules to be followed while writing a program and how to compile and execute C programs.

Course Outcomes:

- **CO1:** Understand the basic programming concepts and syntax of C language
- **CO2:** Develop efficient code using pointers, arrays and dynamic memory allocation
- CO3: techniques
- CO4: Create user defined data types and functions to solve given problems.
- **CO5:** Design an efficient algorithm for a given problem
- **CO6:** Build efficient code to solve the real world problem
- **CO7:** Elucidate the programming constructs of C during interviews

UNIT 1: 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/ Pseudo code with examples, From algorithms to programs; source code, variables (with

data types) variables and memory, locations, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

UNIT 2: Arrays and Strings

Introduction - One dimensional and two dimensional arrays – Declaration of arrays – Initializing and Accessing array elements – Strings: One dimensional character arrays -Declaration and String Initialization - String Manipulation - Multidimensional Arrays -Arrays of Strings

UNIT 3: Basic Algorithms

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

UNIT4: Function

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion, 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 5: Structure, Pointers & File Handling

Structures, Defining structures and Array of Structures, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling (only if time is available, otherwise should be done as part of the lab)

TEXT BOOKS

(i) Byron Gottfried, Schaum's Outline of Programming with C, Mc Graw-Hill(ii) E. Balaguruswamy, Programming in ANSI C, Tata Mc Graw-Hill

REFERENCE BOOKS

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

LIST OF EXPERIMENTS

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series Tutorial 5: 1D Arrays: searching, sorting: Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures

Tutorial 12: File handling: Lab 12: File operations

MEC19D152	ENCINEEDING DDACTICE	L	Т	Р	С
MECION152	ENGINEERING FRACTICE	3	0	2	3
Pre-requisite:	Nil Course Category: Ba	asic Eng	ineerin	g	
	Course Type: Theory	with P	ractical		

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Lectures & videos:

Detailed contents

(i). Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods

- 2. CNC machining, Additive manufacturing
- 3. Fitting operations & power tools
- 4. Carpentry
- **5.** Plastic moulding, glass cutting
- 6. Metal casting
- 7. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

- 1. Machine shop
- **2.** Fitting shop)
- 3. Carpentry
- 4. Welding shop
- 5. Casting
- 6. Smithy
- 7. Plastic moulding& Glass Cutting

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers

private limited, Mumbai.

(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

(iii)Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I" Pearson Education,2008.

CIV19D101	Introduction to Civil Engineering	L	Т	Р	Credit
	Introduction to Civil Engineering	3	1	0	4
	Course Category: I	Basic	Engi	ineeri	ing
Pre Requisite:	Nil Course Type : Theory	with	Tuto	orial(Γ)

Course Objectives

To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering and to motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness

Course Outcomes

CO1: Assess the utility of different Building materials and Construction methods in civil engineering applications.

CO2: Correlate the interconnection between water, environment and energy engineering. **CO3:** Apply basic surveying principles and assess its relationship with advancement in Transportation system.

CO4: Assess the site investigation methods and bore log.

CO5: Comment on the risk associated with and its impact on engineering structures

		РО												PSO			
CO/PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO1							Μ	L		H		Μ		L	Μ		
CO2							Μ	L	-	H	L	Μ		L	М		
CO3							Μ	L		H		Μ		L	Μ		
CO4							Μ	L	-	H		Μ		L	Μ		
CO5							М	L		H	L	Μ		L	М		

Mapping of Course Outcome(s):

UNIT 1: Introduction to Structural and Construction Engineering

Classical and Modern building material including composites-Types of structures and their fundamental differences-Construction method- Bottom down construction-Lean construction-3D Printing-Automation/Robotic Construction-LEED rating-Smart cities-Software's: STAAD - pro, Ms project, Primavera & BIM

UNIT 2: Introduction to Water, Environment and Energy Engineering's

Hydrological cycle-Water distribution network- Water and Waste water treatment-Energy systems and Transformation-Wind, Solar & Hydro energy- Foot print concept-Green energy - Software: EPANET, GIS

UNIT3: Introduction to Surveying and Transportation Engineering

Fundamentals of Civil Engineering Survey-Modern surveying equipment: Total Station, GPS- Intelligent Transportation system-Urban Transport-Traffic control-Software: MX

UNIT 4: Introduction to Geotechnical Engineering

Soil types and formation-Types of foundation-Tunneling- Site investigation method-Bore hole logs- Off shore structures

UNIT 5: Introduction to Disaster Preparedness and Management

Definition: Disaster, Hazard, Vulnerability, Risk-Natural and manmade disasters-Disaster impacts- Principle of disaster management-Sustainable construction

Tutorials: To be based on field visit/Lab Visit/Videos and Report preparation

Reference Books:

- 1. Shanmugam, G,, and Palanichamy, M.S., Basic Civil and Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi,2015.
- 2. Khanna, K., JustoCEG, Highway Engineering, KhannaPublishers, Roorkee, 2014
- 3. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, New Delhi2015.
- 4. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
- 5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
- 6. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press
- 7. Ristinen, Robert A. Kraushaar, Jack J (2006) Energy and the Environment, 2nd Edition, John Wiley

PROGRAM CORE COURSES

CIV19D251	Engineering Coology	L	Т	Р	С
CIV10K251	Engineering Geology	3	0	1	3.5
Pre-requisit	e: Nil Course	Cate	gory	Prog	gram Core
Course Type	: Theory with practice				

Course Objectives

To teach

- the types and mechanisms of flow in open channel sand
- various components of hydrological cycle, their estimation and application

Course Outcomes

Upon successful completion of this course, student can

CO1: site characterization and how to collect, analyze, and report geologic data using standard sin engineering practice

CO2: explain the geological processes of formation of rocks, the properties of various types of rock minerals for civil engineering application

CO3: describe the mode of origin, forms, characters and classification of igneous, sedimentary and metamorphic rocks

CO4: describe rock mass characterization and the mechanics of planar rock slides and topples.

CO5: explain the recent developments applications of geological Investigation

CO /						I	20						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Η	L										Η	Μ	Μ
CO2	Η	Η	L	Μ									Η	Μ	Μ
CO3	Η	Η	L		L							L	Η	Μ	Μ
CO4	Η	Η	L									L	Η	Μ	Μ
CO5	Η	Η	L						L			L	Η	Μ	Μ

Mapping of Course Outcomes:

UNIT 1: General Geology

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, NIRM Mineralogy-Mineral, Introduction, Physical properties of minerals, Optical properties of minerals, Polarizing microscope, crystallography-Elements of a crystal, symmetry

UNIT2: Petrology

Rock forming processes Igneous petrology- Division of rock on the basis of depth of formation, Chemical and Mineralogical Composition. Texture and its types, Classification of Igneous rocks on the basis of Chemical composition. Basic Igneous rocks Like Gabbro, Dolerite, Basalt, Engineering importance. Sedimentary petrology-mode of formation, Mineralogical Composition, Texture, Structures, Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Limestone, Metamorphic petrology-Factors and kinds of metamorphism, metamorphic grades, Mineralogical composition, structures in metamorphic rocks, Detailed study of Gneiss, Schist, Slate with engineering consideration.

UNIT 3: Physical Geology

Weathering,Factors affecting weathering and product of weatheringEngineering consideration. Concept of Rock Deformation & Tectonics, Dip and Strike, Outcrop and stratification, Study of folds – Classification, Causes Effects of folding and its Civil Engineering consideration. Study of faults – Classification, Causes Effects of folding and its Civil Engineering consideration. Study of joints – Classification, Origin Effects of joints and its Civil Engineering consideration.

UNIT 4: Geological Hazards

Mass movement- Introduction, classification, causes of mass movement, types of mass movement, monitoring and control of mass movement. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: classification of earth quake, Magnitude and intensity of earthquake, recording of an earthquake. Case Study on Earthquake problems in India.

UNIT5: Application of Geological Investigations

Field & laboratory tests on rocks. Required geological consideration for selecting dam and reservoir site, Force acting on a dam, relative suitability of different rocks, silting of reservoirs, Geological problems after Dam Construction

Practice

- 1. Model making for Plate Tectonics
- 2. Model making for Earthquake belts in India
- 3. Sample collection Igneous rocks
- 4. Sample collection Sedimentary rocks
- 5. Sample collection Metamorphic rocks
- 6. Model making for classification off old
- 7. Model making for classification of fault
- 8. Model making for classification of joint

TEXTBOOKS

- 1. Parbinsingh, "Engineering and General Geology" S.K.Kataria& son2016
- 2. Gokhale, K.V.G.K., "Principles of Engineering Geology", B.S. Publications, Hyderabad 2011.
- 3. Kesavulu, C.N., "Textbook of Engineering Geology", Macmillan India Ltd., 2009.
- 4. Singh. P.A., "Text book of Engineering and General Geology", Katson publishing house, Ludhiana2009.
- 5. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi,2012.

REFERENCE BOOKS

- 1. Blyth F.G.H. and De Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
- 2. Bell .F.G., "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.

3. Dobrin, M.B., "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.

CIV18D271	Fluid Machanics	L	Т	Р	Credit
CIV10K2/1	Fluid Mechanics	3	0	2	4
Pre-requisit	e: Nil	C	ours	e Ca	tegory: Program Core
		С	ours	e Ty	pe: Integrated Course

Course Objective

To teach the basics of the fluid mechanics such as fluid and flow properties, fluid behavior at rest and in motion and application of fundamental equations like mass and energy conservation, and fundamentals of pumps and turbines.

Course Outcomes

Upon successful completion of this course, student can

CO1: apply static and kinematic properties of fluids in practical problems

CO2: apply dynamic conditions in fluid flow problems

CO3: analyze flow in pipe systems

- **CO4:** find the relationship among variables, use models, and explain the fundamentals of boundary layer theory applications
- **CO5:** demonstrate turbine and pump usages (no design)

Mapping of Course Outcomes:

CO /]	PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Н	Μ							Μ		Μ	Μ	L	L
CO2	Η	Η	Μ							Μ		Μ	Μ	Μ	Μ
CO3	Η	Η	Μ	L	L					Μ		Μ	Η	Μ	Μ
CO4	Н	Η								Μ		М	Μ	L	L
CO5	Η	Η	Μ							М		Μ	Μ	Μ	L

UNIT 1: Statics and Kinematics

Statics: Properties of fluids- viscosity, elasticity, surface tension, vapour pressure, pressure variation with altitude, absolute, gauge, atmospheric and vacuum pressures, measurement of pressures, hydrostatic forces on plane and curved surfaces, buoyancy and floatation.

Kinematics: Classification of fluid flow, flow visualization, path line, stream line, streak line, stream tube, continuity equation, velocity and acceleration, velocity potential and stream function, equipotential line, flow net.

UNIT 2: Dynamics of Fluid Flow

Euler's equations of motion, Bernoulli's equation, applications of energy principle, flow measurement through pipes (venturimeter, orifice meter, pitot tube), flow through simple orifice and mouthpiece (constant and variable heads), momentum equation, bends and jet propulsion. Introduction to micro-fluidics

UNIT 3: Viscous Flow Through Pipes

Flow in conduits, shear stress distribution across a pipe section, criterion for laminar and turbulent flow in a pipe, Moody's diagram, major and minor losses, pipes in series, parallel, equivalent pipe, fundamentals of distribution network, fundamentals of water hammer.

UNIT4: Dimensional Analysis, Similitude And Boundary Layer Concept

Dimensional homogeneity Rayleigh's method, Buckingham Pi theorem, common dimensional numbers, similitude, model laws – boundary layer–definitions, laminar and turbulent boundary layer on a flat plate, separation of boundary layer, drag force on a flat plate.

UNIT 5: Hydraulic Machines

Turbines: Impact of jet on stationary and moving flat plates and curved plates, layout of hydro- electric power plant, classification of turbines, efficiencies of turbine, working principle of Pelton wheel, Francis turbine, velocity triangle (concept only), draft tube, cavitations, characteristic curves, specific speed, unit quantities.

Pumps: Classification of pumps, working principle of centrifugal pump, velocity triangle (concept only), specific speed, working principle of a reciprocating pump, single and double acting, slip, indicator diagram, air vessels, cavitation, NPSH, pumps in parallel and series.

Laboratory experiments

- 1. Measurement of fluid pressure using manometers
- 2. Determination of Meta centric height
- 3. Determination of co-efficient of discharge for orifice and mouthpiece
- 4. Determination of co-efficient of discharge for orificemeter and venturimeter
- 5. Study of friction losses in pipes
- 6. Study of minor losses in pipes
- 7. Study of impact of jet on flat plate
- 8. Study on performance characteristics of Pelton turbine.
- 9. Study on performance characteristics of Francis turbine.
- 10. Study on performance characteristics of Centrifugal pumps
- 11. Study on performance characteristics of Reciprocating pumps

Textbooks

- 1. Cengel, Y.A. and Cimbala, J.M., Fluid Mechanics: Fundamentals and Applications (SIUnits), 3/e in SI units, McGraw Hill, 2010.
- 2. Ojha, C.S.P., Berndtsson, R., and Chandramouli, P.N., Fluid Mechanics and Machinery, Oxford University Press, 2010.

Reference Books

- 1. Munson, B.R., Young, D.F., Okiishi, T.H., and Huebech, W.W., Fundamentals of Fluid Mechanics, 6/e, Wiley India, 2012.
- 2. Subramanya, K., Fluid Mechanics and Hydraulic Machines, McGraw Hill (India),2011
- 3. White, F.M., Fluid Mechanics, 8/e in SI units, McGraw-Hill, 2017

CIV19D 201	Solid Masharias	L	Т	P	Credit
CIV18R 201	Sond Mechanics	3	0	0	3
Pre-requisite: Nil	Course C	atego	ory: F	rogr	am Core
Course Type : Theory				-	

Course Objective

To teach the basic concept of stress, strain, compound stress and strain, BMD, SFD for determinate structures, flexural and Shear stress and torsion of shafts

Course Outcomes

Upon successful completion of this course, student can

CO1: Determine the strength parameters of the materials

CO2: Solve principal stress and principal plane problems.

CO3: Determine shear force, bending moment of a beam

CO4: Determine the bending stress and shear stress distribution

CO5: Analyze members subjected to torsion

Mapping of Course Outcomes:

CO/									I	? 0				PS	0
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	Η			L							L	Μ	L	L
CO2	Μ	Η			L							L	Μ	Μ	Μ
CO3	Μ	Η			L							L	Η	Μ	Μ
CO4	Μ	Η			L							L	Μ	L	L
CO5	Μ	Η			L							L	Μ	Μ	L

UNIT 1: Stresses and Strains

Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity

- Types of stresses and strains, Hooke's law-stress-strain diagram for mild steel - Working stress

– Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy–Resilience–Gradual, sudden, impact and shock loadings –simple applications.

UNIT 2: Compound Stresses and Strains

Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain.

UNIT3: Bending Moment (BM) and Shear Force (SF) Diagrams

BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT 4: Flexural & Shear Stresses

Theory of simple bending – Assumptions – Derivation of bending equation : M/I=f/y=E/R- Neutral axis Determination of bending stresses Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT5: Torsion, Thin Cylinders and Spheres

Derivation of torsion equation and its assumptions - Applications of the equation of the hollow and solid circular shafts, tensional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close – coiled – helical springs. Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

Textbooks

- 1. Timoshenko, S. and Young, D. H., Elements of Strength of Materials, DVNC, New York, USA.
- 2. Kazmi, S. M. A., Solid Mechanics, Tata McGraw Hill, India.
- 3. Hibbeler, R. C., Mechanics of Materials. 6th ed., Pearson Prentice Hall, 2004

Reference Books:

- 1. Laboratory Manual of Testing Materials William KendrickHall
- 2. Mechanics of Materials Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf TMH 2002.
- 3. Strength of Materials by R. Subramanian, Oxford University Press, NewDelhi.

CIV18D 272	SUDVEVING AND CEOMATICS	L	Т	P	Credit
CIV 10K 272	SURVETING AND GEOMATICS	3	0	2	4
Pre-requisite: 1	Vil Course Ca	tegor	y :Pr	ogra	m Core
	Course Type	e: Inte	egrat	ed Co	ourse

Course objective

To have the ability to apply knowledge of mathematics and engineering to understand the measurement techniques and equipment used in land surveying. To relate the knowledge on Surveying to the new frontiers like Electronic Distance Measurement, Total Station, Global Positioning System, Photogrammetric surveying and Remote Sensing.

Course outcomes

After completion of this course the student will able to

CO 1: Apply the knowledge about the conventional methods of surveying like chain, compass and plane table surveying

CO 2: Demonstrate skills in performing measurement of levelling to find elevation of objects and in preparing various contour maps.

CO 3: Develop skills to carry out elevation and angular measurement using theodolite, triangulation methods and curve setting.

CO 4: Expand the knowledge about the basic principles of Electronic Distance Measurement, Global Positioning System and its applications in the field works.

CO 5: Develop basic skills on Photogrammetric and its application and the principles of remote sensing.

CO /						I	90							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Η				Μ	L		Μ	Μ			Μ	Μ	L
CO2	Η	Η					L		Μ	Μ			Μ	Μ	L
CO3	Η	Η		L		Μ	L		Μ	Н		L	Μ	Μ	L
CO4	Μ	Μ	Μ	L	Μ	L			L	Μ	L	Μ	Μ	L	L
CO5	Μ	М	Μ	L	М	L			L	Μ	L	Μ	Μ	L	L

Mapping of Course Outcomes:

UNIT 1: Introduction to Surveying

Chain survey: Principles, Linear, angular and graphical methods- Survey stations-Survey lines- ranging - booking and area computation .Compass survey: Bearing of survey lines - Prismatic and Surveys Compass -WCB & RB and Fore Bearing and Back Bearing- Local Attraction - Plane table surveying: Concepts, Radiation and Intersection.

UNIT2: Leveling

Principles- booking and reducing levels – differential leveling, reciprocal levelling, profile leveling and cross sectioning- Digital and Auto Level- Errors in leveling. Contouring: Characteristics – methods - uses. Calculation of areas and volumes

UNIT3: Triangulation and Trilateration

Theodolite survey: Instruments- Measurement of horizontal and vertical anglemethods -triangulation- network- Signals- Baseline - selection of baseline- Satellite station - reduction to centre – Inter visibility of height and distances – problems – Trilateration-advantages and disadvantages - Trigonometric leveling – Determination of elevation (single and double plane method) - problems.

Curves :Introduction - Elements of simple and compound curves – Method of setting out simple circular curve– Linear and Angular Method (Rankine's method), - Transition curve and Vertical curve (concepts only).

UNIT4: Modern Field Survey Systems

Principle of Electronic Distance Measurement, Types of EDM instruments, Total Station – Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, Global Positioning Systems (GPS) - Surveying with GPS.

UNIT5: Photogrammetric Surveying and Remote Sensing

Photogrammetric Surveying: Introduction, Basic concepts- geometry of aerial photograph (parallax and relief displacement only) flying height – ground control - aerial triangulation, radial triangulation, Remote Sensing: Introduction – Field data collection through remote sensing - elements of visual image interpretation.

List of Experiments

1. Ranging and chaining a line measurement of area

- 2. Closed compass traversing
- 3. Plane Table surveying Radiation method
- 4. Plane Table surveying Intersection method
- 5. Differential leveling
- 6. Profile and cross section leveling
- 7. Trigonometric leveling Single plane method
- 8. Trigonometric leveling Double plane method
- 9. Setting out simple circular curve
- 10. To plot a small area using measurements taken from Total Station.
- 11. Using G.P.S for calculation of Latitude, Longitude and measurement of area.

Text Books:

- 1. P.C.Punmia, surveying vol.I, Laxmi publications, 2015.
- 2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

Reference Books:

- 1. Madhu, N, Sathiskumar, 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.

CIV10D201	Computer-aided Civil Engineering	L	Т	Р	Credit
CIV10K201	Drawing	0	0	3	2
Pre-requisite: Nil	Course Cat	tegor	y: Pr	ogra	m Core
	Course Type	e: Pra	octica	1	

COURSE OBJECTIVES

- a) Develop parametric design and the conventions of formal engineering drawing
- b) Produce and interpret 2D & 3Ddrawings
- c) Communicate a design idea/concept graphically/visually
- d) Examine a design critically and with understanding of CAD The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- e) Get a detailed study of an engineering artifact

COURSE OUTCOMES

Upon successful completion of this course, student can

CO1: identify the functional requirements

CO2: explain the sketches and working drawings

CO/PO PSO Mapping

	PO1	PO	PO	PO4	PO	PO	PO	PO	PO9	PO1	PO1	PO1	PSO	PSO2	PSO
		2	3		5	6	7	8		0	1	2	1		3
CO1	Η			Η						Μ				М	Μ
CO2	Η			Μ				Н			Μ		Н		Μ

UNIT1: Introduction

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co-ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards

UNIT2: Symbols and Sign Conventions

Materials, Architectural, Structural, Electrical and Plumbing symbols - Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

UNIT3: Masonry Bonds

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT4: Building Drawing

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing - Site plan, floor plan, elevation and section drawing of small residential buildings Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity

UNIT5: Pictorial View

Principles of isometrics and perspective drawing - Perspective view of building - Fundamentals of Building Information Modelling (BIM)

Total 15 sessions

It may be advisable to conduct Theory sessions along with Lab demonstrations.

List of Drawing Experiments:

- 1. Buildings with load bearing walls including details of doors and windows.
- 2. Taking standard drawings of a typical two storied building including allMEP, joinery, rebar's, finishing and other details and writing documents
- 3. Description of the Facility in about 500 -700words
- 4. RCC framed structures
- 5. Reinforcement drawings for typical slabs, beams, columns and spread footings
- 6. Industrial buildings North light roof structures -Trusses
- 7. Perspective view of one and two storey buildings

TEXTBOOKS

- 1. Balagopal& Prabhu, T.S., Building drawing & detailing, Spades Publishers, Calicut,2000.
- 2. Verma, B.P., Civil Engg. Drawing & House Planning, Khanna publishers, NewDelhi,2000.

CIV18D273		Strongth of Matorials	L	Τ	Р	Credit
CIV10K275		Strength of Waterlais	3	0	2	4
Pre-requisite	:CIV18R201	Course Categor	y: Pr	ogran	n Cor	e
		Course Type : I	ntegr	ated	Cours	se

Course Objectives

To teach, how to analyze the continuous beam and how to evaluate deflection of beam. And how to analyze the different end conditions of columns. Make students to know the features of unsymmetrical bending and different types of thin and thick cylinders and spheres.

Course Outcomes

Upon successful completion of this course, student can

CO1: Analyze continuous beams, fixed and propped cantilever beams.

CO2: Evaluate the deflection in beams by various methods

- **CO3:** Evaluate the behavior of columns and struts under various combined axial loading and bending
- CO4: Analyze the behavior of cylinders and shells subjected to internal pressure

CO5: Analyze the unsymmetrical bending problems

Mapping of Course Outcomes:

CO /]	PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Η	Μ		Μ								Η		Μ
CO2	Μ	Η	Μ		Μ								Η		Μ
CO3	Μ	Η	Μ		Μ								Η		Μ
CO4	Μ	Η	Η		Μ								Η		Μ
CO5	Η	Μ	Μ		Μ								Η		Μ

UNIT1: Indeterminate Beams

Static and Kinematic indeterminacy - Propped cantilever and fixed beams - Theorem of three moments – Analysis of continuous beams – Shear force and bending moment diagrams for continuous beams.

UNIT2: Deflection of Beams

Governing differential equation – Slope and deflection of beams – Macaulay's method – Moment area method – Conjugate beam method.

UNIT3: Columns and Struts

Columns – Behavior of axially loaded short, medium and long column members – Buckling load - Euler's theory – Different end conditions – Empirical formulae – Rankine's formula – Straight line formula – Secant formula for columns subjected to eccentric loading.

UNIT4: Cylinders and Shells

Stresses and deformations in thin cylinders and spherical shells due to internal pressure – Thick cylinders – Lame's equation – Hoop stress and radial stress distribution – Compound cylinders – Shrink fit.

UNIT5: Unsymmetrical Bending

Moment of inertia – Product of inertia – Principal axes –Principal moments of inertia of symmetrical and unsymmetrical sections – Symmetrical and unsymmetrical bending – Bending stresses in beams subjected to unsymmetrical loading – Shear centre.

LISTOFEXPERIMENTS

- 1. Tension test on mild steel rod
- 2. Compression test on wood
- 3. Double shear test on metal
- 4. Torsion test on mild steel rod
- 5. Impact test on metal specimen (Izod and Charpy)
- 6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
- 7. Deflection test on metal beam
- 8. Compression test on helical spring
- 9. Deflection test on carriage spring

Textbooks

- 1. Rajput R.K., Strength of Materials, S. Chand, 2014.
- 2. Bansal, B.C., Strength of Materials, Laxmi Publications, 2012.

Reference Books

- 1. Sadhu Singh, Strength of Materials, Khanna Publishers, 2012.
- 2. Timoshenko, S.P. and Gere, J.M. Mechanics of Materials, Tata McGraw Hill,2012

CIV18R252	Channel Hydraulics and Hydrology	L	Т	Р	Credit
		3	0	1	3.5
Pre-requisite	:CIV18R271 Course Categ	ory:	Prog	ram (Core
	Course Type :Th	neory	with	prac	tice

Course Objectives

To teach

- the types and mechanisms of flow in open channel sand
- various components of hydrological cycle, their estimation and application

Course Outcomes

Upon successful completion of this course, student can

- **CO1:** apply the specific energy concept in solving channel transition problems and apply the design principles in uniform flow conditions
- **CO2:** analyze the characteristics of gradually and rapidly varied flow

CO3: calculate the various components of hydrologic cycle

CO4: apply the principle of hydrograph to estimate flood characteristics

CO5: calculate the discharge and drawdown in the wells

CO /		РО										PSO			
РО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Η	L										Η	Μ	Μ
CO2	Η	Η	L	Μ									Η	Μ	Μ
CO3	Η	Η	L		L							L	Μ	Η	Μ
CO4	Η	Η	L									L	Η	Η	Η
CO5	Η	Η	L						L			L	Μ	Μ	Μ

Mapping of Course Outcomes:

UNIT1: Critical and Uniform Flow in Channels

Critical flow: Types and regimes off low, velocity distribution, specific energy concept, critical flow computations, application, specific force Uniform flow: Manning's and Chezy's equation, computation of normal depths, compound channels, and most economical section.

UNIT2: Varied Flow in Channels

Gradually Varied Flow: Dynamic equation for GVF, classification off low profiles, computation of GVF profiles, direct step method - standard step method (only concept).Rapidly Varied Flow: Hydraulic jumps, Balengar momentum equation, classification of jumps, introduction to surges.

UNIT3: Precipitation and Abstractions

Hydrological cycle, precipitation, recording and non-recording rain gauges, rain gauge network, estimation of missing data, consistency analysis, mass curve, hyetograph, mean precipitation over an area, depth – area – duration relationships, frequency analysis, intensity – duration – frequency relationship, probable maximum precipitation, evaporation, methods of evaporation estimation, evapo-transpiration, infiltration, Horton's equation, infiltration indices

UNIT4: Run off Hydrograph

Factors affecting shape of hydrograph, components of direct runoff hydrograph, base flow separation, effective rainfall, unit hydrograph, use and limitation, derivation of unit hydrograph of different duration, S-curve hydrograph

UNIT5: Ground Water Hydrology

Ground water and well hydrology – forms of subsurface water, saturated formation, aquifer properties, geo logic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

Practice

- 1. Study of hydraulic jump
- 2. Study of Venturiflume
- 3. Hydrological data analysis
- 4. Study of Horton's equation

Textbooks

1. Subramanya,K.,EngineeringHydrology,4/e, Mc Graw Hill(India),2013.

2. Subramanya, K., Flowin Open Channels, 4/e, Mc Graw Hill (India), 2015.

Reference Books

- 1. Chaudhry, M.H., Open-Channel Flow, 2/e, Springer, 2008.
- 2. Chow V.T., Maidment, D.R., Mays, L.W., Applied Hydrology, McGraw Hill, 1998.
- 3. Chow, V.T., Open Channel Hydraulics, McGraw Hill, 1988.

CIV18D274	Costochnical Engineering	L	Т	Р	Credit						
CIV10K2/4	Geotechnical Engineering	3	0	2	4						
Pre-requisite:	Nil Course Ca	Course Category: Program Core									
	ted C	ourse									

Course Objective

Understand the various phase diagrams and derive various phase relationships of the soil, classify any soils based on their particle size distribution and index properties, Understand the physical significance of effective stress and its relation with pore pressure, Plot isobars due various loading conditions, Differentiate various modes of slope failure, Prepare a soil investigation report.

Course outcomes

Upon successful completion of this course, student can

CO1: Classify the different types of soil based on their formation.

CO2: Analyze the effective permeability and effective stress of soil.

CO3: Analyze the vertical stress in soil mass due to various loading conditions

CO4: Evaluate the stiffness of soil using shear strength parameters.

CO5: Explain various site investigation techniques and their in-situ applications

Mapping of Course Outcomes:

CO /		РО										PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Μ		Η						М		М	Η	Μ	Μ
CO2	Η	Η		Μ							М	М	Η	Μ	Μ
CO3	Η	Μ		Η							Н		Η	Μ	Μ
CO4	Н	Η		Η							Μ		Η	Μ	Μ
CO5			Н				Μ						Η	Μ	Μ

UNIT1: Introduction & Plasticity Characteristics of Soil

Types of soils, their formation and deposition, Basic Definitions and Relationships – Soil as three - phase system in terms of weight, volume, voids ratio, and porosity -Plasticity of soil, consistency limits- liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Use of consistency limits - Classification of Soils.

Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

UNIT2: Permeability & Effective Stress Principle of Soil

arcy's law, validity of Darcy's law. Determination of coefficient of permeability. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets. Introduction, effective stress principle, nature of effective stress, effect of water table -Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition

UNIT3: Compaction & Stresses in Soils

troduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction infield, compaction specifications and field control. Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart.

UNIT4: Consolidation and Shear Strength of Soil

Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test

UNIT5: Stability of Slopes & Soil Exploration

Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.Introduction, methods of site exploration and soil investigation, methods of boring, soil samples, sampling procedures, trail pits, borings, penetrometer tests, analysis of bore hole logs, geophysical and advance soil exploration methods.

Practical Work: List of tests on-

- 1. Field Density using Core Cutter method.
- 2. Field Density using Sand replacement method.
- 3. Natural moisture content using Oven Drying method.
- 4. Field identification of Fine Grained soils.
- 5. Specific gravity of Soils.
- 6. Grain size distribution by Sieve Analysis.
- 7. Grain size distribution by Hydrometer Analysis.
- 8. Consistency limits by Liquid limit
- 9. Consistency limits by Plastic limit
- 10. Consistency limits by Shrinkage limit.
- 11. Permeability test using Constant-head test method.
- 12. Permeability test using Falling-head method.

- 13. Compaction test: Standard Proctor test.
- 14. Compaction test: Modified Proctor test.
- 15. Relative density.
- 16. Consolidation Test.
- 17. Tri axial Test(UU)
- 18. Vane shear test
- 19. Direct Shear Test
- 20. Unconfined Compression Strength Test.

Textbooks

- 1. Soil Mechanics by Craig R.F., Chapman & Hall
- 2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
- 3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
- 4. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
- 5. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning

Reference Books

- 1. David F. Mc CarthyEssentials of Soil Mechanics and Foundations: Basic Geotechnics
- 2. Karl Terzaghi, Ralph B. Peck, and Gholamrez a Mesri.Soil Mechanics in Engineering Practice

CIV19D201	Structural Analysis	L	Т	Р	Credit						
	Structural Analysis	3	0	0	3						
Pre-requisite:CIV1	3R 273 Course	Course Category: Program Core									
	Course Type	: Theo	ory								

Course objectives:

- To introduce the fundamentals of the analysis of statically determinate and indeterminate structures
- To understand the concept of analysis of indeterminate structures by various classical methods
- To analysis the different types of arches.

Course outcomes:

Upon successful completion of this course, student can

CO1: Analyze the statically determinate structures by using method of Joints and method of sections.

CO2: Analyze the determinate structure by using virtual work method and strain energy method

CO3: Analyze the continuous beams and rigid frames (indeterminate structures) by slope deflection method

CO4: Analyze the continuous beams and rigid frames (indeterminate structures) by moment distribution method

CO5: Analyze the different types of arches

CO /	PO											PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	Μ		Η						М		М	Η	Μ	Μ
CO2	Н	Η		М							М	М	Η	Μ	Μ
CO3	Н	М		Η							Η		Η	Μ	Μ
CO4	Н	Η		Η							М		Η	Μ	Μ
CO5			Н				Μ						Η	Μ	Μ

Mapping of Course Outcomes:

UNIT 1: ANALYSIS OF STATICALLY DETERMINATE STRUCTURES:

Equilibrium, Stability and Determinacy of structures - Concept of Free Body Diagram - Analysis of statically determinate structures, Plane truss: method of joints and method of sections

UNIT 2: VIRTUAL WORK AND STRAIN ENERGY:

Support reactions - Internal forces in beams - Axial forces in trusses - Internal forces in frames application of method of virtual work (unit load method) and strain energy method for determination of deflections of statically determinate beams -pin-joined trusses and rigid frames -temperature effects - Lack of fit

UNIT 3: SLOPE DEFLECTION METHOD:

Application of slope deflection method - Analysis of continuous beams with and without settlement - Rigid jointed plane frame with and without sway

UNIT 4: MOMENT DISTRIBUTION METHOD:

Application of moment distribution methods - Analysis of continuous beams with and without settlement – Rigid jointed plane frames with and without sway

UNIT 5: ARCHES:

Types of Arches - Analysis of three hinged and two hinged arches – Parabolic and circular arches –Three and two hinged arches for calculating horizontal thrust, radial shear and BM at any section

Text book, title, author, and year:

- 1. Vaidyanadhan, R and Perumal, P, -"Structural Analysis Vol 1&Vol 2 Laxmi Publications Pvt. Ltd, New Delhi, 2015.
- 2. BhavaiKatti, S.S, "Structural Analysis –Vol. 1 & Vol. 2", Vikas Publishing Pvt Ltd., New Delhi, 2015
- 3. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications Pvt. Ltd., New Delhi, 2016
- 4. Reddy. C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

CIV19D202	Construction Engineering and	L	Т	Р	С					
CIV 10K302	Management	3	0	0	3					
Pre-requisite: Ni	Course Category: Program Core									
Course Type: Theory										

Course Objectives

This course elaborates the basic principles of planning, scheduling and techniques used in the construction industry. It focuses on understanding the project cost management, thus selecting the proper equipment for specific construction tasks. It also highlights the needs of project scheduling and techniques involved in resource leveling.

Course Outcomes

Upon successful completion of this course, student can

- **CO1**: An idea of how structures are built and projects are developed on the field an understanding of modern construction practices
- **CO2**: Be able to apply theoretical and practical aspects of equipment selections to achieve project goals.
- **CO3**: Be capable of apply knowledge for planning in Construction.
- **CO4**: Be capable of apply knowledge for scheduling, executing and controlling of construction projects.

CO5: A basic ability to plan, control and monitor construction projects with respect to time and cost

CO /		РО										PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		Η				Η			L			М	Η	Μ	Μ
CO2			Μ				L					Η	Η	Μ	Μ
CO3	L				Н				Μ				Η	Μ	Μ
CO4			L					Μ				H	Η	Μ	Μ
CO5	Η				М						Η		Η	Μ	Μ

Mapping of Course Outcomes:

UNIT1: Construction techniques and Construction methods

Unique features of construction, construction projects-types and features, phases of a project; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works); Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

UNIT2: Construction Equipments and Contracts Management

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earth moving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities; Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties
of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination - Changes & variations, Dispute Resolution methods

UNIT3: Construction Project Planning

Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT-Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

UNIT4: Resource Scheduling and Levelling

Planning and organizing construction site and resources: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Histograms and S- Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling - Common Good Practices in Construction

UNIT5: Project Monitoring and Construction Cost

Supervision, record keeping, periodic progress reports, periodical progress meetings - Updating of plans: purpose, frequency and methods of updating - Common causes of time and cost overruns and corrective measures - Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Funds: cash flow, sources of funds; Classification of costs, time-cost trade-off in construction projects, compression and decompression.

Tutorials

- 1. Develop a bar chart for the construction of building, including finishing
- 2. Develop a CPM chart
- 3. Develop a Gantt Chart for the construction of multi storied building
- 4. Develop the histograms
- 5. The advantages of Lean Construction method over conventional project management systems.
- 6. Group activity
- 7. Refer to a standard schedule of rates of any PWD (available on the Net), develop the approximate cost of any civil structure.
- 8. Refer to a Standard Schedule of Rates of any PWD (available on the Net), develop the approximate cost of any structure.

Textbooks

1. Chudley, R., Construction Technology, ELBS Publishers, 2007.

2. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson

Education India,2015

- 3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
- 4. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006

Reference books

- 1. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
- 2. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.
- 3. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.

CIV10D251	Transportation Engineering	L	Т	Р	Credit
	Transportation Engineering	3	0	0	3
Pre-requisite: Nil	Course Categ	ory: I	Progra	nm Co	ore
	Course Type:	Theo	ory wi	th Pra	actical

Course Objectives

This course applies scientific and technical knowledge to provide economical and efficient transportation service that meets societal needs while maintaining compatibility with environmental, energy, and safety goals. Analyze complex Transportation Engineering problems critically; apply independent judgment for synthesizing information. Transportation serves society's basic needs for personal travel and transfer of goods. The program provides the student with skills in planning, construction, design, operation, and maintenance of transportation systems and facilities. The course provides both a broad awareness of transportation concepts and an understanding of scientific and technical knowledge to address transportation problems.

Course Outcomes

- Upon successful completion of this course, student can
- **CO1**: Carry out surveys involved in planning and highway alignment.
- **CO2**: Design the geometric elements of highways and expressways.
- **CO3:** Carry out traffic studies and implement traffic regulation and control measures and intersection design.
- **CO4:** Characterize pavement materials and analyze its properties.
- **CO5**: Design flexible and rigid pavements as per IRC.

CO /	PO												PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1		Η				Η			L			М	Η	М	Μ	
CO2			Μ				L					Н	Η	Μ	Μ	
CO3	L				Н				Μ				Η	М	Μ	
CO4			L					Μ				Η	Η	Μ	Μ	
CO5	Н				М						Η		Η	Μ	Μ	

Mapping of Course Outcomes:

UNIT 1: Highway development and planning: Classification of roads, road development in India and Current road projects in India; highway alignment and project preparation.

UNIT 2: Geometric design of highways: Introduction; highway cross section elements; of sight distance, design horizontal alignment; design of vertical alignment; design intersections, problems

UNIT 3: Traffic engineering & control: Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

UNIT 4: Pavement materials: Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems

UNIT 5: Design of pavements: Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems, construction practice for WBM road, bituminous road and cement concrete road.

Textbooks

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017

Reference books

- 1. Kadiyalai, L.R., 'Traffic Engineering and Transport Planning', Khanna Publishers.
- 2. Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning,
- 3. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
- 4. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.
- 5. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.

CIV19D271	Environmental Engineering	L	Т	Р	Credit
	Environmentai Engineering	3	0	2	4
Pre-requisite: Nil	Course Ca	tegor	y: Pr	ogran	n Core
	Course T	ype: I	Integr	ated (Course

This course mainly intended to make the students conversant with principles of water supply, treatment and distribution and also to familiarize about the importance and methods of sewage treatment and solid waste with special attention to design and application.

Course Outcomes

Upon successful completion of this course, student can

CO1: Evaluate the characteristics and efficiency of water treatment plant with appropriate design principles.

CO2 :Evaluate the characteristics and efficiency of wastewater treatment plant appropriate design principles.

CO3: Describe the suitability of environment in terms of air and noise quality

CO4 :.Describe the engineered system of solid waste management.

CO5 :Explain Plumbing systems, fixtures, valves used for carrying water and sewage

CO /	PO	0											PSO		
РО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	М	Μ	L									L	Μ	
CO2	L	М	Μ	L									L	Μ	
CO3	L						L	Μ					L	Μ	
CO4	L						L						L	Μ	
CO5	L	М											L	Μ	

Mapping of Course Outcomes:

UNIT1:Water&Water Treatment:

Water: -Sources of Water and quality issues, Water quality requirement for different beneficial uses, Water quality standards, Need for planned water supply schemes, Water demand, Components of water supply system; Transmission of water, Distribution system, Service reservoirs and design.Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection,advanced treatments like adsorption, ion exchange, membrane processes.

UNIT2:Sewage

Storm Water- Quantification and design of Storm water, Quantity of Sewage, Sewage flow variations, Conveyance of sewage- Shapes of Sewers, Sewer appurtenances, Sewage pumping, Design of sewers, Characteristics of sewage, Pollution due to improper disposal of sewage, effluent discharge standards, National River cleaning plans.

Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage, sludge disposal.

UNIT3:Air& Noise Pollution

Types of pollutants, their sources and impacts, Air pollution meteorology, Air quality standards, Control measures for Air pollutionNoise-Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

UNIT 4: Solid waste management

Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Generation, Collection, transport, treatment and disposal of MSW, Engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

UNIT5: Building Plumbing

Introduction to various types of home plumbing systems for water supply and wastewater disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.Government authorities and their roles in water supply, sewage disposal, Solid waste management and monitoring/control of environmental pollution.

Practical Work: List of Experiments

1. Analysis of solids content of water: Turbidity, Total, Dissolved, Suspended, Settleable solids.

- 2. Alkalinity and acidity: pH, Total hardness, Alkalinity.
- 3. Determination of Ions: Chlorides, Sulphates
- 4. Optimum coagulant dose
- 5. Chemical Oxygen Demand (COD)
- 6. Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD)
- 7. Residual chlorine
- 8. Ambient Air quality monitoring (SPM)
- 9. Characteristics of Solid waste (Moisture content, Particle size, Density, Proximate Analysis)

Text/References

- 1. Gilbert Masters, Prentice Hall, New Jersey. Introduction to Environmental Engineering and Science by
- 2. P. AarneVesilind, Susan M. Morgan Introduction to Environmental Engineering by, Thompson /Brooks/Cole: Second Edition 2008.
- 3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw -Hill International Editions, New York 1985.
- Eddy, Wastewater engineering, 4. Metcalf and Treatment and Reuse, Tata McGraw-Hill, New Delhi, 5th edition2013.
- 5. Manual on water supply and Treatment CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2013.
- 6. Manual on Sewerage and Sewage Treatment CPHEEO, Ministry of Urban Development, GoI, New Delhi, 2013.

CIV19D202		DESIGN OF STRUCTURES	L	Т	Р	Credit
CI V 10K303		DESIGN OF STRUCTURES	3	0	0	3
Pre-requisite:CIV18	SR 273	Course C	Catego	ory: Pi	rograi	m Core
		Course Type:	: Theo	ory		

Course Objective(s):

To introduce the students to limit state design of structural steel and concrete members subjected to compressive, tensile and bending loads, including connections.

Course Outcome(s):

CO1: Analyze the design philosophies of Reinforced concrete and Steel structures

CO2: Analyze the behavior of reinforced concrete members in bond, anchorage, shear and torsion

- CO3: Analyze the flexural capacity of steel and concrete members and design suitable cross section for beams
- CO4: Analyze the failure of a joint under tension and design suitable connections for a given joint against tension.

CO5: Design suitable cross section for compression and Tension steel members

Mapping of Course Outcome(s):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Н	Μ										Н
CO2	Н	Н	Н			Μ				L		Н
CO3	Н	Н	Н	Μ		Μ				L		М
CO4	Н	Н	Μ	Н		Μ				L		Н
CO5	Н	Н	Μ	Н		Μ				L		L

UNIT1: Basics of Structural Design

Working stress, Limit state and ultimate load design concepts; Classification of structures – function, material and shape-different structural systems – Basic structural requirements – stability, strength and stiffness

UNIT2: Design For Bond, Anchorage, Shear and Torsion of concrete members

Behaviour of reinforced concrete members in bond and anchorage,-Development length - Design recommendations - Behaviour of reinforced concrete beams in shear and torsion - Design for combined bending, shear and torsion. Limit state of serviceability – deflection, crack width, corrosion.

UNIT3: Design of Flexural Members

Concrete Members: Design of beams, slabs, columns- Analysis of beam sections at transfer and service loads Steel Members: Design of Steel beams - Plastic analysis of beams and frames

UNIT4: Design of Connections of Steel members

Types of connections – Welded connections – Types of Joints and Welds – Connection Design – Concentric Connection – Eccentric Connections – Truss connections – Bolted connections – Force transfer mechanism – Failure mechanism – Analysis of bolt groups – Column base – Beam column connections – plate girders and trusses connection

UNIT5: Design of Tension and compression steel Members

Tension members: Design of a Tension member – for yielding, net section rupture – Blockshear–.Compression members: Elastic Buckling – Strength Curves – Concept of Effective Length – Design Strength – Types of Sections – Design Criteria – Loced and Battened Columns – Column Bases.

Text Book(s):

Subramanian. N., Design of Steel Structures, Oxford University Press, New Delhi, 2016.
Ramachandra, Design of steel structures, Vol. 1, Standard Book House, New Delhi, 2012.

3. Punmia, B.C., Ashok Kumar Jain and Arunkumar Jain, Comprehensive Design of Steel Structures, Laxmi Publications, New Delhi,2nd Edition, 2012.

4.Krishna Raju, N., Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International Publishers, New Delhi, 201

Reference(s):

1. Negi, L S., Design of Steel structures, Tata McGraw Hill, New Delhi, 2015.

2. Ragupathy, M., Design of Steel Structures, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1996.

3. Subramanian, Reinforced Concrete Design, Oxford Publishing Company, 2015.

4.Gambir, M.L. Fundamentals of Reinforced Concrete Design

5..Varghese, P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd, New Delhi,2002.

CIV18D272	Estimating and Costing	L	Т	Р	Credit
CIVIONJ/2	Estimating and Costing	3	0	2	4
Pre-requisite:CIV1	8R303 Course Category: Program C	Core			
Course Type: Integ	ated Course				

Course Objectives

This course mainly intended to know the importance of preparing the types of estimates under different conditions. Also to know about the rate analysis and bill preparations.

Course Outcomes

Upon successful completion of this course, student can

CO1:To estimate the quantities required for building works using the drawings.

CO2:To carry out the analysis of rates.

CO3:To prepare the cost estimate for various buildings

CO4:To prepare the estimate of civil engineering structures other than buildings

CO5:To prepare the report on the basis of specifications and valuation of the existing buildings

Mapping of Course Outcomes:

CO /	PO												PSO		
РО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		Н				Н			L			Μ	Η	Μ	Μ
CO2			Μ				L					Н	Η	Μ	Μ
CO3	L				Н				Μ				Η	Μ	Μ
CO4			L					Μ				Н	Η	Μ	Μ
CO5	Η				Μ						Η		Η	Μ	Μ

UNIT1:Procedure Of Estimating Quantities

Introduction – Estimate – Types of Estimates – Units of measurements – Methods of building estimate – calculation of quantities of earth work, stone masonry, brick masonry, plastering, cement concrete, R.C.C, PCC Doors, Windows, Flooring, White Washing, colour washing and painting Nourishing for load bearing structures and framed structures.

UNIT2:Rate Analysis

Data – Types of Data – Scheduled of rates – lead statement – Theoretical materials – Requirement calculations - Analysis of Rates for cement concrete, R.C.C., brick masonry, Stone masonry, Hollow block masonry, Plastering, Painting, Flooring, Road works, Sanitary Works, Water supply works and Electrical works.

UNIT3:Cost Estimate of Buildings

Estimation of the cost of residential buildings by load bearing structures and framed structures - Estimation of Roofs – R.C.C. slab roof, GI sheet roof, Tiled Roof, Roof Truss. Estimation of R.C.C. works – Beam, T-beam and Slab, Column, Foundation, Stair case, Retaining wall etc.

UNIT4:Estimate of Other Structures

Estimation Of Roads – Earth Work, Pitching Of Slopes, Hill Roads - Estimation Of R.C.C. Slab Culvert, Pier, Pipe Culvert, R.C.C. T-Beam Bridge - Estimation Of Water Supply And Sanitary Works Like Septic Tank, Soak Pit, Manhole, Sewer line

UNIT5:Specifications and Valuation

Specifications – Objectives – Types Of Specifications – Principles Of Specification - Writing – Typical Specifications – Tenders – E-Tendering, Contracts – Types Of Contracts – Arbitration And Legal Requirements - Valuation – Market Value – Book Value – Scrap Value – Salvage Value – Annuity – Capitalized Values – Sinking Fund – Depreciation – Valuation Of A Building – Rent Fixation – Mortgage – Lease – Cash Flow And Cost Control.

Experiment: Detailed Estimation of a multi storied building (case study)Experiment: Preparation of Rate analysisExperiment: Case study on cost of an existing buildingExperiment: Case Study On Valuation Of A Existing Project

Text book, title, author, and year:

- 1. Dutta, B.N., Estimating And Costing, S Dutta and Co., Lucknow 2016.
- 2. Rangawala, S.C., Estimating And Costing, Charotar Anand Publications, 2006.
- **3.** Kohli, D.D.And Kohli R.C., A Text Book On Estimating, Costing And Accounts, S.Chand And Co, New Delhi, 2004

PROFESSIONAL ELECTIVES

STRUCTURAL ENGINEERINGSTREAM

CIV19D252	CONCRETE ΤΕCHNOLOCY	L	Т	Р	Credit
CIV10K352	CONCRETE TECHNOLOGI	3	0	0	3
Pre-requisite: NII	Course Category: Pro	ofessi	onal E	Electiv	ve
	Course Type : Theory	with	Pract	ical	

COURSE OUTCOMES:

CO1. Identify the materials used to make concrete; including their sources, production and properties

CO2. Describe and carry out tests relevant to the use of fresh and hardened concrete

CO3. To design concrete mixtures with and without admixtures

CO4. Classify the different types of concrete based on their applications

CO5. To identify the various concreting methods to place the concrete on site

COURSE OUTCOMES VS PROGRAM OUTCOMES MAPPING:

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					М	М	Н					
CO2	М	М	Н	М	М							
CO3	Μ	М	М	Н			М					М
CO4			М			М						М
C05	M		Μ		Μ				Μ		Μ	

UNIT:1 CONCRETE CONSTITUENTS

Aggregates classifications, IS Specifications, properties, grading, methods of combining aggregates, specified gradings, testing of aggregates, fibers – Cement - grade of cement, chemical composition, testing of cement, hydration of cement, structure of hydrated cements, special cements – water - chemical admixtures, mineral admixtures.

UNIT: 2PROPERTIES OF CONCRETE

Properties of fresh and hardened concrete – strength, elastic properties, creep and shrinkage, variability of concrete strength quality control (transferred from Mix Design) – permeability, volume changes, thermal properties, fire resistance, sulphate attack – durability of concrete in sea water –action of sewage – resistance to freezing and thawing – corrosion mechanism – effects of cover thickness – cracking – various causes and effects.

UNIT: 3 MIX DESIGN

Principles of concrete mix design, methods of concrete mix design - testing of concrete – High Strength Concrete Mix Design – Super Plasticizers - Principles involved for high performance concrete with fly ash or GGBS replacements.

UNIT: 4 SPECIAL CONCRETES

Light weight concrete, fiber reinforced concrete, polymer concrete, super plasticised concrete - epoxy resins and screeds for rehabilitation – properties and applications – high performance concrete – Ready mix Concrete

UNIT: 5 CONCRETING METHODS

Process of manufacturing of concrete - methods of transportation, placing and curing – extreme weather concreting - special concreting methods - vacuum dewatering - under water technology - special form work

TEXT BOOK

1. Shetty, M.S., Concrete Technology, S. Chand & Company Ltd., Delhi, 2000.

2. Gambhir. M.L.Reinforced Concrete Structures, Prentice Hall India, 2009.

REFERENCES

1.Neville, A.M., Properties of Concrete, Pitman publishing limited, London.1999.

CIV18R353	ADVANCED STR	UCTURAL ANALYSIS	L	Τ	P	Credit
			3	1	0	4
Pre-requisite:CIV	/18R301	Course Category: Pro	fessio	onal E	Electiv	ve .
Course Type: The	ory with Practical					

Course Objective(s):

To introduce the students to advanced methods of analysis like matrix methods, Plastic analysis and FE method and also analysis of space structures; To know the concept and analysis of suspension cable with stiffening girders.

Course Outcome(s):

CO1: Analyse the continuous beams and frames by using kinematic method of plastic analysis **CO2:** Calculate the member forces in space frames by tension coefficient method and analyse the suspension bridge with stiffening girders

CO3: Analyse the indeterminate structures using flexibility matrix method

CO4: Analyse the indeterminate structures using stiffness matrix method

CO5: Explain the basic concepts of finite element method

CO/PO						PC)						PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н	Μ				Η								Η	
CO2	М	Η				Η								Μ	Η
CO3	Н			Μ		Η									М
CO4	Н	Η		Μ		Η								Η	
CO5	Η			Μ		Μ									Μ

Mapping of Course Outcomes:

UNIT1: Plastic Analysis

Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems

UNIT2: Space and Cable Structures

Analysis of space trusses using method of tension coefficients – Suspension cables over pulley and saddle arrangements – Cables with two and three hinged stiffening girders.

UNIT3: Flexibility Method

Equilibrium and compatibility – Determinate vs Indeterminate structures – Indeterminacy – Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT4: Stiffness Method

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames.

UNIT5:Finite Element Method

Introduction – Discretization of a structure – Displacement functions – Truss element – Beam element - variation formation – Plane stress and plane strain Triangular elements

Text Book(s):

- 1. Coates R.C, Coutie M.G. and Kong F.K., Structural Analysis, ELBS and Nelson, 2010
- 2. L.S. Negi & R.S. Jangid, Structural Analysis, Tata McGraw-Hill Publications, New Delhi,2003

Reference(s):

- 1. Ghali.A, Nebille, A.M. & Brown, T.G., Structural Analysis: A unified classical and Matrix approach , Spon Press, London and New York, 5th Edition,2003.
- 2. Vazirani V.N, &Ratwani, M.M., Analysis of Structures, Khanna Publishers, Delhi, 2000
- 3. Pandit, Structural Analysis A Matrix Approach , Tata McGraw Hill, New Delhi, 2006

CI1/10D 401	DESIGN OF MASONRY AND TIMBER	L	Т	Р	Credit
CIV18R401	STRUCTURES	3	0	0	3
Pre-requisite:	CIV18R303 Course Category	r: Pro	ofessi	onal l	Elective
	Course Type: Theory	у			

Course Objective(s):

To know the concepts of masonry and timber structures and its load distribution elements: To understand the stress strain relationship of aluminium structures.

Course Outcome(s) :

CO1: Able to design the walls and columns with and without eccentricity

CO2: Apply the concept of stability of masonry dams and retaining walls

CO3: Evaluate in the basic concepts of limit state design of masonry walls and columns.

CO4: Design of timber structures

CO5: Evaluate the procedures for the connections in Aluminum structures

Mapping of Course Outcomes:

CO/							PO							PSC)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L		Η						Μ	Н	М	L		Η	
CO2			Μ	Н					Μ	М				Μ	Η
CO3	L			Η			L			Μ	М				Μ
CO4	L		Η						Η	Μ				Η	
CO5	L			Μ						М	Η				Μ

UNIT1: Masonry Walls and Columns

Axially loaded square and rectangular columns with uniaxial eccentricity – Solid walls – Load bearing walls – axially loaded – eccentrically loaded walls with openings – Non load bearing walls

UNIT2: Laterally Loaded Masonry Structures

Structures and loads – stability of masonry – middle third rule – Masonry dams – Trapezoidal dams – Retaining walls.

UNIT3: Load Distribution Elements

Bed blocks – spread footings for walls and columns – area based on safe bearing capacity. Design of Reinforced Masonry Introduction – basic concepts – limit state design of reinforced brick masonry – lintels – axially loaded columns – Design of cavity walls.

UNIT4: Timber Structures

Factors affecting the strength – permissible stresses – Design for bending, shear and bearing - Flitched beams – solid and built up columns – combined bending and direct stress – application to formwork.

UNIT5: Aluminum Structures

Introduction, Stress-Strain Relationship - Permissible Stresses - Tension and Compression Members, Laced and Battened Columns, Beams, Riveted and Bolted Connections

Text Book(s):

1. Arya A.S., Structural Design in Steel, Masonry and Timber, Nemchand and Bros., Roorkee,2007.

Reference Book(s):

1. Dayarathnam P., Bricks and Reinforced Brick Structures, Oxford & IBH Publishing Co., New Delhi,2000.

CIV18D402	EARTHQUAKE RESISTANT DESIGN OF	L	Т	Р	Credit
CI V 10K402	3	0	0	3	
Pre-requisite: CIV	18R303Course Catego	ory:	Profes	sional	Elective
	Course Type : 7	Theor	ry		

COURSE OUTCOME

CO1: Explain the basic concepts on theory of vibrations

CO2: To get a knowledge on earthquakes and its resistant features for different types of buildings

CO3: Able to design earthquake resistant structures as IS Codes

CO4: To acquire knowledge in knowing the performance of buildings under past earthquakes

CO5: To obtain skills in the field of repairing and retrofitting techniques

COURSE OUTCOMES VS PROGRAM OUTCOMES MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	М	Н						М		М		L
CO2			Н			М		М		М		L
CO3	L	М		Н		М				М		L
CO4				L		М		М		М		L
C05			Н		М		L					L

UNIT 1:THEORY OF VIBRATION

Formulation of equation of motion, Damping, Types of Damping – Damped and undamped vibration, Free and Forced vibration of SDOF and MDOF, RESPONSE OF DYNAMIC LOADING – Response spectrum.

UNIT 2:SEISMOLOGY

Earthquake – causes of earthquake – seismic waves – Measurement of earthquake – Earthquake History – Seismic design concepts – Principles of capacity design – Earthquake resistant features for masonry and concrete buildings.

UNIT 3:CODAL PROVISIONS AND DESIGN METHODOLOGY

IS 1893, IS 13920 and IS 4326 – codal provisions – Building systems – frames, shear walls, Braced Frames – Design and detailing as per the codes

UNIT 4: CONTROL MEASURES AND CASE STUDIES

Base isolation – types of base isolation devices – Applications – Dampers – Types of dampers – Liquefaction – Behaviour of structures in the past Earthquakes – case studies

UNIT 5:SEISMIC EVALUAITON AND RETROFITTING OF BUILDINGS

Evaluation methodology – Field evaluation – Non-destructive testing – Retrofitting of buildings – Classification of retrofitting techniques – Repairing techniques of buildings

TEXT BOOKS:

- 1.Pankaj Agarwal, "Earthquake Resistant Design of Structures" PHI Learning Private Limited, New Delhi, 2010.
- 2.SK.Duggal,"Earthquake Resistant Design of Structures", Oxford University Press, New Delhi, 2010

3.Chopra. AK, "Dynamics of Structures – Theory and Applications to Earthquake Engineering" Second Edition, Pearson Education, 2003

CI1/10D 402	FORENSIC ENGINEERING AND	L	Т	Р	Credit
CIV18R403	REHABILITATION OF STRUCTURES	3	0	0	3
Pre-requisite: N	il Course Category: P	Profes	siona	ıl Ele	ctive
CourseType: The	ory				

Course Objective(s):

To provide a comprehensive knowledge on the diagnosis, assessment and material application relating to maintenance and rehabilitation of structures

Course outcome(s):

CO1: Apply various Construction Safety Codes, Standards, and Regulations.

- CO2: To understand the causes of distress in structural members and failure of structures.
- **CO3:**Analyze the various assessment of distress in multi story buildings.
- **CO4:** To prepare concrete investigation reports for repair and rehabilitation projects and natural hazards.
- **CO5:** To understand the strengthening of structures(Retrofitting) using Morden techniques.

CO/]	PO				PS	50
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ		Η						Μ	Н	Μ	L		Η	
CO2			Μ	Η					Μ	М				Μ	Η
CO3	Μ			Μ			L			Н	Μ				Μ
CO4	L		Η						Μ	Μ				Η	
CO5	L			Μ						Μ	Н				Μ

Mapping of Course Outcomes:

UNIT1: Design and Construction Practice

Design construction process- design codes and standards - Construction Safety Codes, Standards, and Regulations- standard of care

UNIT2: Failure of Structures

Review of the construction theory – performance problems – responsibility and accountability – case studies – learning from failures – causes of distress in structural members – design and material deficiencies – overloading.

UNIT3: Diagnosis and Assessment of Distress

Visual inspection – non- destructive tests – ultrasonic pulse velocity method – rebound hammer technique – ASTM classifications – pullout tests – Bremortest – Wind sorprobetest – Crack detection techniques – case studies – single and multistory buildings – Fibre optic method for prediction of structural weakness

UNIT4: Environmental Problems and Natural Hazards

Effect of corrosive, chemical and marine environment – pollution and carbonation problems - durability of RCC structures – damage due to earthquakes and flood- strengthening of buildings – provisions of BIS 1893 and 4326

UNIT5: Modern Techniques of Retrofitting

Structural first aid after a disaster – guniting - jacketing – use of chemicals in repair – application of polymers – ferrocement and fiber concretes as rehabilitation materials – rust eliminators and polymer coating for rebar's- foamed concrete- mortar repair for cracks-shoring and underpinning -strengthening by pre-stressing. Case studies – buildings - heritage buildings- high rise buildings- water tanks – bridges and other structures

Text book(s):

1. Raikar, R.N., Learning from failures – Deficiencies in Design, Construction and Service R&D Centre (SDCPL), RaikarBhavan,1997.

Reference(s):

- 1. Robert T. Ratay, ForensicStructuralEngineeringHandBook (Second Edition), McGraw Hill,2010.
- 2. Dovkaminetzky, Design and Construction Failures, Galgotia Publication, NewDelhi, 2001.

CIV18R404	PREFABRICATED STRUCTURES	L	Τ	Р	Credit
		3	0	0	3
Pre-requisite: Nil	Course Category	Pro	fessi	onal I	Elective
	Course Type: Theo	ory			

Course Objective(s):

To impart knowledge to students on modular construction industrialized construction and design of prefabricated elements and construction methods.

Course Outcome(s):

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

- **CO1:** Describe the basic properties of pre-fabricated structures.
- CO2: Analyze the prefabricated components
- **CO3:** Design principles of structural components
- **CO4:** Analyze the joints in structural members
- **CO5:** Design the earthquake and cyclone loads

Mapping of Course Outcomes:

CO/							PO							PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	Η	Μ	М		Μ	Μ	Μ		Μ		Μ	М	Μ		Μ	
CO2		Η	Η	Μ	Η	Μ	Η		Η				Μ		Η	
CO3	Μ	Η	М	Μ	Η				Μ						Μ	
CO4	Μ	Μ	Η		Η	Μ	Μ		Η				Μ		Η	
CO5	Η	Μ	Μ		Μ	Μ	Μ		М		Μ	М	Μ		Μ	

UNIT1: Introduction

Need for prefabrication - Principles - Materials - Modular co-ordination – Standardization – Systems Production – Transportation – Erection Disuniting of Structures.

UNIT2: Prefabricated Components

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs Wall panels – Columns – Shear walls.

UNIT3: Design Principles

Design of Structural components - Beam Column Corbel Stress limitations – Handling without cracking, handling with controlled cracking – Design for stripping forces

UNIT4: Joints in Structural Members

Joints for different structural connections – Beam to Column, Beam to Beam, Column to Column, Column to Foundation, Connect47ions between wall panels, Connections between floor panels - Dimensions and detailing – Design of expansion joints- Jointing Materials

UNIT5: Design For Earthquakes and Cyclones

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones etc. - Importance of avoidance of progressive collapse

Textbook(s):

- 1. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge Based Process Planning 76 for Construction and Manufacturing, Academic Press Inc., 1989
- 2. Koncz T., Manual of Precast Concrete Construction, Vols. I, II and III, Bauverlag, GMBH, 1971.
- 3. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the Use of Precast Concrete, Netherland Betor Verlag, 1978.
- 4. M.Levitt, "Precast Concrete Material, Manufacture, Properties and Usage" Applied Science Publishers Ltd., 1982.
- 5. A.S.G. Bruggeling and G.F.Huyghe, Prefabrication with concrete, Netherlands: A.A. Balkema Publishers, 1991.

Reference(s) :

1. Building Materials and Components, CBRI, India, 1990.

2. Glover C.W, Structural Precast Concrete, Asia Publishing House, 1965

	PRE-STRESSED	CONCRETE	L	Т	Р	Credit
CIV 18R405	STRUCTURES		3	0	0	3
Pre-requisite:CIV	18R303	Course Category	r: Pro	ofessi	onal	Elective
CourseType:Theory						

Course Objective(s):

To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students. Students will be introduced to the design of prestressed concrete structures subjected to flexure and shear.

Course Outcome(s):

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

CO1: Describe the basic properties of pre-stressed concrete constituents and various losses.

CO2: Apply the provisions of IS 1343-1984 to determine the flexural strength of concrete members and also evaluate the deflection in beams

CO3: Analyze and design the end blocks of prestress concrete members.

CO4: Interpret the behavior of composite constructions for propped and unpropped conditions **CO5:** Analyze and design of pre-stressed concrete water tanks and pipes.

CO/							PO							PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	S	Μ		L									S	Μ		
CO2		L		Μ						S						
CO3	L		S	Μ						Μ			S			
CO4		L	S	Μ									S			
CO5	S		L	Μ						S					S	

Mapping of Course Outcomes:

UNIT1: Introduction – Theory and behaviour

Basic concepts – Advantages – Materials required – Systems and methods of pre-stressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – losses of prestress.

UNIT2: Design Flexure

Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections

UNIT3: Design of Compression Member and EndBlock

Design of compression members (Axial and Bending) – Design of tension member - Stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria – partial pre-stressing –Applications

UNIT4: Composite Construction

Analysis for stresses – Estimate for deflections – Flexural and shear strength of composite members

UNIT5: Design of Water Tanks And Miscellaneous Structures

Design of pre-stressed concrete tanks – Poles and sleepers –design of pre-stressed concrete pipes and sleepers

Text Book(s):

- 1. Krishna Raju N., Pre-stressed concrete, Tata McGraw Hill Company, New Delhi2012
- 2. Mallic S.K. and Gupta A.P., Pre-stressed concrete, Oxford and IBH publishing Co. Pvt. Ltd.2007.

Reference(s):

- 1. Ramaswamy G.S., Modern pre-stressed concrete design, Arnold Heinimen, New Delhi, 20100
- 2. Lin T.Y., Design of pre-stressed concrete structures, Asia Publishing House, Bombay 2005.

.CIV18R406	FINITE ELEMENT TECHNIQUES	L	Т	Р	Credit
		3	0	0	3
Pre-requisite:CIV18	R353 Course Category: Profess	ional	Elec	tive	
Course Type: Theory					

Course Objective(s):

To apprise the students about the basics of Finite Element theory, computer implementation of this theory and its practical applications

Course outcome(s):

CO1: Explain the fundamental concepts of the Finite Element Method (FEM).

CO2: Apply the basic properties, behaviour and usage of different types of finite elements.

CO3: Analyze two dimensional Problems by using FEM.

CO4: Formulate Iso-parametric elements by using FEM.

CO5: Explain the application of FEM

CO/							PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η							Μ		М			Μ		L
CO2		Η	Η		Η				Η			Η		Μ	
CO3		Η	Η		Η				Η			Η			
CO4								Η		Н					
CO5		Μ		Η		Μ							L	М	

Mapping of Course Outcomes:

UNIT1: Introduction

General field problems in Engineering – Modelling – Discrete and Continuous models – Characteristics – Difficulties involved in solution – The relevance and place of the finite element method – Historical comments – Basic concept of FEM, Boundary and initial value problems – Gradient and divergence theorems – Functionals – Shape and Displacement function and generation of Stiffness matrix and load vector– The Ritzmethod.

UNIT2: Finite Element Analysis of One Dimensional Problems

One dimensional second order equations – discretisation of domain into elements – Generalised coordinates approach – derivation of elements equations – assembly of elements equations – imposition of boundary conditions – solution of equations – Cholesky method – Post processing – Extension of the method to fourth order equations and their solutions – time dependant problems and their solutions – example from heat transfer, fluid flow and solid mechanics.

UNIT3: Finite Element Analysis Of Two Dimensional Problems

Second order equation involving a scalar-valued function – model equation – Variational formulation – Finite element formulation through generalized coordinates approach – Triangular elements and quadrilateral elements – convergence criteria for chosen models – Interpolation functions – Elements matrices and vectors – Assembly of element matrices –

boundary conditions - solution techniques.

UNIT4: Isoparametric Elements And Formulation

Natural coordinates in 1, 2 and 3 dimensions – use of area coordinates for triangular elements in - 2 dimensional problems – Isoperimetric elements in 1,2 and 3 dimensional – Largrangean and serendipity elements – Formulations of elements equations in one and two dimensions – Numericalintegration.

UNIT5: Application Of FEM

Introduction – Application of Finite Element Analysis – Modelling and Analysis using software (Procedure only)

Text Book(s):

- 1. Chandrupatla, T.R., and Belegundu, A.D., Introduction to Finite Element in Engineering, Third Edition, Prentice Hall, India,2003
- 2. Rao, S.S., The Finite Element Method in Engineering, Pergaman Press, 2003.

Reference(s):

- 1. Reddy J.N., An Introduction to Finite Element Method, McGraw-Hill, Intl. Student Edition, 1985.
- 2. Zienkiewics, The finite element method, Basic formulation and linear problems, Vol.1, 4/e, McGraw-Hill, BookCo.

CIV18R407	EXPERIMENTAL STRESS ANALYSIS	L	Т	P	Credit
		3	0	0	3
Pre-requisite:	Nil Course Categor	r y: Pi	rofess	sional	l Elective
CourseType: Th	leory				

Course Objective(s):

To make students aware of various measurement techniques and experimental planning and procedures adopted in laboratory.

Course Outcome(s):

- **CO1:** Of the application basic science systematization thought excavation, the evaluation, the diagnosis project question, and plans and carries out ability of the special study and the solution.
- **CO2:** Have independent research, collection the data, standard problem take into analytical the identification acquire conclusion, and have development innovation and compose the ability of professional thesis.
- **CO3:** Usage mathematics engineering realm is related analysis and design software, explanation data with independently solve the ability of problem.
- **CO4:** Effectively communicate, expression integrity, leadership management, team cooperation division of labor and moderate integration of ability.
- **CO5:** Has mathematical and the project professional field self-study, the innovation ponder and ability of the sustained development.

CO/							PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ								Η				Μ		L
CO2											М			М	
CO3											М				
CO4									Μ						
CO5		Μ		Н		Μ							L	Μ	

Mapping of Course Outcomes:

UNIT1: Design of Experiment

Design of conduct of an experiment – Reduction of data – Experimental error – Preparation of report

UNIT2: Strain Measurement Methods

Strain gauges – basic characteristics – mechanical, optical, acoustic, electrical inductance and capacitance, pneumatic types – description and working principles – factors producing strain sensivity – Gauge construction – Temperature compensation – Gauge sensivities and gauge factors – Strain rosettes – Calculation of principal strain and principal stress

UNIT3: Photo Elasticity

Two dimensional photo elasticity – Stress optic law – Polari scope – Isoclinic and isochromatic fringes – compensators – separation techniques – Model materials – Calibration of photo elastic materials

UNIT4: Model Analysis

Model analysis – Direct and Indirect models – laws of structural similitude – Choice scales – Model Materials – Limitations of model studies – Buckingham pi theorem – Design of direct and indirect models – Begg'sDeformeter and its applications.

UNIT5: Advanced Techniques

Fundamental of photo elastic coating – Morie fringe and Brittle coating techniques – crack detection techniques – Introduction to stress freezing techniques – Introduction to non-destructive testing

Text Book(s):

1.Sadhu Singh, "Experimental stress analysis", Khanna Publishers, New Delhi, 2005.

Reference Book(s):

1. Dally and Railey, "Experiment Stress Analysis", New Delhi, 2003.

2.Dove and Adam, "Experimental Stress analysis and Motion measurement", 1989 3.Srinath.L.S, "Experimental StressAnalysis",2004

CONSTRUCTION ENGINEERING & MANAGEMENT STREAM

	PLANNING AND DESIGN OF	L	Т	Р	Credit
CIV18R304	BUILDING SERVICE	3	0	0	3
Pre-requisite: NilC	ourse Category: Professional Elective				
Course Type: Theor	У				

Course Objective(s):

To understand the principles of planning and the various design components that should be consider; The concept of safety measures are also understand easily.

Course outcome(s):

CO1: To design a building with all essential facilities for better life style.

CO2: To create a sustainable structure.

CO3: To design a green building.

CO4: To Explain the refrigeration principles

CO5: To Explain the fire safety installation

Mapping of Course Outcomes:

CO/							PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	Μ	Μ			Η	Η					М	Η	Μ	Μ
CO2		Μ				Η	Η					М	Η		Μ
CO3	Μ	Μ	Η			Η	Η					М	Η	Η	Μ
CO4		Μ		Н		Μ		Η		М			Η	Μ	Μ
CO5	Μ		Η		Μ		Н		Μ				Η	Η	Μ

UNIT1:Machineries

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT2: Electrical Systems In Buildings

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT3: Principles of Illumination & Design

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy

distribution – Luminous efficiency – Colour temperature – Colourrendering.

Design of modern lighting systems– Lighting for stores, offices, schools, hospitals and house lighting - Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT4:Refrigeration Principles & Applications

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub-cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C.Systems

UNIT5:Fire Safety Installation

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems - Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

Text Book(s):

- 1. Ambrose, E.R., Heat Pumps and Electric Heating, John and Wiley and Sons, Inc., New York, 2014.
- 2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2008.

Reference(s):

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2004.

2. R.G.Hopkinson and J.D.Kay, The Lighting of buildings, Faber and Faber, London, 2009.

3. William H.Severns and Julian R.Fellows, Air-conditioningand Refrigeration, John Wiley and Sons, London, 2008.

4. A.F.C. Sherratt, Air-conditioning and Energy Conservation, The Architectural Press, London, 2000.

CIV18R305	PROFESSIONAL PRACTICES IN	L	Т	Р	Credit
	CIVIL ENGINEERING	3	0	0	3
Pre-requisite: Nil	Course Category: Pa	rofes	siona	l Elec	ctive
Course Type: Theory					

Course Objective(s):

To identify various career paths that are available to professional engineers, and elaborate on how your path could change over the duration of your career; Identify personal attributes necessary to function professionally in an engineering career

Course Outcome(s):

CO1: The students will be able to setout of foundation for buildings.

CO2: The students will be able to carry out testing of construction materials

CO3: The students will be able to manage inventory on site.

CO4: The students will be able to maintain quality control on site.

CO5: To Explain the advanced legal concepts

CO /]	PO						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Μ	Μ		Η	Η			М	Μ		Μ
CO2					Η	Μ		Η	Η			М	Μ		Μ
CO3					Μ	Μ		Η	Η			М	Μ		Μ
CO4					Μ			Η	Η			М	Μ		Μ
CO5			Μ			Η							Μ		Μ

Mapping of Course Outcomes:

UNIT1: Professional Practice

Technical, legal, and ethical considerations in civil engineering practice - examination of contract specifications and technical specification writing.

UNIT2: Fundamentals of Construction Engineering

Introduction to concepts required by professionals involved in the construction industry-Contracts, bidding, estimating, scheduling- Cash flow, Safety, Labor issues- Equipment ownership - Productivity.

UNIT3: Heavy Construction

Conventional heavy construction - equipment, methods, and practice - planning for critical operations - modeling and simulation, safety - Field studies

UNIT4: Value Management Process

Industry value management processes - Value engineering and LCC- individual value engineering- process simplification- function analysis concept development- design to capacity- constructability, modularization and preassembly- Design effectiveness.

Industry value management processes - mechanical reliability modeling- predictive maintenance- design for maintainability- waste minimization and pollution prevention-sustainable design and construction- planning for startup- lean construction- value engineering change proposals- post-occupancy evaluation- knowledge management and lessons learned systems.

UNIT5: Planning

Principles and applications for effective early planning of capital facilities- finance, economic decision making- risk management- team alignment - pre-project planning processes and tools.

Text Book(s)

1.Roshan H Namawathi, Professional Practice, Lakshmi publications, fifth edition, New Delhi, 1998.

CIV19D206	HOUSING PLANNING AND	L	Т	Р	Credit
CIVIONJUU	MANAGEMENT	3	0	0	3
Pre-requisite:]	Nil Course Category: Professional Elect	ive			
Course Type : Theo	ry				

Course Objective(s):

The objective of the course is to train the students to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects. The course focuses on cost effective construction materials and methods. Emphasis is given on the principles of sustainable housing policies and programme

Course outcome(s):

- **CO1:** To Explaining require knowledge of plan drawings. This knowledge will be useful to the student to planning to the buildings, as per the law and rules and regulations. They should also able to present the knowledge in a way that it is understandable by others.
- **CO2:** To know the approval of house building is to be base on the national policies and state level laws. They should also able to present the knowledge in a way that it is Explainable by others.
- **CO3:** The students should have the knowledge to analyze the slum clearance project, to prepare plan for plot map cost flow. They should also able to present the knowledge in a way that it is understandable by others.
- CO4: To Explain the Construction techniques and cost effective materials
- **CO5:** To Explain the housing finance and project appraisal

Trappi	ing or	Cour			103.										
CO/							PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L		Μ	Η		Μ	Μ	L	Η		М	L	Η		Η
CO2	L		Μ	Η		Μ	Μ	L	Η		М	L	Η		Η
CO3	Н	Μ	Μ	Η		Μ	Μ	L	Η		М	L	Η		Η
CO4			Μ		Η		Μ						Μ		Η
CO5		Μ			Η			Μ					Η		Η

Mapping of Course Outcomes:

UNIT1: Introduction to Housing

Definition of basic terms – house, home, household, apartments, multi-storied buildings, special buildings- Objectives and strategies of national housing policies, Principle of sustainable housing- Housing Laws at State level, Bye-laws at urban and rural local bodies – levels - Development control regulations- Institutions for housing at national, state and local levels

UNIT2: Housing Programmes

Basic Concepts - Contents and standards for housing programme - Sites and servicesneighborhoods- open development plots, apartments, rental housing, co-operative housing, slum housing programme- role of public, private and non-government organizations.

UNIT3: Planning and Design of Housing Projects

Formulation of housing projects – Site analysis- Layout design- Design of housing units (Design Problems)

UNIT4: Construction Techniques and Cost-Effective Materials

New constructions techniques – Cost effective modern construction materials, building centers – concept, functions and performance evaluation

UNIT5:Housing Finance And Project Appraisal Appraisal of housing projects – Housing finance, Cost recovery – Cash flow analysis, Subsidy and cross subsidy, Pricing of housing units, rents, recovery pattern (Problems).

TEXT BOOKS

- 1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi,1999.
- 2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay,1997.

CIV18D207	CONSTRUCTION PLANNING AND	L	Т	Р	С
CIV10K30/	MANAGEMENT	3	0	0	3
Pre-requisite: 1	Vil Course Catego	ory: P	rofessi	onal E	Elective
	Course Type : Theo	ory			

Course Objective(s):

To make the student to acquire proficiency in the application of modern techniques in construction Management; It exposes the student to site planning in CPM and PERT, Management methods, quality and safety in construction; To develop skills on the various aspects of construction Management.

Course outcome(s):

CO1: To Explain role and challenges in construction Industry.

CO2: To clarify the different network techniques.

CO3: To estimate the expected time for construction activities.

CO4: To compare and contrast CPM and PERT for construction planning.

CO5: To examine the quality aspects in construction.

Mapping of Course Outcomes:

CO/							PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L		Μ	Η		Μ		L	Η	Μ		М			Η
CO2			Μ					Η		Μ		Н			Η
CO3		Μ	Μ	Η		Μ			Η		Μ	М			Η
CO4			Μ	Η		Μ									Η
CO5			М					Η		Μ		Н			Η

UNIT1: Project planning

Construction as industry and its challenges, Role of construction management, Methods of construction managements, Project reports ,sanctions , tendering ,contracts, Execution of works , measurements ,payment , disputes ,compensation Arbitration.

UNIT2: Network Techniques in Construction Planning

Defining activities and their interdependence, planning of network construction, network diagram, classification of networks, choice of type of network

UNIT3: Program Evaluation and Review Techniques

Introduction, time estimates shape of probability distribution curve, mean variance and standard deviation, expected time for activities, earlier expected and latest allowable occurrence time, critical path

UNIT4: Critical Path Method

Introduction, CPM and PERT, CPM application, earliest and latest time event calculation, activities time, Float, critical path

UNIT5: Quality and Safety in construction

Planning and control of quality during design of structures, quality standards and codes in design and construction concept and philosophy of Total Quality Management, Factors affecting safety, site management with regard to safety recommendations, safety legislation, standards and codes with regard to safety recommendations.

Introduction to Management Software (Not for examinations) Use of software packages likes. MS. Project and Primavera

Textbook(s):

- 1. Chitkara. K.K(1998) "Construction Project Management: Planning Scheduling and Control", Tata mcgraw Hill Publishing Company, NewDelhi
- 2. Dr. Neeraj Kumar Construction Project Management, JhaPearsonPublications
- **3.** Chris Hendrickson and Tung Au(2000), "Project Management for Construction Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall Pittsburgh
- 4. B.L Gupta "Construction Management and Machinery", Standard publishers, NewDelhi.

Reference(s):

- 1. Moder.J., C.Phillips and Davis, Project Management with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.
- 2. Willis., E.M., Scheduling Construction Projects, John Wiley and Sons, New Delhi 1986.
- 3. Halpin,D.W., Financial and Cost Concepts for Construction Management, John Wiley and Sons, New York,1985.
- 4. Cliff Schexnayder, Construction Management Fundamentals, Tata McGraw-Hill, New Delhi,2006
- 5. Donald S.Barrie& Boyd C.Paulson, Professional Construction Management, Tata McGraw-Hill, New Delhi, Third Edition, 2006

CIV/19D209	CONSTRUCTION TECHNIQUES	L	Т	Р	Credit
CI V 10K300	AND PRACTICES	3	0	0	3
Pre-requisite: Nil	Course Category:	Profe	essior	al El	ective
	Course Type: Theory	ý			

Course Objective(s):

The main objective of this course is to make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities

Course Outcome(s):

CO1: Student will be able to explain erection techniques for high rise structures.

- **CO2:** Student will be able to apply different construction techniques in underwater construction.
- **CO3:** Student will be able to apply grouting techniques.
- CO4: Student will be able to find output of earth moving equipment.
- CO5: Student will be able to describe safety of equipment

CO/							PO							PSC)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Μ	Η	Н				Н		L		М
CO2						Η	Н				Н		L		М
CO3					Μ	Η	Η				Η		L		Μ
CO4					Μ	Η	Η				Η		L		М
CO5						Η	Η				Η		L	Η	М

Mapping of Course Outcomes:

UNIT1: Construction Practices

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering sheet piles – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – air conditioning – acoustic and fire protection.

UNIT2: Sub Structure Construction

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques- driving well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting- Large reservoir construction with membranes and Earth system- well points - Dewatering and stand by Plant equipment for underground open excavation.

UNIT3: Super Structure Construction

Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, aerial transporting handling -

erecting light weight components on tall structures -erection of transmission towers -Construction sequences in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges -Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks

UNIT4: Repair and Rehabilitation

Study on causes of building damage and deterioration – Assessment of materials and methods of repair and restoration.

UNIT5: Construction Equipment

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling, drilling, blasting — dewatering and pumping equipment – Transporters.

Text Book(s):

- 1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 5th Edition, 2015.
- 2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, New Delhi2007.

Reference(s):

- 1. Jha, J and Sinha, S.K., Construction and Foundation Engineering, Khanna Publishers, New Delhi, 2004.
- 2. Sharma S.C. Construction Equipment and Management, Khanna Publishers New Delhi, 1988.

CIV19D409	CONTRACT LAWS AND	L	Т	Р	Credit					
CI V 10K400	REGULATIONS	3	0	0	3					
Pre-requisite: Nil	Course Category: Professional Elective									
	Course Type: Theory									

Course Objective(s):

This course is designed to acquaint a student with the conceptual and operational parameters of various general principles relating to contract law.

Course Outcome(s):

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

- CO1: Prepare contract schedules, notice inviting tender and contract documents
- CO2: Explain laws of construction contract

CO3: Implement dispute resolution.

CO4: Prepare contract management plan as per standards

CO/		РО													
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			Μ		Н					L		М	L		
CO2					Н	L					М	L	L		Μ
CO3	L		Μ								Η		L		
CO4			Η								М		L		Μ
CO5															

Mapping of Course Outcomes:

UNIT1: Construction Contracts

Indian Contracts Act – Elements of contracts – Types of contracts – Features – Suitability Design of contract documents – International contract document – Standard contract document – Law of torts.

UNIT2: Tenders

Prequalification – Bidding – Accepting – Evaluation of tender from technical, contractual and commercial points of view – Contract formation and interpretation – Potential contractual problems – World Bank procedures and guidelines – Tamil Nadu transparency intenders act.

UNIT3: Arbitration

Comparison of actions and laws – Agreements – Subject matter – Violations – Appointment of arbitrators – Conditions of arbitration – Powers and duties of arbitrator – Rules of evidence Enforcement of award – Costs

UNIT4: Legal Requirements

Insurance and bonding – Laws governing sale, purchase and use of urban and rural Land – Land revenue codes – Tax laws – Income tax, sales tax, excise and custom duties and their influence on construction costs – Legal requirements for planning – Property law – Agency law – Local government laws for approval – Statutory regulations.

UNIT5: Labour Regulations

Social security – Welfare legislation – Laws relating to wages, bonus and industrial disputes, labour administration – Insurance and safety regulations – Workmen's compensation act – Indian factory act – Tamil Nadu factory act – Child labour act – Other labour laws.

Text Book(s):

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd., Bombay,1982.

Reference(s):

- 1. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
- 2. Kwaku. A., Tenah. P.E. Jose M. Guevara, P.E., Fundamentals of Construction Management and Organization, Printice Hall, 1985.

TRANSPORTATION ENGINEERING STREAM

CIV19D200	TOTAL STATION AND GPS	L	Т	Р	Credit						
CI V 18K309	SURVEYING	3	0	0	3						
Pre-requisite: NIL	Course Category: Professional Electiv										
	Course Type : Th	eory									

Course Objective(s):

This course is designed to prepare the students to handle sophisticated state-of-the-art survey equipment and to execute large survey projects

Course Outcome(s):

At the end of the course, students would be able to CO1: Describe the fundamentals of total station and GPS CO2: Understand propagation of EMR CO3: Describe the electro optical and micro wave system CO4: Describe the satellite system CO5: Describe the GPS data processing

Mapping of Course Outcomes:

CO/	PO												PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1			М		Н					L		Μ	Η			
CO2			М		Н	Μ					Н	Μ	Η	Μ		
CO3	Μ										Н					
CO4			Η								Μ					
CO5			Μ		Н		Μ						Η		Μ	

UNIT1: Fundamentals of Total Station And GPS

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion - Kepleri's Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept - GNSS

UNIT2: Electromagnetic Waves

Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature- pressure transducers.

UNIT3: Electro Optical And Micro Wave System

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparis on between Electro- optical and Microwave system - Care and maintenance of Total Station instruments - Modern positioning systems – Traversing and Trilateration

UNIT4: Satellite System

GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT5: GPS Data Processing

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data –data processing – software modules -solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -basic constellation of satellite geometry & accuracy measures - applications- long baseline processing- use of different software's available in the market.

Textbook(s):

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1990.

2. Satheesh Gopi, Rasathishkumar, madhu, "Advanced Surveying, Total Station GPS and Remote Sensing "Pearson education, 2007 ISBN: 978-81317 00679

Reference(s):

1. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.

2. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 2003.

CIV/19D210	HIGHWAY AND AIRPORT	L	Т	Р	Credit					
	PAVEMENT SYSTEMS	3	0	0	3					
Pre-requisite: NIL	Course Category: Professional Electi									
	Course Type : Th	eory								

Course Objective(s):

To know about the pavement design of both highway and airport which are the basic necessity of the transport system.

Course Outcome(s):

- CO1: Introduce students to the basic types and behavior of highway materials.
- CO2. Expose students to the general aspects of pavement structural design, flexible or rigid.
- **CO3:** Expose students to the analysis concepts and procedures for stresses, strains and deflection in pavements.
- **CO4:** Introduce students to commercially available software in the area of pavement structural design.
- CO5: Understand the Highway Management

Mapping of Course Outcomes:

CO/	PO												PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	Μ								Н				Н			
CO2											Μ		Η	Μ		
CO3											Μ				L	
CO4									Μ							
CO5		Μ		Н									Η		Μ	

UNIT1: General Principles Of Pavement Design

Components, Factors affecting pavement stability – vehicle and traffic factors, Moisture Factors – Climatic Factors, Soil Factors, Comparison of highway and Airport pavements.

UNIT2: Flexible and Rigid Pavement Design Methods

Various methods of flexible and rigid pavement design

UNIT3: Pavement Materials And Construction Methods

Soil sub grade – Stone aggregates – Bituminous materials – Portland cement – Characteristics and Desirable Properties – Tests, Construction Methods.

UNIT4: Drainage And Drainage Structures

Surface and sub-surface drainage structures – Design of drainage system and Cross Drainage Structures – Drainage for Hill Roads.

UNIT5: Highway Management

Pavement Distress – Pavement Evaluation and Strengthening – Pavement Management System – Highway maintenance.

Text Book(s):

1.S.K. Sharma, Principles, Practice and Design of Highway Engineering, C. Chand and Company Ltd., New Delhi, 1985.

Reference(s):

1. Sharma S.K. and Justo, Highway Engineering, Chand and Co., Roorkee, 1998.

2. Robert F. Baker, (Eds), Handbook of Highway Engineering Van Nostrand Reinttold Company, New York, 1975.

3. Bindra S.P., A Course in Highway Engineering, Dhanpet Raj Publications, New Delhi, 1999.

CIV19D211	TDAFFIC ENCINEEDING	L	Τ	Р	Credit
	I RAFFIC ENGINEERING	3	0	0	3
Pre-requisite: Nil	Course Categ	gory:	Profe	ssiona	al Elective
	Course Type :	Theor	y		

Course Objective(s):

To give an overview of traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.

Course Outcome(s):

CO1: Estimate basic characteristics of traffic stream

- CO2: Conduct traffic studies and analyze traffic data
- **CO3:** Gain knowledge in traffic flow characteristics.
- **CO4:** Determine the capacity of intersection
- CO5: Traffic control & Management

Mapping of Course Outcomes:

CO/	CO/ PO														PSO				
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3				
CO1		Н											Η						
CO2		Н											Η	Μ					
CO3				Н															
CO4				Н									L						
CO5		Μ													Μ				

UNIT1: Components Of Traffic Engineering

Role of Traffic Engineering – Road user characteristics – Static & Dynamic Characteristics of vehicle – Statistical techniques and applications.

UNIT2: Surveys And Studies In Traffic Engineering

Traffic data nature and need – Volume capacity studies – Speed delay studies – Origin & Destination studies – Parking management – Pedestrian path & cycle track design.

UNIT3: Traffic Flow Characteristics

Speed density flow characteristics, Basic diagram of traffic flow, Level of Service concepts – Capacity under heterogeneous condition – Urban and Rural condition – Factors affecting traffic flow characteristic – Street Lighting

UNIT4: Intersections And Inter-Changes Design

Cross sectional elements, types of intersections and inter-changes – Design Principles – Rotary Design – Delays at intersections – Computer applications in intersection design.

UNIT5: Traffic Control & Management

Traffic Signs, Marking - Types, standard and Location, Road furniture, Parking Regulation, Accident Analysis - Traffic and Environment - Traffic Restraint technique - Low cost traffic management techniques - Transport System Management - Travel Demand Management.

Text Book(s):

1. Kadiyali L.R Traffic Engineering and Transport Planning –. Khanna Publishers, 1999.)

Reference(s):

1. Taylor M.A.P. and W. Young, Traffic Analysis - New Technology and New solutions, Hargreen Publishing Company, 1988.

	PRIDCE DI ANNING AND DESIGN	L	Т	Р	Credit
CIV 10K409	DRIDGE FLAMMING AND DESIGN	3	0	0	3
Pre-requisite: Nil	Course Categor	y: Pr	ofessi	onal I	Elective
	Course Type : Th	eory			

Course Objective(s):

The aim of this course is to give basic knowledge on planning, analysis and design of bridges. After this course, the student will be able to classify different types of bridges and to calculate loads, lane factor, load cases and load combinations.

Course outcome(s)

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

CO1: Understand the design theories for super structure and substructure of bridges

CO2: Design Culvert, R.C.C T- Beam Bridge.

CO3: Understand the behaviour of continuous bridges, box girder bridges.

CO4: Possess the knowledge to design prestressed concrete bridges.

CO5: Design Railway bridges, Plate girder bridges, different types of bearings, abutments, piers and various types of foundations for Bridges.

CO/	PO												PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	Н				Μ							Μ	Н			
CO2		Μ									М			М		
CO3	Μ		М									Н	М		М	
CO4																
CO5			Η												Η	

Mapping of Course Outcomes:

UNIT1: Introduction

Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations

UNIT2: Short Span Bridges

Load distribution theories, analysis and design of slab culverts, Tee beam and slab bridges.

UNIT3: Long Span Girder Bridges

Design principles of continuous bridges, box girder bridges, balanced cantilever bridges.

UNIT4: Design of Prestressed Bridges

Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

UNIT5: Design of Plate Girder Bridges, Bearings and Substructures

Design of riveted and welded plate girder bridges for highway and railway loading – wind effects – main section, splicing, curtailment, stiffeners – Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of foundations

Text Book(s):

- 1. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2014.
- 2. Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 2010

Reference(s);

- 1. Jagadeesh.T.R. andJayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt.Ltd. 2014.
- 2. Raina V.K." Concrete Bridge Practice" Tata McGraw Hill Publishing Company, New Delhi, 1991.

CIV19D410	DAVEMENT MANACEMENT SVSTEM	L	Т	Р	Credit						
CIV10K410	FAVENIENT MANAGEMENT STSTEM	3	0	0	3						
Pre-requisite: N	il Course Categor	Course Category: Professional Elective									
	Course Type : Th	eory									

Course Objective(s):

The primary goal of this course is to educate graduate level civil engineering students in the principles of pavement management. The purpose is to provide a core of civil engineering graduates with a thorough understanding of the pavement management process.

Course Outcome(s):

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

CO1: Develop the knowledge in pavement management process and investments.

CO2: Analyze stresses and strains in a rigid pavement using Westergaard's theory.

CO3: Design a flexible pavement using IRC, Asphalt Institute, and AASHTO methods.
CO4: Develop pavement performance prediction models.

CO5: Gain the knowledge in repair and maintenance of pavements.

CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ				Μ							М	Η		
CO2		Μ									Μ			М	
CO3	Н		Μ									М	Μ		Μ
CO4															
CO5															Н

Mapping of Course Outcomes:

UNIT1: Pavement Management Process

Historical background – general nature and applicability of systems methodology – basic components of Pavement Management System – planning pavement investments

UNIT2: Evaluation and Performance

General concepts – economic and functional evaluation – evaluation of pavement performance – evaluation of structural capacity – pavement distresses – condition surveys – safety evaluation

UNIT3: Design Strategies

Framework for pavement design – design objectives and constraints – basic structural response models – characterization of physical design inputs – generating alternative pavement design – economic evaluation of alternative design – analysis of alternative design strategies – selection of optimal design strategy

UNIT4: Performance Prediction Models

Techniques for developing prediction models – AASHO, CRRI and HDM models – computer applications

UNIT5:Rehabilitation

Repair of pavement defects – maintenance of flexible and rigid pavements – bituminous and cement concrete overlays – system analysis

Text Book(s):

1. Ralph Haas, W.Ronald Hudson and John Zaniewski, Modern Pavement Management, Kreigar Publishing Company, New York, 2014

Reference(s):

1. M.Y.Stalin, Chapman and Hall Pavement Management for Airports, Roads and Parking Lots, New York, 2012.

2. Michael Sargious, Pavements and surfacing for Highways and Airports, Applied Science Publishers Limited, London, 2001

CIV19D412	INTELL CENT TO ANGRODT SYSTEMS	L	Τ	Р	Credit
CIV10K413	INTELLIGENT TRANSFORT STSTEMS	3	0	0	3
Pre-requisite: Nil	Course Categor	y: Pro	ofessi	onal l	Elective
	Course Type : Th	eory			

Course Objective(s):

The primary objective of this course is to provide the students with an understanding of ITS and its applications. The course will provide an in-depth understanding on the theory and application of Intelligent Transportation Systems.

Course Outcome(s):

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

CO1: Differentiate different ITS user services.

CO2: Select appropriate ITS technology depending upon site specific conditions.

CO3: Design and implement ITS components.

CO4: Understand ITS architecture and standards

CO5: Understand the basic knowledge about intelligent traffic management.

Mapping of Course Outcomes:

CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			Μ		Н					L		Μ	Н		
CO2					Η	L					Μ	L		М	
CO3	L		Μ								Н		М		М
CO4			Н								Μ				
CO5															Н

UNIT1: Management Information Systems

Characteristics of Information, Constituents of Computer Based Information Systems, Element and functions of Management Information Systems in Urban Transportation Sectors – Development of Database and Management Information System– Concept of Database – Development of Transportation Database.

UNIT2: Transportation Management

Objective of Transportation Management – Core functions of Transport Management – Traffic Signal System – Freeway Management Systems (FMS) Information Technologies – Information Systems Concept – Overview of the System Development Cycle – Traditional System Development Life Cycle Methodology –Decision Support System (DSS) in Urban Transport Development

UNIT3: Intelligent Transport Technologies

Wireless Communication – Computational Technologies – Floating Car Data Floating Cellular Data – Sensing Technologies – Inductive Loop Detection – Video Vehicle Detection – Advanced Traffic Sensors and Surveillance Systems – Dynamic Message Sign (DMS) Positioning Systems – Maps – Maps Matching – Path Finding and Route Guidance, Information Dissemination and Display Technologies.

UNIT4: Intelligent Transport Application

Technologies for delivering Pre-Trip and En-route Traveler Information –Electronic Payment Technologies – Electronic Toll Collection – Emergency Vehicle Notification Systems – Fleet Operation and Management – Cordon Zones with Congestion Pricing, Automatic Road Enforcement

UNIT5: Intelligent Traffic Management

Intelligent Speed Adaptation – Telematics – Traffic Estimation and Prediction Systems, Multimodal Travel Management and Traveler Information – SCATS Traffic Signal Systems, the Challenge of ITS and ORM versus traditional Transportation Improvements, Technical Function in Integrating ITS and Transport Planning.

Text Book(s):

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001

2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 1992

Reference(s):

- 1. E.Turban, Decision Support and Export Systems Management Support Systems, Maxwell Macmillan, 1998
- 2. SitausuS.Mittra, Decision Support Systems Tools and Techniques, John Wiley, New York, 1986
- 3. Cycle W.Halsapple and Andrew B.Winston, Decision Support Systems Theory and Application', Springer Verlog, New York, 1987

CIV19D414	HICHWAY SAFETY AND SAFETY AUDIT	L	Т	Р	Credit
CI V 10K414	IIIGIIWAT SAFETT AND SAFETT AUDIT	3	0	0	3
Pre-requisite: Ni	I Course Categor	y: Pr	ofessi	onal I	Elective
	Course Type : Th	eory			

Course Objective(s):

The objective of the programme is intended to familiarize the students with road safety analysis, facility design and evaluation and better understanding of EIA process.

Course Outcome(s):

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

CO1: Analyze the effect of driver characteristics, roadway characteristics, climatic factors on highway safety.

CO2: Students can understand the various safety measures.

CO3: Plan and design a road safety improvement program.

CO4: Analyze accident data and suggest safety measures and Conduct road safety audit.

CO5: Analyze the accident studies and investigation.

CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			Н		Η					L		Μ	Η		
CO2					Μ	L					Μ	L		М	
CO3	Μ		Μ								Н		М		М
CO4			Н								Μ				
CO5															Н

Mapping of Course Outcomes:

UNIT1: Description of Problems

Causes of accidents – Human factors – Vehicles – Road and its condition –Environmental Studies

UNIT2: Accident Analysis Techniques

Collision Diagram – Preparation, Spatial Analysis of Accidents – Methods and GIS in Accident Analysis - Black Spot, Black Route and Area Identification

UNIT3: Before and After Studies

Accident Prediction Models – Development – Empirical Bayees Approach – Before and After Evaluation – Case Studies

UNIT4: Safety Audit

Need for Safety Audit – Concept and Elements of Safety Audit – Safety Audit for existing roads – Legal requirements – Provisions of Motor Vehicle Act and role of NGO's in prevention of accidents.

UNIT5: Accident Studies and Investigation

Accident data – Identification of Accident Prone Location – Prioritisation –Investigation – Problems and Remedies

Text Book(s):

1. Ministry of Surface Transport, Accident Investigation and Prevention Manual for Highway Engineers in India, Government of India, 2001

Reference(s):

1. Khanna S.K. and Justo C.E.G, Highway Engineering, Nem Chand and Brothers, Roorkee, 2001

2. Robert F. Baker, Hand Book of Highway Engineering, Van NonstrantKeinhold Company, New York, 1975

3. Robert F.Baker, The Highway Risk Problem – Policy Issues in Highway Safety, John Wiley and Sons

CIV19D411	PAVEMENT EVALUATION &	L	Т	Р	Credit
CIV10K411	MANAGEMENT	3	0	0	3
Pre-requisite: Ni	Course Category: P	rofess	sional	Elect	tive
	Course Type : Theor	y			

Course Objective(s):

To identify the pavement surface condition, management and evaluation

Course Outcomes:

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

CO1: Identify the quality and serviceability condition of roads.

CO2: Determine the pavement condition using functional and structural methods.

CO3: Decide the type and timing of maintenance required for given pavement.

CO4: Evaluate and estimate the life cycle cost of pavements

CO5: Develop the knowledge on pavement performance prediction models.

Map	ping	of	Course	Outcomes:
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CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Н	Μ		Μ	М	Μ			Н		
CO2	Н							Н	Н	Η		Μ		М	
CO3	Н					Μ		Μ	М	Η			М		Μ
CO4								Н	Н	Μ					
CO5															Η

UNIT1: Pavement Surface Condition & Its Evaluation

Various Aspects of Surface and their Importance; Causes, Factors Affecting, Deterioration and Measures to Reduce: i) Pavement Slipperiness ii) Unevenness iii) Ruts, Pot holes, and Cracks; Methods of Measurement of Skid Resistance, Unevenness, Ruts and Cracks. Pavement Surface Condition Evaluation by Physical Measurements, by Riding Comfort and Other Methods; their Applications

UNIT2: Pavement Structure & Its Evaluation

Factors affecting Structural Condition of Flexible and Rigid Pavements; Effects of Subgrade Soil, Moisture, Pavement Layers, Temperature, Environment and Traffic on Structural Stability, Pavement Deterioration; Evaluation by Non-Destructive Tests such as FWD, Benkelman Beam Rebound Deflection, Plate Load Test, Wave Propogation and other methods of Load Tests; Evaluation by Destructive Test Methods, and Specimen Testing

UNIT3: Pavement Overlays & Design: Pavement Overlays

Design of Flexible Overlay over Flexible Pavement by Benkelman Beam Deflection and other Methods, Flexible Overlays and Rigid Overlays over Rigid Pavements, Use of Geosynthetics in Pavement Overlays.

UNIT4: Pavement Management System

Historical background – general nature and applicability of systems methodology – Concepts of pavement management systems basic components of Pavement Management System – planning pavement investment

UNIT5: Modelling

Pavement performance prediction concepts, modeling techniques, structural conditional deterioration models, mechanistic & empirical models, functional condition deterioration models, unevenness deterioration models and other models, ranking and optimization methodologies.

Reference(s) :

- 1. Yoder E.J. and Witezak, Principles of Pavement Design, II Ed., John Wiley and Sons, 1975.
- 2. Woods, K.B., Highway Engineering Hand Book, McGraw Hill Book Co.
- 3. David Croney, The Design and Performance of Road Pavements, HMSO Publications, 2008.
- 4. Haas and Hudson, Pavement Management System, McGraw Hill Book Co., New York, 1982.
- 5. Per Ullidtz, Pavement Analysis, Elsevier, Amsterdam, 1998.
- 6. HRB/TRB/IRC/International Conference on Structural Design of Asphalt Pavements, 1988.
- 7. SHAHIN, M Y, Pavement management for airport, roads and parking lots, Chapman and hall 2005.

CIV18D412	PAVEMENT MATERIALS AND	L	Т	Р	Credit
CIV10K412	CONSTRUCTION	3	0	0	3
Pre-requisite: NII	Course Category: Profession	nal El	ective	;	
	Course Type : Theo	ory			

Course Objective(s):

To know about the pavement materials and its construction procedure

Course Outcome(s):

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

CO1: Understand the function and significance of sub grade.

CO2: Evaluate the flexible pavement materials.

CO3: Evaluate the rigid pavement materials.

CO4: Understand the construction procedure for various pavements.

CO5: Decide the highway construction equipment for various pavement works.

Mapping of Course Outcomes:

CO/	PO												PSC)	
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Н	М		Н	Μ	Μ			Η		
CO2	Н							Н	Η	Μ		М		Μ	
CO3	Н					М		Μ	М	Н			Μ		Μ

CO4				Н	Η	Μ			
CO5									Η

UNIT1: Sub grade

Functions and significance of sub grade properties – Methods of assessment of sub grade strength – Soil classification – Ground Improvement Techniques – Wheel loads – ESWL– EWLF

UNIT2: Materials for Flexible Pavement

Bitumen – types and grades – properties and testing of materials used in granular layers and bituminous layers – Types of granular and bituminous mixes — mix design for granular materials – bituminous mix design - super pave concepts – new materials like polymer modified bitumen, geosynthetics etc.

UNIT3: Materials For Rigid Pavement

Cement – grades – chemical composition – hydration of cement – testing – admixtures –fibres - properties and testing of pavement quality concrete – mix design – acceptance criteria

UNIT4: Construction Procedures

Methods of construction and field control checks for various types of flexible pavement layers – recycling of bituminous materials Cement concrete pavements – methods of construction of various layers – joints-quality control tests

UNIT5: Highway Construction Equipments

Excavators, graders, vibratory rollers, sensor pavers, computerized asphalt mix plant, plants and trucks for ready mix concrete, slip form paver – working principle, advantages and limitations

Reference(s):

- 1. Specifications for Road and Bridge works, Fourth Revision, MoSRT&H(India), 2001
- 2. IRC 15 2002, Standard Specifications and Code of Practice for Construction of Concrete Roads
- 3. Peurify.R.L., Construction Planning, Equipment and Methods, McGraw Hill Publishers, New York, 2000

WATER RESOURCES ENGINEERINGSTREAM

CIV19D212			L	Т	Р	Credit
CIV10K312		UKDAN HIDKULUGI	3	0	0	3
Pre-requisite:CIV	/18R252	Course Category	: Pro	fessio	onal I	Elective
		Course Type: Theory				
Pre-requisite:CIV	/18R252	Course Category Course Type: Theory	: Pro	fessio	onal l	Electi

Course Objective(s):

To provide an overview of urban hydrology and storm water management and characterize the most important types of storm water structures used in urban drainage systems

Course Outcome(s):

Upon successful completion of this course, it is expected that students will be able to:

CO1: Explain the relevance of various components of urban hydrologic cycle

CO2: Analyse the changes in runoff process due to urbanization

CO3: Hydraulically analyse the grate inlet and street network

CO4: Evaluate the hydraulic behaviour of sewer system

CO5: Analyse the quality aspect of receiving water

Mapping of Course Outcomes:

CO/							PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Η	М											Μ	
CO2	Η	Η												Η	
CO3	Η	Η	Η											L	
CO4	Η	Η	Η											Μ	Μ
CO5	Η	Η											L		

UNIT1: Urban Hydrolgical Cycle

Urban water resources- Urban hydrological cycle- Storm water management- Objectives and limitation- Urban drainage

UNIT2: Urban Runoff

Changes in Runoff Process- Runoff Pollution- Calculation of Runoff in Urban catchment

UNIT3: Hydraulics of Street Flow

Hydraulic analysis of grate inlets- Street network and street flow- Maximum flow- Optimal location of inlets.

UNIT4: Hydrologic of Sewer Systems

Steady and unsteady flow approaches- Detention basin- Hydraulic behavior- Inlet and outlet- Maintenance operation.

UNIT5: Quality Aspects of Receiving Water

Concepts of combined sewer overflow- CSO components - Sanitary sewer overflow- Water quality aspects- Organic and inorganic matter- Simulation and measurements.

Text Book(s):

1. D.Butler, J.Davies. Urban Drainage.London: Spon Press, 2011.

2. A. Osman Akan, Robert J. Houghtalen. Urban Hydrology, Hydraulics, and Stormwater Quality: Engineering Applications and Computer Modeling2003

3. Horner, R.R.Skupien, J. J.Livingston, E.H. Shaver, H.E.: Fundamentals of urban runoff management: Technical and institutional issues. Terrene Institute, Washington, D.C, 1994

Reference Book(s):

- 1.Novotny, V, Nonpoint pollution and urban storm water management. Water quality management library, Vol. 9. Technomic Publishing.1995.
- 2. Hormoz Pazwash. Urban Storm Water Management. CRC Press, 2011.
- 3. Martin P. Wanielista, Yousef A. Yousef. Storm water Management. New York: Wiley-Inter science, 1992

CIV19D212	INTRODUCTION TO CLIMATE	L	Т	Р	Credit
	CHANGE	3	0	0	3
Pre-requisite: Nil	Course Categor	y: Pr	ofessi	onal l	Elective
	Course Type : The	eory			

Course Objective(s):

To know about the climate system and climate change in the earth and how it affects on the ecology.

Course Outcome(s):

Upon successful completion of this course, can:

CO1: Explain the climate system of the earth

CO2: Analyse the climate change in recent past

CO3: Explain the concept of future projection of climate change

CO4: Analyse the impact of climate change in water resources

CO5: Explain the mitigation technologies of climate change

Mapping of Course Outcomes:

CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	Μ												М	
CO2	Μ	Μ												Η	
CO3	Μ	Μ			Μ									L	
CO4	Μ	Μ			Μ									М	М
CO5	Μ	L											L		

UNIT1: Climate System of The Earth

Introduction – IPCC-Earth's Climate System- Interaction- Earth energy balance- Green house effect- Biogeochemical cycles- El Nino- La Nina- ENSO- Teleconnection

UNIT2: Climate Change In Recent Past

Introduction to historical global climate change- Changes in temperature and precipitation-Climate data set.

UNIT3: Future Projection Of Climate Change

Climate Knowledge- Development- Performance- Emission Scenarios- Climate projections and uncertainties

UNIT4: Climate Change Impact

Introduction - Observed Impacts- Future Climate impacts- Case Studies

UNIT5: Climate Change Mitigation

Introduction- Sources and sinks of green house gases- Mitigation technologies and practices-Sustainable development and climate change

Text Book(s):

- 1. Pittock A.B. Climate Change: the science, impacts and solutions. Earthscan., 2009
- 2. Henderson-Sellers, A. & K. McGuffie . The future of the world's climate. Elsevier, 2012

Reference Book(s):

1. John T. Hardy, Climate Change: Causes, Effects, and Solutions ,2003

- 2.IPCC Fourth Assessment Report: Climate Change 2007 (AR4), 2007
- 3.IPCC Fifth Assessment Report: Climate Change (AR5), 2013 & 2014

4.UNFCC Technologies for Adaptation to climate change, 2006.

- 5.P R Shukla, Subobh K Sarma, NH Ravindranath, Amit Garg and Sumana Bhattacharya, Climate Change and India: Vulnerability assessment and adaptation, University Press (India) Pvt Ltd, Hyderabad.
- 6.Climate Change 2014 Impacts, Adaptation, and Vulnerability Part A: Global and Sectoral Aspects, Cambridge university press
- 7.Climate Change 2014 Impacts, Adaptation, and Vulnerability Part B: Regional Aspects, Cambridge university press

	APPLICATION OF SOFT COMPUTING	L	Т	Р	Credit
CIV18R314	TECHNIQUES IN WATER RESOURCES ENGINEERING	3	0	0	3
Pre-requisite:	Nil Course Category:	Profe	ession	al Ele	ective
	Course Type : The	ory			

Course Objective(s):

To impart training in the application of Artificial Neural Networks, Genetic Algorithms and Genetic Programming in solving water resources problems.

Course Outcome(s):

Upon successful completion of this course, can:

- **CO1:** Understand the application of Simulation techniques in hydrology and hydraulics
- **CO2:** Understand the Decision support system and data mining methods
- CO3: Apply ANN techniques in water resources studies
- **CO4:** Apply Genetic Algorithm techniques in water resources studies
- CO5: Apply Genetic Programming techniques in water resources studies

Mapping of Course Outcomes:

CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	М		Μ	Μ									М	
CO2	Μ	М		Μ	Μ									Н	
CO3	Μ	М		Μ	Н				L					L	
CO4	Μ	Μ		Μ	Η				L					Μ	Μ
CO5	Μ	Μ		Μ	Η				L				L		

UNIT1: Introduction

Concept of Hydro informatics- Introduction to Simulation techniques - Application of Simulation techniques in hydrology and hydraulics

UNIT2: DSS and Data Mining

Decision Support Systems- History and Principles- Data mining methods- Model Calibration and Validation

UNIT3: Artificial Neural Network

Artificial Neural Networks- Different Training Algorithms- Applications in water resources-Case studies

UNIT4: Genetic Algorithm

Concept of Evolutionary Algorithms- Basic Principle of genetic algorithm- Applications in water resources- Case Studies

UNIT5: Genetic Programming

Genetic Programming Introduction- Mathematical modeling with genetic programming-Applications in water resources- Case Studies

Text Book(s):

1. Winston, P.H. Artificial Intelligence, Pearson Education, 1999.

2.Goldberg, D.E. Genetic Algorithms, Addison Wesley Longman, 1999.

- 3.Haykin, S. Neural Networks: A comprehensive Foundation, Second Edition, Prentice Hall, New Jersey, USA, 1999.
- 4.Han, J., Kamber, M., and Pei, J., Data Mining: Concepts and Techniques, Morgan Kaufmann, 2011

Reference Book(s):

- 1.Vedula, S. and Mujumdar, P. P., Water Resources Systems: Modeling Techniques and Analysis, Tata-McGraw Hill,2005
- 2.Carlos A. CoelloCoello, David A Van Veldhuizen, Gary B Lamont, "Evolutionary Algorthms for Solving Multi-objective problems", Springer, 2002.
- 3.Tayfur Gökmen "Soft computing in water resources engineering", WIT Press, Great Britain,UK,2012

CIV18R315	IRRIGATION ENGINEERING	L	Т	Р	C
		3	0	0	3
Pre-requisite:C	IV18R252 Course Categ	ory: Pr	ofession	nal Elec	tive
	Course Type		Theory	/	

COURSE OUTCOMES:

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

CO1 Estimate crop water requirements and irrigation efficiency

CO2 Apply seepage theories to design weir on permeable foundation

CO3 Design gravity dam and plan reservoir sizing

CO4 Design irrigation canal structures.

CO5 Design of subsurface drainage

UNIT1: IRRIGATION

Necessity of irrigation type and methods of irrigation systems -Total planning concept-Water requirements of crops-Command area-duty-delta - Consumptive use of water –Irrigation efficiency-Irrigation requirement of crops- Tank Irrigation(Basic Concepts)

UNIT2: DIVERSION HEAD WORKS

Location – Essential components of Weir and Barrage-Weirs on permeable foundations-Bligh's and Khosla's seepage theories - Design procedure.

UNIT3: DAMS AND RESERVOIRS

Types of dams and their selection-Gravity dam-Analysis and design.Spillways-Different types and suitability.Reservoir planning-Site investigation-Zones of storage-Reservoir yield-Reservoir losses and Control-Life of reservoir.

UNIT4: IRRIGATION CANALS

Intake structures, Canal Outlets, Canal regulation works-Canal falls-Canal regulators-Canal escapes- Cross drainage works-Types and selection of type of cross drainage works- Canal design Concept- water logging and drainage- outlets and escapes

UNIT5: AGRICULTURAL DRAINAGE

Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy's law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.

TEXT BOOKS

1. Asawa, G.L., Irrigation and Water Resources Engineering, New age International publishes, New Delhi, 2008.

2. Punmia.B.C., Pande, B.B., Lal, Irrigation and Water power Engineering, Laxmi Publications (P) Ltd, New Delhi, 2016.

3. Ritzema, H.P., "Drainage Principles and Applications", Publication No. 16, International Institute of Land Reclamation and Improvement, Netherlands, 1994.

REFERENCES

1. Ven Te Chow etal, Applied Hydrology, Mc Graw -Hill Book Co, Newyork, 2017.

2. Subramanya, K., Engineering Hydrology, Tata Mc Graw - Hill publishers, New Delhi

3. Linsley, R.K., Water Resources Engineering, Mc Graw-Hill International Edition, reprint 2018.

CIV19D216	COASTAL ENCINEEDING	L	Т	P	Credit
	COASTAL ENGINEERING	3	0	0	3
Pre-requisite:CIV	8R252 Course Categor	y: Pro	ofessi	onal	Elective
	Course Type: Theorem	ry			

Course Objective(s):

To know about the wave formation, coastal and shore protection .

Course Outcome(s)

On successfully completing this course unit, students will be able to:

CO1: Calculate the wave transformations

CO2: Appreciate the multi-faceted nature of coastal problems and the techniques of coastal engineering analysis, modeling and design of coastal structures and shore protection

CO /						F	0						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Μ			Μ						Μ	
CO2			Η		Η	Μ								Η	
CO3														L	
CO4														Μ	Μ
CO5													L		

Mapping of Course Outcomes:

UNIT1: Introduction to Coastal Engineering

Introduction - Wind and waves – Sea and Swell - Introduction to small amplitude wave theory – use of wave tables- Mechanics of water waves – Linear (Airy) wave theory – Wave measurement.

UNIT2: Wave Properties And Analysis

Introduction to non-linear waves and their properties – Waves in shallow waters – Wave Refraction, Diffraction and Shoaling –Hind casting of waves - Short term wave analysis – wave spectra and its utilities - Long term wave analysis- Statistical analysis of grouped wave data

UNIT3: Types and Wave Transformation

Tide analysis and prediction, storm surge, seiches and seasonal fluctuations - Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction

UNIT4: Coastal Structures and Shore Protection

Risk analysis – design wave – Break waters – Shore protection – groins, seal walls, offshore breakwaters, and artificial nourishment

UNIT5: Modeling In Coastal Engineering

Physical modeling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – limitations

Textbook(s):

1. Kamphuis, J.W., Introduction to coastal engineering and management, 2000

2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994.

Reference(s):

1. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, Inc., New York, 1978.

2. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, NewYork, 1978.

3. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC,2006

	ADVANCED REMOTE	L	Т	P	Credit
CIV18R317	SENSING TECHNIQUES	3	0	0	3
Pre-requisite	:NIL Course Category:	Profes	ssional	Electi	ve
	Course Type	: Theo	ry		

Course Objective(s):

To introduce the students to the basic concepts and principles of various components of remote sensing

Course Outcome(s):

- **CO1:** Explain the theory behind Hyperspectral remote sensing observations and be able to select suitable data sources to investigate conditions in the land, vegetation, and atmosphere.
- **CO2:** Describe the applications of LiDAR and Microwave radar for various civil engineering applications.
- **CO3:** Explain how the Advanced remote sensing techniques will be used in the future extraction

CO/							PO						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Μ	Η		Μ	Μ	М					
CO2	Μ							Μ	Η	Η		Μ			
CO3	Μ					Μ		Μ	Μ	Η			Μ	Μ	Μ
CO4													Μ	Η	Η
CO5													Μ	Μ	Η

Mapping of Course Outcomes:

Unit1: Advanced Image Processing:

Data Fusion, Spectral Indices and Texture Analysis, object oriented image classification, Band differencing, Pattern recognition, linear and non-linear classifiers, Application of ANN and SVM techniques, Change Detection analysis.

Unit2: Hyperspectral Remote Sensing:

Introduction, sensors, data capture and analysis, SAM, Linear spectral unmixing, Applications and case studies will include environmental, disaster response assistance, agricultural, soilscience.

Unit3:Li Dar And Radar Remote Sensing:

LiDAR techniques, Sensor, Applications of terrain mapping, Corridor Mapping and Forest, Principles of Radar techniques, Altimetry, Scatterometry, Radar Interferometry Polarimetry, Synthetic Aperture Radar (SAR), Understanding SAR Images, SAR intensity Processing, TOPSAR data and DEM ,Shuttle Radar Topographic Mission (SRTM) data, Sea surface Roughness.

Unit4: Micro wave Remote Sensing

Principles, Properties of Microwaves, sensors, Microwave interactions with natural objects Active and Passive microwaves, Principles of data assimilation, Microwave Soil moisture mapping Flood mapping, Assessment of data assimilation in improving weather forecasting.

Unit5: Remote Sensing of Atmospheric Chemistry:

Aerosol remote sensing products, Cloud remote sensing products (MODIS and ISCCP), Remote sensing for mapping of SO2, CO and O3mapping

Reference(s) :

1. Sabins, F., Remote Sensing Principles and Interpretation, W. H. Freeman and Company, New York, 3rd edition,2007.

2. George Joseph, Fundamentals of Remote sensing, University Press, Second edition, 2005.

3. Thomas. M. Lillesand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.

CI1/10D 210	GEOGRAPHIC INFORMATION	L	Т	Р	Credit
CIV18R318	SYSTEMS	3	0	0	3
Pre-requisite:Nil	Course Category:	Profe	ession	al El	ective
CourseType: Theor	y				

Course Objective(s):

To provide an exposure to GIS and its practical applications in civil engineering

Course Outcome(s):

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

CO1: Students should be able to learn the basics and coordinate in Geographic Information System.

CO2: Students should be able to Explain the various components of GIS.

CO3: Students should be able to learn the various types of analysis in GIS

CO4: Gain knowledge in modeling software and recent application of GIS

CO5: Gain knowledge in GIS applications

Mapping of Course Outcomes:

CO/							PO						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			Μ						L						
CO2	Μ							Μ					Μ	Μ	Μ
CO3		Μ								L			Μ	Η	Η
CO4				Μ						L			Μ	Μ	Η
CO5		Μ							L						

UNIT1: Introduction to GIS

Map as a model of geographic data - types of maps – Scale, Map projections and coordinate systems

UNIT2: Components of GIS

Data models – Vector and Raster data structures – Topology – Meta data - Data input – Data Editing – Data Management – Data Display

UNIT3: GIS Analysis Concepts

Vector data analysis – Raster data analysis - set theory – intersection – union – Querying, overlay, buffering. Map statistics – Regional analysis, Network analysis – shortest path, location – allocation problems – GIS outputs.

UNIT4: Terrain Mapping and Analysis

Digital terrain modeling concepts – DEM generations, spatial interpolation - applications of DEM. Uncertainties and errors in GIS - Error propagation

UNIT5: GIS Applications

Socio-Economic data visualization and analysis, AM/FM Application – Natural resources – Change analysis Working with GIS Softwares and application demos. Project Work.

Text Book(s):

- 1. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications 2001
- 2. Burrough P.A., Principles of GIS for Land Resources Assessment, Oxford Publications, London, 2001
- 3.Basude Bhatta B "Remote Sensing and GIS" Oxford University Press, Second Edition, 2011Chennai.

Reference(s):

- 1. Star J. and Estes. J., GIS An Introduction, Prentice Hall, USA.
- 2. Kang-Isung Chang, Introduction to Geographical Information Systems, Tata Mcgraw Hill, New Delhi,2006
- 3. Robert Laurini and Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press, 1996.
- 4. Paul M.Mather, Computer applications in Geography, Wiley Publications, London, 2007
- 5. Giles M.Foody and Peter M.Atkinson, Uncertainty in Remote Sensing and GIS, Wiley Publications, New York, 2007

ENVIRONMENTAL ENGINEERING STREAM

CIV19D210	SOLID WASTE MANACEMENT	L	Т	Р	Credit
CIV10K319	SULID WASTE MANAGEMENT	3	0	0	3
Pre-requisite: Nil	Course Categor	y: Pr	ofessi	onal l	Elective
	Course Type : Th	eory			

Course Objective(s):

At the end of the course the students should able to analyze the properties of solid waste, onsite method of collection

Course Outcome(s):

CO1: Evaluate physical and chemical properties of solid waste and able to prepare a report. **CO2:**Evaluate different options for onsite storage and processing of solid waste onsite.

CO3: Recommend appropriate methods for solid waste collection and transportation.

CO4: Evaluate different options of offsite processing methods of solid waste.

CO5: Recommend engineered method of disposal of solid waste.

Mapping of Course Outcomes:

CO/]	PO						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	L	Μ					М	L	Μ	L	L		L	Μ	
CO2	L					L		L		L			L	М	
CO3	L	Μ											L	Μ	
CO4	L			L									L	Μ	
CO5	L							L					L	Μ	

UNIT1: Sources, Types and Characteristics of solid waste

Sources and types of solid waste, Methods of sampling and characterization, Effect of improper disposal of solid waste, Public health effect, Public awareness, Role of NGO, Principle of solid waste management, Legislation

UNIT2:On-Site Storage & Processing

On-site storage methods, materials used for containers, on-site segregation of solid wastes, public health & economic aspects of onsite storage, options under Indian conditions - critical Evaluation of Options

UNIT3: Collection and Transfer

Methods of Collection, types of vehicles, manpower requirement, collection routes; transfer stations, selection of location, operation & maintenance; options under Indian conditions.

UNIT4:Off-Site Processing

Processing techniques and equipment; resource recovery from solid wastes, composting, incineration, pyrolysis - options under Indian conditions.

UNIT5: Disposal

Dumping of solid waste; sanitary land fills - site selection, design and operation of sanitary landfills, Leachate collection & treatment

References

- 1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil Integrated Solid Waste Management, McGraw-Hill International edition, New York, 2nd edition, 1993
- 2. CPHEEO Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2016.
- 3. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, Waste Management, Springer, 1994.
- 4. William A. Worrell P. AarneVesilind ,Solid Waste Engineering, Cengage Publications, 2nd Edition

CIV/19D220	ECOLOCICAL ENCINEEDING	L	Т	Р	Credit
CIV 10K320	ECOLOGICAL ENGINEERING	3	0	0	3
Pre-requisite: Nil	Course Categor	y: Pr	ofessi	onal l	Elective
	Course Type : Th	eory			

Course Objective(s):

To incorporates knowledge in engineering, ecology and social sciences to produce energyand information-efficient solutions to environmental problems

Course Outcome(s):

CO1: Explain the basic concept of Ecological Engineering.

CO2: Explain functional elements and interactions between environmental systems.

CO3:. Describe Ecological Engineering Processes

CO4: Describe different eco technological approaches for wastewater treatment.

CO5: Strengthen the knowledge in eco technology by different case studies.

Mapping of Course Outcomes:

CO/							PO						PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н					L						Μ	Μ		Η
CO2				Μ		L		Μ							Η
CO3	Μ			Μ									Μ		
CO4				Μ									Η		
CO5				Μ											

UNIT1: Introduction To Ecology And Ecological Engineering

Aim, scope and applications of ecology – Development and evolution of ecosystems – Principles and concepts pertaining to communities in ecosystem – Energy flow and material cycling in ecosystems – productivity in ecosystems – Rationale of ecological engineering and ecotechnology – Classification of ecotechnology – Principles of ecological engineering.

UNIT2: Systems Approach In Ecological Engineering

Classification of systems – open and closed systems - Structural and functional interactions of environmental systems – Environmental systems as energy systems

UNIT3: Ecological Engineering Processes

Self-organizing design and processes – Multi seeded microcosms – Concept of energy – Determination of sustainable loading of ecosystems - Modelling and ecotechnology – Elements of modelling – Modelling procedure – Classification of ecological models – Applications of models in ecotechnology – Ecological economics.

UNIT4: Ecotechnology For Waste Treatment

Ecosanitation – Principles and operation of soil infiltration systems – Wetlands and ponds – Source separation systems – Aquacultural systems – Agro ecosystems – Detritus based treatment for solid wastes – Applications of ecological engineering for marine systems.

UNIT5: Case Studies

Case studies of Integrated Ecological Engineering Systems and their commercial prospects.

Text Book(s):

1.Rana, Essentials of Ecology and Environmental Science, Prentice Hall of India, New Delhi, 2nd Edition, 2006.

Reference(s):

- 1.Kangas, P.C. and Kangas, P., Ecological Engineering: Principles and Practice. Lewis Publishers, New York. 2003.
- 2.Etnier, C. and Guterstam, B., Ecological Engineering for Wastewater Treatment, Lewis Publishers, New York. 1997.

CIV19D201	ENVIDONMENTAL MANACEMENT	L	Т	Р	Credit
CIV10K321	EN VIRONVIEN I AL WANAGEWIEN I	3	0	0	3
Pre-requisite: Nil	Course Categor	y :Pro	ofessi	onal I	Elective
	Course Type : T	heory	7		

Course Objective(s):

This course explains about the components of environment and its sustainable development; also briefly describes about the managing of industrial wastes and the role of institutions in maintaining an eco-friendly environment. **Course Outcome**(s): At the end of the course, students would be able to

CO1: Illustrate the problems and disturbances associated with the natural environment.

CO2: Elaborate and identify the sources, causes and effects of water pollution.

CO3: Elaborate and identify the sources, causes effects air and noise pollution.

CO4: Illustrate the various management techniques of solid waste and soil pollution.

CO5: Explain the management strategies & Legislations available for protecting the environment.

CO/							PO						PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1		L	Н	Μ		Μ	Μ	L	Η	L		Н	М		Η	
CO2	Н	Η	Η	Μ	Η	Μ	Μ	L	Μ	Μ	Н	Μ		L	Η	
CO3	Н	Η	Н	Μ	Η	Μ	Μ	L	Μ	Μ	Н	Μ	Μ	L		
CO4		Н	Н	Μ	Η	Μ	Μ	L	Μ	Μ	Η	Μ	Η			
CO5		L	Н	Μ		Μ	Μ	L	Η	L		Μ		L		

Mapping of Course Outcomes:

UNIT1: Nature and Scope of Environmental Problems

Environment and sustainable development – Natural and human disturbances – Global warming –acid rain – ozone depletion – effects and control - climate change conventions – Kyoto protocol – India's efforts for Environmental protection – Public policy and role of NGO's

UNIT2: Water Pollution and Control

Fresh water and its pollution – Natural processes – sources and pollutants – effects on streams – limitations of disposal by dilution – BOD consideration in streams – Oxygen Sag Curve – Strategies for sustainable water management – Marine environment and its management – Water acts

UNIT3: Air and Noise Pollution

Pollutant emissions - sources and sink – effects of air pollution – their prevention and control – Control of particulates – Air pollution survey sand sampling – Air quality monitoring - Air Act – – Sound level – Effect of noise on people – Environmental noise control- noise pollution rules, 2000

UNIT4: Solid Waste Management and Soil Pollution

Sources – Characteristics – Quantities – Collection methods – Processing and disposal techniques – Onsite Handling, storage and processing – sanitary landfill – Incineration and pyrolysis – Composting – aerobic and anaerobic of compositing – Recycling and reuse of solid wastes – Hazardous wastes – Sources & types only – Integrated system for waste management; The Basel convention Land use and degradation – Management problems – strategies for sustainable land management – soil pollution – wetland conservation

UNIT5: Environmental Management System

EMS – Environmental standards – ISO 14000 (Series) – basic principles – Environmental Audit – Environmental Impact assessment - Trade rules and environmental protection– Practices For Waste Minimisation And Cleaner Production

Text Book(s):

1. N.K.Uberoi, Environmental Management, Excel Books, New Delhi, 2011.

Reference Book(s)

1. I.V Murali Krishna, Valli Manickam, Anil Shah, Environmental Management: Science and Engineering for Industry, BS Publications, 2017.

2. Balakrishnamoorthy, Environmental Management: Text and cases, PHI learning, 2017.

CIV18D222	CEO ENVIRONMENT ENCINEEDINC	L	Т	Р	Credit
CIV10K322	GEO-ENVIRONVIENT ENGINEERING	3	0	0	3
Pre-requisite: N	il Course Categor	y: Pr	ofessi	onal l	Elective
	Course Type : Th	eory			

Course Objective(s):

To know about the waste generation and mainly its disposal to maintain the stabilization of the environment

Course Outcome(s):

The students completing the course will have ability to

CO1:Describe the fundamentals of Geo-environmental engineering and waste soil interactions

CO2:Carryout site selection for carry out safe disposal of waste

- **CO3:**Apply soil-water-contaminant interactions in the design of waste containment systems and contaminated site remediation
- **CO4:**Explain different Waste Stabilization methods for soil improvement

CO5:Dsicuss different remediation techniques of Contaminated Soils

Mapping of Course Outcomes:

CO/	PO												PSC	C		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1				Μ			Μ						Μ			
CO2		Η		Н	М								L	L		
CO3				Μ									L			
CO4	L				L								Μ	Μ		
CO5	L				L								L			

UNIT1: Generation Of Wastes And Consquences Of Soil Pollution

Introduction to Geoenvironmental engineering – environmental cycle – sources, production and classification of waste – causes of soil pollution – factors governing soil pollution interaction clay minerals failures of foundation due to waste movement

UNIT2: Site Selection And Safe Disposal Of Waste

Safe disposal of waste – site selection for land fills – characterization of land fill sites and waste – Risk assessment – Stability of land fills – current practice of waste disposal – monitoring facilities – passive containment system – application of geosynthetics in solid waste management – rigid or flexible liners.

UNIT3: Transport Of Contaminants

Contaminant transport in sub surface, advection – diffusion – dispersion – governing equations – contaminant transformation – sorption – biodegradation – ion exchange – precipitation – hydrological consideration in land fill design – ground water pollution

UNIT4: Waste Stabilization

Stabilization - solidification of wastes – micro and macro encapsulation – absorption, adsorption, precipitation – detoxification – mechanism of stabilization – organic and inorganic stabilization – utilization of solid waste for soil improvement.

UNIT5: Remediation Of Contaminated Soils

Exsitu and insitu remediation-solidification, bio-remediation, incineration, soil washing, electro kinetics, soil heating, vetrification, bio-venting

Textbook(s)

- 1. Hari D. Sharma and Krishna R. Reddy, Geo-Environmental Engineering –John Wiley and Sons, INC, USA, 2004.
- 2. Daniel B.E., Geotechnical Practice for waste disposal, Chapman & Hall, London 1993.

Reference(s)

- 1. Westlake, K, Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.
- 2. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989
- 3. Proceedings of the International symposium of Environmental Geotechnology (Vol.I and II). Environmental Publishing Company, 1986 and 1989.
- 4. Ott, W.R. Environmental indices, Theory and Practice, Ann Arbor, 1978.
- 5. Fried, J.J. Ground Water Pollution, Elsevier, 1975.

CIV19D415	ADVANCE TECHNOLOGY FOR WATER	L	Т	Р	Credit
CIV10R415	3	0	0	3	
Pre-requisite: C	Course Category Course Category	y: Pro	ofessio	onal E	Elective
	Course Type : Theo	ry			

Course Objective(s):

The course is meant to give a more thorough theoretical understanding of the various unit advanced processes used in water and wastewater treatment.

Course Outcome(s):

CO1: Describe membrane technologies for treatment of water & wastewater.

CO2: Explain Electro Chemical Technologies used for treating water and wastewater.

CO3: Describe Plant Based Treatment Technology used for water and wastewater treatment.

CO4: Describe Enhanced Biological Treatment Process treatment of water & wastewater

CO5: Explain combined technologies used for treating of water and wastewater.

Mapping of Course Outcomes:

CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	М	М					L						Μ		
CO2	Μ	М					L						Μ		
CO3	Μ	М					L						Μ		
CO4	Μ	Μ					L						Η		
CO5	Μ	Μ					L						Μ		

Unit 1 Membrane Technologies

Types and choice of membranes, Membrane filtration, Filtration- theory- Reverse osmosis, Nanofiltration- Ultrafiltration- Microfiltration- Membrane Module/Element designs-Design of Bio Membrane systems- Characterization of membranes-Recent development in membranes, Membrane bioreactors Submerged anaerobic membrane bioreactors, Micro screening.

UNIT2: Electro Chemical Technology

Electrodialysis- principles- Electro Oxidation-Electro Coagulation, -Electro Deposition-Electro floatation -Electro Figuration- Electrooxdation

UNIT3 : Plant Based Treatment Technology

Treatment Plant- Scientific Valuer-Biological Nutrient Removal in ANAMMOX and SNAS Systems-Phytoremediation and plant Microbe interaction in remediation

Unit 4: Enhanced Biological Treatment Process

UV, UV/H₂O₂,sequential biofilter granular reactor, Ozonation, Advance Oxidation Process, Adsorption, Fenton Process

UNIT5: Combined Technology

Synthetic Membranes- composite membranes, MBR with advanced oxidation process, MBR with Adsorption.

Reference(s):

- 1. R.D. Noble and S.A. Stern, Membrane Separations Technology: Principles and Applications, Elservier, 2007.
- 3. Metcalf and Eddy, Wastewater engineering, Treatment and Reuse, Tata McGraw-Hill, New Delhi, 2011
- 4. J.G. Crespo and K.W. Boddekes, Membrane Processes in Separation and Purification, Kluwer Academic Publications, 2004.
- 5. R. Rautanbach and R.Albrecht, Membrane Process, John Wiley & Sons, 2010.

6.Simun Judd, Principle and Applications of Membrane bioreactors in water and wastewater treatment , Elsevier, 2011.

GEOTECHNICAL ENGINEERING STREAM

CIV10D/14	DOCK MECHANICS	L	Τ	Р	Credit
CIV10K410	RUCK MECHANICS	3	0	0	3
Pre-requisite:	CIV18R274 Course Catego	y: Pro	fessio	onal I	Elective
	Course Type: Theorem	У			

Course Objective(s):

To have an overview of the areas where rock mechanics principles are apllied for design and stability analyses

Course outcome(s):

- **CO1:** Understand Geological classification of rocks, engineering classifications and index properties of intact rocks.
- **CO2:** Analyze of rock engineering problems.
- **CO3:** Evaluate stresses in rock and measurements.
- **CO4:** Apply rock mechanics in engineering
- **CO5:** Understand the installation techniques and rock bolt systems.

Mapping of Course Outcomes:

CO/							PO							PSC)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	L			L										
CO2		L		Η											Μ
CO3			Μ		L								Μ		
CO4	Μ			L										Μ	
CO5		Н	Μ	Н	Η								Μ		

UNIT1: Classification and Index Properties of Rocks

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose.

UNIT2: Rock Strength and Failure Criteria

Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength – Stress strain behavior in compression – Mohr-coulomb failure criteria and empirical criteria for failure – Deformability of rock.

UNIT3: Initial Stresses and Their Measurements

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – technique for measurements of insitu stresses.

UNIT4: Application of Rock Mechanics In Engineering

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence

UNIT5: Rock Bolting

Introduction – Rock bolt systems – rock bolt installation techniques – Testing of rock bolts – Choice of rock bolt based on rock mass condition.

Text Book(s):

- 1. Goodman P.E., Introduction to Rock Mechanics, John Wiley and Sons, 1999.
- 2. Stillborg B., Professional User Handbook for rock Bolting, Tran Tech Publications, 1996.

Reference(s):

- 1. Brow E.T., Rock Characterisation Testing and Monitoring, Pergaman Press, 1991.
- 2. Arogyaswamy R.N.P., Geotechnical Application in Civil Engineering, Oxford and IBH, 1991.

CIV19D417	SOIL DYNAMICS AND MACHINE	L	Τ	Р	Credit
CIV 10 K4 17	FOUNDATIONS	3	0	0	3
Pre-requisite	: CIV18R274 Course Category	y: Pro	ofessi	onal	Elective
	Course Type: Theory	у			

Course Objective(s):

To familiarize students with the dynamic properties of soil. To create an understanding about the importance of designing machine foundation for reciprocating and impact machines.

Course Outcome(s):

CO1: Explain the vibration of elementary system.

CO2: Explain the waves and wave propagation.

CO3: Explain the dynamic behavior of foundations.

CO4: Design machine foundations.

CO5: Identify vibration isolation techniques

	Ŭ								1					D	
CO/									_	PO				P3	50
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			Μ		Η					L		Μ			
CO2					Η	L					Μ	L	Μ		Η
CO3	L		Μ								Н				Η
CO4			Η								Μ		Μ		
CO5													Η		

Mapping of Course Outcomes:

UNIT1: Introduction

Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping

UNIT2: Waves and Wave Propagation

Wave propagation in an elastic homogeneous isotropic medium- Raleigh, shear and compression waves-waves in elastic half space

UNIT3: Dynamic Properties of Soils

Elastic properties of soils-coefficient of elastic, uniform and non-uniform compression - shear-effect of vibration dissipative properties of soils-determination of dynamic properties of soil- codal provisions

UNIT4: Design Procedures

Design criteria -dynamic loads - simple design procedures for foundations under reciprocating machines - machines producing impact loads - rotary type machines

UNIT5: Vibration Isolation

Vibration isolation technique-mechanical isolation-foundation isolation-isolation by location- isolation by barriers- active passive isolation tests

Text Book(s):

- 1. Swamisaran, Soil Dynamics and Machine Foundations, Galgotia Publications Pvt. Ltd., 2014
- 2. Prakesh S. and Puri V.K, Foundation for machines, McGraw-Hill, New Delhi, 2013
- 3. Srinivasulu, P and Vaidyanathan, Hand book of Machine Foundations, McGraw-Hill, New Delhi,2006.
- 4. Kramar S.L, Geotechnical Earthquake Engineering, Prentice Hall International series, Pearson Education, Singapore
- 5. Kameswara Rao, Dynamics Soil Tests and Applications, Wheeler Publishing, New Delhi,2003

Reference(s):

- 1. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing, New Delhi,2012
- 2. IS code of Practice for Design and Construction of Machine Foundations, McGraw-Hill,1996.
- 3. Moore P.J., Analysis and Design of Foundation for Vibration, Oxford and IBH, 1995

CIV18R418	REINFORCED SOIL STRUCTURES	L	Т	Р	Credit
		3	0	0	3
Pre-requisite:CIV	18R274Course Category	Pro: Pro	ofessi	onal	Elective
	Course Type: Theory				

Course Objective(s):

To understand the principle of Geo membranes and reinforcing mechanism in earthern walls **Course Outcome(s):**

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

CO1: Understand the basis for confidently making and defending decisions when designing Geosynthetic - reinforced steep slopes and walls

CO2: Development an understanding of the fundamental concepts that govern the behavior of soils reinforced with geosynthetics.

CO3: Understand the historical development for external and internal stability.

CO4: Design guide for allowable tensile strength, vertical reinforcement spacing, and length of reinforcement, drainage, seismic loading issues and different facing systems.

CO5: Understand the application of Reinforced Soil structures

CO/]	PO						PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1			Μ		Н					L		М	Μ		Η	
CO2			Μ		Н	Μ					Н	М			Η	
CO3	Μ										Н		Μ			
CO4			Н								Μ		Η			
CO5			Μ		Η		Μ									

Mapping of Course Outcomes:

UNIT1: Introduction

Historical background - Principles of reinforcement of ground- Basic introduction to the elements of ground engineering characteristics of reinforcing materials- definition of reinforced and advantage of reinforced soils

UNIT2: Geotextiles

Definitions, functions, properties, and application of geotextiles, design of Geotextile applications geotextiles associated with other geosynthetics, testing on geotextiles, environmental efforts, ageing and weathering

UNIT3: Geomembranes

Definitions, functions, properties and applications of geomembranes, design of geomembranes applications Geomembranes associated with other geosynthetics, testing on geomembranes, environmental efforts, ageing andweathering

UNIT4: Reinforcement Mechanism

Soil reinforcement interaction, behaviour of Reinforced earth walls, basis of wall design, the Coulomb force method, the Rankine force methods, internal and external stability condition, field application of RE, randomly reinforced earth and analysis of reinforced soils, testing of soil reinforcements

UNIT5: Applications

Design of reinforced soil structures like retaining walls, embankments, foundation beds, landfills etc.; Case histories of applications.

Reference(s):

1. Bowles, J.E., Foundation Analysis and Design, McGraw Hill., 1996.

2. Braja M. Das, Principles of Foundation Engineering, Thomos Asia Pvt. Ltd., Singapore, 2005.

3. Shamsher Prakash, Soil Dynamics, McGraw - Hill Book Company, 1985.

CIT/10D 410	GROUND IMPROVEMENT	L	Τ	Р	Credit
CIV18R419	TECHNIQUES	3	0	0	3
Pre-requisite:CIV	8R274 Course Category	: Profe	ession	al Ele	ective
	Course Type: Theor	У			

Course Objective(s):

At the end of the course student is expected to identify the problematic soil and suitable suggest remedial measures to improve their behaviour.

Course Outcome(s):

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

- **CO1:** Students should be able to learn the basic principles of remote sensing
- **CO2:** Students should be able to Explain the application of remote sensing knowledge to civil engineering construction.
- **CO3:** Students should be able to learn the various types of satellite remote sensing and its engineering application.
- **CO4:** Gain knowledge in modern image interpretation and recent analysis techniques to be used
- **CO5:** Gain knowledge in grout techniques to be used

CO/							PO							PSC)
РО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ							Μ							
CO2				Μ					L						Μ
CO3		Μ							L				Μ		
CO4			Μ							L				Μ	
CO5		Μ						L					Μ		

Mapping of Course Outcomes:

Version 1.1

UNIT1: Introduction

Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.

UNIT2: Drainage and Dewatering

Drainage techniques - Well points - Vacuum and electro-osmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple casesonly).

UNIT3: InsituTreatment Of Cohesionless and Cohesive Soils

In situ densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.

UNIT4: Earth Reinforcement

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth–Use of geotextiles for filtration, drainage and separation in road and other works

UNIT5: Grout Techniques

Types of grouts - Grouting equipment and machinery - Injection methods - Groutmonitoring - Stabilization with cement, lime and chemicals - Stabilization of expansive soils.

Text Book(s):

- 1.Koerner R.M., Construction and Geotechnical Methods in Foundation Engineering, McGraw-Hill, New York1994.
- 2. Purushothama Raj, P., Ground Improvement Techniques, Tata McGraw-Hill Publishing Company, New Delhi, 1995

Reference(s):

- 1. Moseley M.P., Ground Improvement Blockie Academic and Professional, Chapman and Hall, Glassgow, 1993
- 2. Jones J.E.P., Earth Reinforcement and Soil Structure, Butterworth, 1995.
- 3. Koerner, R.M., Design with Geo synthetics, (3rd Edition) Prentice Hall, New Jersey, 2002

CIV19D420	MARINE FOUNDATION	L	Т	Р	Credit
CI V 10K420	ENGINEERING	3	0	0	3
Pre-requisite: Nil	Course Category: Pro	ofessi	onal	Electi	ive
	Course Type: Theory				

Course Objective(s):

The objective of the course to make the students to plan and develop the foundation system at marine level

Course outcome(s):

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

- **CO1:** Recommend suitable offshore investigation techniques for the proposed project and able to provide appropriate soil design parameters
- CO2: Analyze gravity structures, jacket by performing foundation analysis
- CO3: Analyze the foundation for jacket.
- CO4: Analyze jack-up kind of offshore structures.
- **CO5:** Analyse suitable anchor system for mooring structures

Mapping of Course Outcomes:

CO/]	PO				PS	50
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ				Η							Μ	Μ		Η
CO2		Μ	Η								Н				Η
CO3	Н											Μ	Μ		
CO4													Η		
CO5															

UNIT1: Offshore Soil Investigation:

General characteristics of offshore soil exploration – sampling using free corer, gravity corer, tethered systems and manned submersibles – deep penetration sampling using wire line techniques – sampling disturbances – mechanical and environmental - In-situ determination of strength of submarine soils – penetrometer, piezocone, vane and pressure meter techniques – penetration tests from tethered submersible platforms, manned submersibles and using wire line techniques - classification of marine soils – relative distribution of marine soils in the different marine regions – general characteristics of marine deposits in some specific locations and in the Indian subcontinent.

UNIT2: Foundations for Gravity Structures:

Types of gravity structures – Installation techniques – movement of gravity structures – settlement of soil beneath gravity structures – stress distribution beneath gravity structures – stability of gravity structures under static and cyclic loads.

UNIT3: Foundation for Jacket Type Structures:

Types – installation techniques – design considerations – axial and lateral load capacity of piles – lateral load deformation behaviour of piles – calculation of bearing capacity of piles-design of piles subjected to lateral loads – Reese – Matlock method and p-y curves method.

UNIT4: Foundations for Jack up Platforms:

Types of jack up platforms – piles and mat supported – spud cans – different types – installation techniques – techniques for removal of jack ups – stability of jack up platforms – determination of penetration of supports – stability under lateral loads –stability under static and cyclic load effects.

UNIT5: Sea Bed Anchors, Submarine Pipe Lines:

General introduction to sea bed anchors, moorings, submarine pipe line etc., - general design considerations (brief outline only) – geotechnical aspects in the design and installation of sea bed anchors, moorings, submarine pipe lines etc.,

Text Book(s):

- 1. Arous, D.A. (Ed.), Offshore Site Investigation, GrahamTrotman
- Chaney, R.C and Demars, K.R , Strength Testing of Marine Sediments Laboratory and In-situ Measurements, ASTM, STP-883

Reference(s) :

- 1. George P. and Wood D., Offshore Soil Mechanics, Cambridge UniversityPress.
- 2. Le Tirant, Sea Bed Reconnaissance and offshore Soil Mechanics for the Installation of Petroleum Structures, Gulf Publ.Company
- 3. Poulos, H.G and Davis, E.H, Pile Foundation Analysis Design, John Wiley, NewYork.

OPEN ELECTIVES:

CIV19D421	BUILDING SERVICES	L	Т	Р	Credit
CI V 10K421	BUILDING SERVICES	3	0	0	3
Pre-requisite:Nil	Course Catego	ry: C)pen E	Electiv	ve
CourseType:Theory					

Course Objective(s):

To know about the electrical system, refrigerant system in buildings

Course outcome(s):

CO1: To design a building with all essential facilities for better life style.

CO2: To create a sustainable structure.

CO3: To design a green building.

CO4: To Explain the refrigeration principles

CO5: To Explain the fire safety installation

Mapping of Course Outcomes:

CO/]	PO							PSO)
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	Μ	Μ			Η	Η					Μ			
CO2		Μ				Η	Η					Μ		L	
CO3	Μ	Μ	Η			Η	Η					Μ	Η	Η	
CO4		Μ		Η		Μ		Η		Μ			L		
CO5	Μ		Η		М		Н		Μ				L	Η	

UNIT1: Machineries

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT2: Electrical SystemsInBuildings

Basics of electricity – Single / Three phase supply – Protective devices in electricalinstallations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT3: PrinciplesOf Illumination&Design

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colourrendering.Design of

modern lighting systems– Lighting for stores, offices, schools, hospitals and house lighting -Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types

UNIT4:Refrigeration

Principles&Applications

Thermodynami cs – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub-cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged airconditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C.Systems

UNIT5: FireSafetyInstallation

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems - Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

Text Book(s):

- 1. Ambrose, E.R., Heat Pumps and Electric Heating, John and Wiley and Sons, Inc., New York, 2014.
- 2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2008.

Reference(s):

- 1 Philips Lighting in Architectural Design, McGraw-Hill, New York, 2004.
- 2. R.G.Hopkinson and J.D.Kay, The Lighting of buildings, Faber and Faber, London, 2009.
- 3. William H.Severns and Julian R.Fellows, Air-conditioning and Refrigeration, John Wiley and Sons, London, 2008.
- 4. A.F.C. Sherratt, Air-conditioning and Energy Conservation, the Architectural Press, London, 2000.

CIV18R422	DISASTER MANAGEMENT	L	Т	Р	Credit
		3	0	0	3
Pre-requisite:NilCo CourseType:Theory	ourse Category: Open Elective				

Course Objective(s):

To provide students an exposure to disasters, their significance and types; To ensure that students begin to understand the relationship between vulnerability, disasters, disaster

prevention and risk reduction

Course Outcome(s):

- **CO1:** To increase the knowledge and understanding of the disaster phenomenon and, its factors.
- **CO2:** Explain the relationship of hazard, risk and vulnerability
- **CO3:** To obtain the skills in role of education and training in disaster prevention.
- CO4: To ensure skills in post disaster management activities
- CO5: To get the knowledge in understanding various prone zones in India

Mapping of Course Outcomes:

CO/									P	0				PS	0
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Μ	Η		Μ	М	Μ			Μ		Μ
CO2	L							Μ	Η	Н		М	Μ	Η	Μ
CO3	L					Μ		Μ	Μ	Н			Μ	L	Μ
CO4								Η	Η	Μ			Μ	Μ	Μ
CO5	L							Η				М	Μ		Μ

UNIT1:UnderstandingDisaster

Introduction – Types of Disaster (Rapid disaster – Natural, manmade disaster and slow disaster – Natural, manmade disaster) – Factors of Disaster, Geology and topography, Weather and climate, Ecosystems, Humanfactors

UNIT2: Hazard, Risk and Vulnerability

Hazard classification and assessment - Hazard evaluation and hazard control - Concept And Elements of disaster risk - Techniques of Risk Assessment - Vulnerability Concept and Parameters, Risk and Vulnerability Relationship, Observation and PerceptionOf Vulnerability, Vulnerability Identification, Socio-Economic Factors of Vulnerability, Vulnerability Analysis.

UNIT3:Pre-DisasterManagementActivities

Introduction - Institutional arrangements - Vulnerability and capacity assessment -Prevention and mitigation - Structural Mitigation And Non-Structural Mitigation -Preparedness and planning - Institutional learning and memory - Warning indicators -Public Awareness, Role Of Education And Training In DisasterPrevention.

UNIT4:Post-DisasterManagementActivates

Critical stress debriefing – Debriefing Checklist – Claims and follow-up of disaster-Insurance companies – Sale of debris – The relative risk of communicable disease after disaster – Persistence of many serious communicabledisease

UNIT5: Disaster ManagementInIndia

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And
Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami - Rescue, Relief And Rehabilitation - National Disaster Policy Of India (Salient Features) - News Media In DisasterManagement - Impact Of Media On Policy.

TextBook(s):

- 1. D.B.N. Murthy, Disaster Management: Text and Case Studies, Deep & Deep Publications Pvt.Ltd.
- 2. Parag Diwan, "A Manual on Disaster Management", Ritomate International, Noida Special Economic Zone, India

Reference(s)

- 1. White, Gilbert F. and J. Eugene Hass, 1975, Assessment of Research on Natural Hazards, Cambridge, the MIT Press, MA
- 2. Larry R. Collins, "Disaster Management and Preparedness", CRCpress
- 3. Alexander, D. Natural Disasters, ULC press Ltd, London, 1993.
- 4. Carter, W. N. Disaster Management: A Disaster Management Handbook, Asian Development Bank, Bangkok, 1991.
- 5. Chakrabarty, U. K. Industrial Disaster Management and Emergency Response, Asian Books Pvt. Ltd., New Delhi2007.

CIV19D422	IDDICATION WATED MANACEMENT	L	Т	Р	Credit
CI V 10K425	IKKIGATION WATEK MANAGEMENT	3	0	0	3
Pre-requisite: CIV18	R319 Course Category	: Ope	n Eleo	ctive	
Course Type : Theo	ry				

Course Objective(s):

This course details the basics and types of irrigation in order to practice better irrigation water management on-farm development and command area development.

Course outcome(s): At the end of the course, students would be able to

CO1: Explain the basic requirements of irrigation system and identify the crop water demand

CO2: Analyze and suggest the best scheduling pattern of irrigation system

CO3: Elaborate the different techniques available for Optimized Irrigation Management

CO4: Demonstrate the performance indicators for water regulating structures

CO5: Illustrate the opportunities for practising Participatory irrigation management

CO /	PO												PSC)	
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Н					Η	Η					Μ		М	
CO2				Μ		М	Η	Μ						Η	
CO3	М			Н										L	
CO4				Μ										М	L
CO5				Μ		Η	Н						L		

Mapping of Course Outcomes:

Version 1.1

UNIT1: Irrigation System Requirements

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

UNIT2: Irrigation scheduling

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation

UNIT3: Management

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water

UNIT4: Operation

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

UNIT5: Involvement of Stake Holders

Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management

Text Book(s):

1.Dilip Kumar Majumdar, "Irrigation Water Management – Principles and Practice", PrenticeHall of India Pvt. Ltd., New Delhi, 2013

Reference(s):

1.M.H.Ali, Fundamentals of Irrigation and On-farm water management, Springer New York, 2010.

2.Blaine Hanson, Steve Orloff and Blake SandenMonitoring Soil Moisture for Irrigation water management, ANR, California, 2007.

CIV19D424	INDUSTRIAL WASTE WATER	L	Т	Р	Credit
CI V 10K424	MANAGEMENT	3	0	0	3
Pre-requisite: Nil	Course Categor	•y : O	pen E	lectiv	re
Course Type : T	heory				

Course Outcome(s):

CO1 : Compare the sources of waste water in industries, their types and important characteristics.

- **CO2:** Demonstrate the concepts of prevention vs. control of industrial pollution and waste minimization
- CO3: Examine basic methods of industrial waste water treatment

CO4: Analyze basic principles of waste water reuse and residual management

CO5: Case studies on industrial processes and water management in industries such as Textiles -

Tanneries – Dairy Industries - Sugar and Distilleries – Dairy Industries

INTRODUCTION

Industrial activity and Environment – Sources and types of industrial wastewater – Industrial wastewater and environmental impacts – Industrial waste survey – Industrial wastewater generation rates, characterization and variables – Population equivalent – Toxicity of industrial effluents and Bioassay tests

INDUSTRIAL POLLUTION PREVENTION

Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Source reduction techniques – Waste Audit – Evaluation of Pollution prevention options – Environmental statement as a tool for pollution prevention – Waste minimization

INDUSTRIAL WASTEWATER TREATMENT

Equalization - Neutralization - Oil separation - Flotation - Precipitation - Aerobic and anaerobic biological treatment - Wet Air Oxidation - Evaporation - Ion Exchange - Membrane Technologies

WASTEWATER REUSE AND RESIDUAL MANAGEMENT

Individual and Common Effluent Treatment Plants – Joint treatment of industrial wastewater -Quality requirements for Wastewater reuse – Industrial reuse – Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – management, Thickening, digestion, conditioning, dewatering and disposal of sludge

CASE STUDIES

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for: Textiles – Tanneries – Dairy Industries - Sugar and Distilleries

REFERENCES

- 1. Industrial Wastewater Treatment., Patwardhan A.D., PHI Learning Pvt. Ltd, New Delhi, 2017
- 2. Eckenfelder, W.W., Industrial Water Pollution Control, McGraw-Hill, 1999.
- 3. Wastewater Engineering, Treatment and Reuse, Metcalf and Eddy, McGraw-Hill International, 4th Edition (2003) (RP. 2016)
- 4. Arceivala, S.J., Wastewater Treatment for Pollution Control, Tata McGraw-Hill, New Delhi, 1998.
- 5. Frank Woodard Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi, 2001.

CIV19D425	ENVIRONMENTAL IMPACT	L	Т	Р	Credit
CIV10R425	ASSESSMENT	3	0	0	3
Pre-requisite: Nil	Course Category: C)pen H	Electi	ve	
Course Type : Th	neory				

Course Objective(s):

To provide a critical overview of the theory and practice of EIA as operated internationally

Course Outcome(s):

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

CO1: Develop of major problems in Environmental impact and control, regulations

CO2: Familiar with different methodologies adopted for predicting impact assessment.

CO3: Describe general environmental impact problems on men and materials.

CO4: Present mitigation of adverse impact on environment.

CO5: develop the Skill in EIA using different case studies.

Mapping of Course Outcomes:

CO/	PO	<u>0</u>													PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
CO1		Μ			Μ		Н							L				
CO2			L			Μ		L					М					
CO3				L		L							М					
CO4		Н			Μ								М					
CO5			Μ		Μ			L					Μ	Μ				

UNIT1: Introduction

Impact

of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA.

UNIT2: Methodologies

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case studies.

UNIT3: PredictionAnd Assessment

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA

UNIT4: Environmental Management Plan

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; addressing the issues related to the Project Affected People – ISO 14000

UNIT5: Case Studies

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

Text Book(s):

- 1. Canter, L., Environmental Impact Assessment, McGraw-Hill Inc., New Delhi, 2006.
- 2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 2002.

Reference(s):

- 1. John G. Rau and David C Hooten (Ed)., Environmental Impact Analysis Handbook, McGraw-Hill Book Company, New York, 2010.
- 2. Environmental Assessment Source book, Vol. I, II &III.The World Bank, Washington, D.C., 1991.
- 3. Judithpetts, handbook of environmental impact assessment vol. i& ii, blackwell science, 1999.

CIV19D426	SMADT CITV	L	Т	Р	Credit
CIV10K420	SWART CITT	3	0	0	3
Pre-requisite:NilC	ourse Category: Open Elective				
CourseType:Theory					

Course Objective(s):

To explain the solid waste management and urban transportation.

Course Outcome(s):

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

CO1:To study various methods of water and waste water management

CO2: To study various methods of solid waste management and pollution control

CO3: To study different types of urban transportation and infrastructure development

CO4: To study various types of disastermanagement

CO5: To learn about E- governance system

Mapping of Course Outcomes:

CO/	PO)													
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1					Η	Μ		Η	Μ	Μ			Μ	Η	Μ
CO2	Η							Η	Η	Μ		Μ	Μ	Η	Μ
CO3	Н					Μ		Μ	Μ	Н			Μ	Η	Μ
CO4								Η	Η	Μ			Μ	Η	Μ
CO5				Μ			Н						Μ	Η	Μ

UNIT1: Water&WasteWater

Water Supply Treatment - Water Extraction - Desalination - Macro Water Management-Water Conservation-Rain Water Harvesting - Waste-water Management & Recycling -Sanitation, Toilets & Safe Disposal - Effluent Treatment - Pumps, Valves, Compressors & Fittings – Distillation - FiltrationSystems

UNIT2: Solid Waste Management and PollutionControl

Collection, Storage, Transportation -Treatment and Disposal of Municipal -Industrial, Hazardous & Bio-medical-Waste - Waste Recycling - Waste-to-energy, Plastic-to-fuel - Biomethanation - Composting, Incineration/Combustion -Renewable and Alternative Energy -Carbon Credits -Environmental Education-Environmental Protection-Bio-fuels/Alternative Fuels-Eco-friendly TransportVehicles

UNIT3: Urban Transportation and InfrastructureDevelopment

Mass Rapid and Multi-modal Transport -Bus & Rail Systems - Traffic Control, Info and Management Systems - Fare and Toll Systems- Road Safety and Guidance-Road Markings and Signage's-Street Furniture and Lighting- Parking Solutions- Infrastructure Development for Airports, Roads, Bridges- SEZs, Business & Industrial Parks-Public Amenities-Electricity and LightingofRoads – DistributionofPower,Telecomand Energy-EnergyEfficient/Environment friendly/Ecologically appropriateoptions

UNIT 4:DisasterManagement

Fire Prevention, Protection & Rescue Equipment- Disaster Prevention and Management-Natural Calamity Mitigation-Riot, Vandalism and Unrest Control-Public Security Policing & Crime Prevention-Insurance & Loss Prevention-Anti Terrorism Equipment & Services- Audio& Video Surveillance Equipment-Equipment for rescue, recovery

UNIT5: E-Governance

E-governance solutions, hardware &software -GIS/GPS Solutions - Intelligent Networks – Telecommunication-ICT Applications – E-commerce and e-payments- ERP Solutions-Successful e-gov. /ICT application by States, Cities, Utilities

Reference(s)

1. Ministry of Urban Development Government of India smartcities.gov.in/

	INTRODUCTION TO REMOTE	L	Т	Р	Credit
CIV18R42/	SENSING	3	0	0	3
Pre-requisite:NilCou					
CourseType:Theory					

Course Objective(s):

This course will appeal to those students whose vocation or interests involve anyaspect of the physical environment of the earth's surface or near-surface. Remote sensing involves gathering information about the earth's surface remotely, and generally encompasses acquiring this data from aircraft orsatellites

Course Outcome(s):

CO1: To Retrieve the information content of remotely sensed data

CO 2: ToAnalyse the energy interactions in the atmosphere and earth surface features

CO3: To Interpret the images for preparation of thematic maps

CO4: To Apply problem specific remote sensing data for civil engineering applications **CO5:** To Evaluate the application of Remote sensing

CO5: To Evaluate the application of Remote sensing

CO/	PO												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Η	Μ	L	Μ					Н						
CO2	Μ	Μ	Η	Н							Μ		Μ	L	Μ
CO3	L	L	Η	Н							Μ		Μ	Η	Η
CO4	Μ	Η	L						Μ				L	Η	Η
CO5				Η					Μ				Η	L	

Mapping of Course Outcomes:

UNIT1: Physical Principles OfRemoteSensing

EM Waves – Matter interactions - energy sources and radiation principles - energy interactions intheatmosphere–AtmosphericWindows-Spectralreflectanceof earthsurface

Features-SpectralSignatures-water, vegetation and urban areas-Remote sensing platforms and methods

UNIT2: AerialPhotography

Introduction - Principles - B&W and Color photographs – film factors - aerial photogrammetry – relief displacement – parallax – height measurement – map preparation from aerialphotographs

UNIT3: SatelliteRemoteSensing

Visible, Infra Red and Microwave sensing - Active and passive sensors - Satellites and their sensors, Indian Space Programme - Sources of Data and Imagery

UNIT4: Image Interpretation, ClassificationandAnalysis

Interpretation principles – interpretation keys – Image Geometry- scale, and resolution -Image statistics – histograms – Image enhancement – Image rectification - Digital image analysis – edge detection – band rationing – vegetation indices - classification – supervised and unsupervised classification

UNIT5: ApplicationsofRemoteSensing

Multitemporal Analysis - change detection - vegetation mapping – land use land cover analysis, geological applications – water resources - urban mapping, and other applications

TextBook(s):

1. Lillesand, T.M. and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York2006.

2. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications, 2001.

Reference(s):

1. Manual of Remote Sensing, American Society of Photogram metric Engineering and Remote Sensing, 2003.

2. Charles Elachi, Introduction to the Physics and Techniques of Remote Sensing, 2nd Edition, Wiley Publishers, New York, 2007.

3. Paul M. Mather, Computer Processing of Remotely-Sensed Images, 3rd Edition, Wiley Publishers, London, 2007.

CIV19D429	REPAIR AND REHABILITATION OF	L	Т	Р	Credit								
CIV10R420	STRUCTURES	3	0	0	3								
Pre-requisite:Ni	Pre-requisite:NilCourseCategory: Open Elective												
CourseType: Theory													

Course Objective(s):

The course seeks to recognize the mechanisms of degradation of concrete structures, provide the students with the knowledge of available techniques and their application for strengthening or upgrading existing structural systems.

Course outcome(s):

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

CO1: Assess through and materials deficiency in concrete structures.

CO2: Suggest methods and techniques used in repairing/ strengthening existing concrete structures.

CO3: ApplyNon Destructive Testing techniques to field problems

CO4: Apply costeffective retrofitting strategies for repairs in buildings

CO5: Explain the repairsrehabilitation and retrofitting of structures

CO/	PO)												PSO		
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	Η		Μ		L							Μ	Η		Μ	
CO2		Μ									Μ	Μ	Η		Μ	
CO3				Η			L						Η	Μ	Μ	
CO4		L								L			Η	Μ	Μ	
CO5	Μ		Μ					Η				Η	Η		Μ	

Mapping of Course Outcomes:

UNIT1: Maintenance And Repair Strategies

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration

UNIT2:Serviceability And Durability Of Concrete

Quality assurance for concrete construction concrete properties- strength, permeability, thermalproperties and cracking. - Effects due to climate, temperature, chemicals, corrosion – designand construction errors - Effects of cover thickness and cracking

UNIT3:Materials For Repair

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete

UNIT4: TechniquesFor Repair And Demolition

Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and drypack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoringand underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion

UNIT5: Repairs, Rehabilitation And Retrofitting Of Structures

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure

Reference(s):

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 2011.

- 2. R.T.Allen and S.C.Edwards, Repair of Concrete Structures, Blakie and Sons, UK, 1987
- 3. M.S.Shetty, Concrete Technology Theory and Practice, S.Chand and Company, New Delhi, 1992.
- 4. Santhakumar, A.R., Training Course notes on Damage Assessment and repair inLowCostHousing,"RHDC-NBO"AnnaUniversity,July1992.
- 5. Raikar, R.N., Learning from failures Deficiencies in Design, Construction andServiceR&DCentre(SDCPL),RaikarBhavan,Bombay,1987.

CIV18D 420	CODDOSION ENCINEEDINC	L	Т	Р	Credit
CIV10K429	CORROSION ENGINEERING	3	0	0	3
Pre-requisite:Nil	Course Category: Open	Electi	ve		
CourseType: Theorem	ry				

Course Objective(s):

The objective of the course is to make students to become familiar with the most common forms of corrosion that are encountered in industry. It will enable students to carry out measurements of rates and observe forms of attack which canoccur.

Course Outcomes:

CO1 : To Explain the basic knowledge of corrosion

- **CO2** : To Explain the corrosion factors in steel and concrete
- **CO3** : To Explain the basic test on corrosion techniques.

CO4 : To Explain the basic test on corrosion techniques.

Mapping of Course Outcomes:

CO/	PO	PO											PSO				
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
CO1	Μ								Η								
CO2											Μ						
CO3											Μ		Η	Μ	Η		
CO4									Μ				Η	Μ	Η		
CO5																	

UNIT1: Corrosion

Corrosion - Definition, classification, forms of corrosion, expressions for corrosion rate, emf and galvanic series , merits and demerits, Pourbaix diagram for iron, magnesium and aluminium - Forms of corrosion, Uniform, pitting, intergranular, stress corrosion - Corrosion fatigue - Dezincification - Erosion corrosion - Crevice corrosion - Cause and remedial measures, Pilling Bed worth ratio, High temperatureoxidation

UNIT2: CorrosionOf ConcreteAndSteel

Introduction of corrosion of steel in concrete – factors responsible for corrosion of steel in concrete – transport mechanisms of ions in concrete – corrosion of reinforced and prestressed concrete – corrosion of blended cement concrete – corrosion monitoring in R.C.C. and pre-stressed concrete structures – special steels and concretes – coating to concrete – coatings to steel – repairing of corroded concrete structures – repair materials – residual life estimation –deteriorationofconcrete.

UNIT3: CorrosionTesting

Purpose of corrosion testing, classification, humidity and porosity tests, accelerated weathering tests - Chloride ion test and impedance analysis - ASTM standards for corrosion testing

UNIT4: Polarization

Polarization - Exchange current density, Activation polarization, Tafel Equation, Passivating metals and nonpassivating metals, Effect of oxidizing agents

UNIT5: Electroless PlatingAndAnodising

Coating based on cements – cathodic protection of concrete structures – sacrificial anodes – impressed current cathode

Text Book(s):

1. Fontana and Greene. Corrosion Engineering, McGraw Hill Book Co, New York, 2013 2.Raj Narayan ., An Introduction to Metallic Corrosion and its prevention, Oxford andIBH, New Delhi, 2013

Reference(s):

1. Budinski, K.G., Surface Engineering for Wear Resistance, Prentice Hall Inc., Engelwood Cliff, New Jersey, USA,2008

2. Uhlig, H.H ., Corrosion and Corrosion Control , John Wiley and Sons, New York, USA, 2005

CIV19D420	A ID DOLL LITION AND CONTROL	L	Т	Р	Credit
CI V 10 K4 30	AIR FOLLUTION AND CONTROL	3	0	0	3
Pre-requisite: Nil	Course Catego	ry: O	pen E	Electiv	'e
Course Type : The	eory				

Course Objective(s):

The course has been designed to improve the understanding of the students about air pollution control strategies and the skills on remediation techniques to combat pollution.

Course Outcome(s):

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

CO1: Elaborate the fundamentals of indoor air pollution and monitoring system

CO2: Identify the suitable technique to control particulate contaminants

CO3: Identify the suitable technique to control gaseous contaminants

CO4: Demonstrate the concept of biological air pollution and suggest a suitable controlling technique

CO5: Illustrate the standards available for noise pollution and identify the suitable control measures

CO/	PO	РО										PSO			
PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	Μ	Μ		Μ	Η	Η	L	Η	Н	L	Μ	Η	Μ		Η
CO2	Μ	Η	Н	Н	Η	L	L	Н		L	Μ	Μ		L	Η
CO3			Η	Н		L	L	Н		L	Μ	Н	Μ	Μ	
CO4	Μ	Η				L	L	Н	Μ	L	Μ	Н	Η	Μ	
CO5				Η	Μ	Η	L	Η	Μ	L	Μ	Μ		Μ	

Mapping of Course Outcomes:

UNIT1: Introduction

Air quality management - Sources and classification of pollutants and their effect - Global implications - Meteorology Fundamentals - Atmospheric stability – Atmospheric turbulence - mechanical and thermal turbulence - Wind profiles – Plume rise - Ambient air quality and emission standards – Air pollution indices – Indoor Air Pollutants – Models – Air Quality Sampling and Monitoring.

UNIT2: Control of Particulate Contaminants

Settling chambers - Filters, gravitational, Centrifugal – multiple type cyclones, prediction of collection efficiency, pressure drop, wet collectors, Electrostatic Precipitation theory – ESP design – Operational Considerations – Process Control and Monitoring – Automobile air pollution and control

UNIT3: Control of Gaseous Contaminants

Absorption – principles - description of equipment-packed and plate columns - design and performance equations – Adsorption - principal adsorbents - Equipment descriptions – Design and performance equations – Condensation - Incineration - Equipment description

UNIT4: Biological Air Pollution

Biological Air Pollution - Control Technologies – Bio Scrubbers, Bio filters – Operational Considerations – Process Control and Monitoring

UNIT5: Noise Control

Noise Standards - Measurement - Modelling - Control and preventive measures.

Text Book(s):

1. Noel de Nevers, Air Pollution Control Engg., McGraw-Hill, New York, 2017.

Reference(s):

1. Lawrence Kwan, Norman C Perelra, Yung-Tse Hung, Air Pollution Control Engineering, Springer Science Business Media, New York, 2007.

2. David H.F Liu, Bela G.Liptak, Air Pollution, Lewis Publishers, 2000.

3. Singal, S.P., Noise Pollution and Control Strategy, Narosa Publishing House, New Delhi, 2005.

	CIV10D200	COMMUNITYSEDVICEDDOIECT	L	Т	P	С
CIV 18K399	COMMUNITYSERVICEPROJECT	0	0	6	3	

OBJECTIVE:

- Todeveloptheabilitytosolveaspecificproblemrightfromitsidentificationandli teraturereviewtillthesuccessful solution of the same.
- Totrainthestudentsinpreparingprojectreportsandtofacereviewsandvivavoce examination.

STRATEGY:

The student works on a topic approved by the head of the department under the guidanceof a faculty member and prepares a comprehensive project report after completing theworktothesatisfaction. The student will be evaluated based on the reporta ndthevivavoce examination by ateam of examiners including one external examiner.

OUTCOME:

OnCompletionoftheprojectworkstudentswillbeinapositiontotakeupanychallenging practicalproblems and find solution by formulating propermethodology

CIV19D400	BBO JECT WORK	L	Τ	P	C
CIV18R499	PROJECT WORK	0	0	20	10

OBJECTIVE:

- Todeveloptheabilitytosolveaspecificproblemrightfromitsidentificationandli teraturereviewtillthesuccessful solution of the same.
- Totrainthestudentsinpreparingprojectreportsandtofacereviewsandvivavoce examination.

STRATEGY:

The student works on a topic approved by the head of the department under the guidanceof a faculty member and prepares a comprehensive project report after completing thework to the satisfaction. The student will be evaluated based on the report and the vivavoce examination by ateam of examiners including one external examiner.

OUTCOME:

OnCompletionoftheprojectworkstudentswillbeinapositiontotakeupanychallenging practicalproblems and find solution by formulating propermethodology

CIVX005	SUSTAINABILITY FOR ENGINEERS	L	Τ	P	С
		0	0	0	1

Course Outcomes:

1. Create new engineering materials to improve the performance of infrastructure

2. Characterize and mitigate natural and man-made hazards

3. Improve fundamental knowledge of the inter-relationships between the built environment and natural systems.

4. Develop the technological innovations needed to safeguard, improve, and economize infrastructure and society.

Unit I-Fundamentals of Sustainable Construction Engineering

Sustainability and resources, need, present practices at national and international level, The Sustainability Quadrant- challenges & Issues, Government initiatives.

Unit II- Product sustainability

Construction Product, Process Design and Development- Sustainability of construction resources, process modifications, product performance evaluation.

Unit III-Evaluation

Sustainability assessment using standard approaches- LEED/GRIHA rating evaluation process.

Unit IV- Feasibility of sustainable construction

Socio-economic feasibility of sustainable construction products- Innovative & customized sustainable product design based on social constraints, tools & aids available for sustainable construction products.

Unit V-Life Cycle Assessment and Costing

Various aspects related to construction cost, present value analysis, life cycle stages, cost calculation & measures, evaluation criteria, uncertainty assessment, sensitivity analysis, break even analysis.

REFERRENCE:

1. Sustainable Engineering Practice ASCE Publication 2010.

2. Hagger Sustainable Industrial Design and Waste Management, Techniz Book 2010.

3. Helmut Rechberger, Practical handbook of Material Flow Analysis, Taylor & Francis. 2010.

4. Michael Z. Hou, HepingXie, Jeoungseok Yoon Underground Storage of CO2 and Energy Taylor & Francis, 2010.

CIVX006	DOAD SAFETV IN INDIA	L	Τ	P	С
	KOAD SAFETT IN INDIA	0	0	0	1

Course Objectives:

- This module on the fundamental of traffic engg. &some of the statistics methods to analysis the traffic safety.
- The accident interrogations 7 risk involved with measures to identity the causes are dealt.

- The role of road safety in planning the urban infrastructures design is discussed.
- The various traffic management systems for safety & safety improvement strategies are dealt.

Course Outcomes:

- To understand fundamental of Traffic Engg.
- To investigate & determine the collective factors & remedies of accident involved.
- To design & planning various road geometrics.
- To massage the traffic system from road safety point of view.

Unit – I: Fundamentals of Traffic Engineering

Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

Unit - II: Accident Investigations and Risk Management,

Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction

Unit – III: Road Safety in Planning And Geometric Design:

Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care

Unit – IV: Role of Urban infrastructure design in safety:

Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their Safety.

Unit – V: Traffic Management Systemsfor Safety

Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

References:

- Traffic Engineering and Transportation Planning L.R. Kadiyali, Khanna Publishers
- Fundamentals of Transportation Engineering C.S. Papacostas, Prentice Hall India.
- Transportation Engineering An Introduction, C.Jotinkhisty, B. Kent Lall
- Fundamentals of Traffic Engineering, Richardo G Sigua
- Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson
- Road Safety by NCHRP.

CIVY007	DATA ACQUISTION AND SIGNAL CONDITIONING	L	Т	P	С	
	DATA ACQUISTION AND SIGNAL CONDITIONING	0	0	0	1	

Course Objectives:

To understand concepts of acquiring the data from transducers/input devices, their interfacing and instrumentation system design.

Course Outcomes:

- 1. Elucidate the elements of data acquisition techniques.
- 2. Design and simulate signal conditioning circuits.
- 3. Explain various data transfer techniques
- 4. Understand the components of data acquisition system

Unit I: Data Acquisition Techniques: Analog and digital data acquisition, Sensor/Transducer interfacing, unipolar and bipolar transducers, Sample and hold circuits, Interference, Grounding and Shielding.

Unit II: Data Transfer Techniques: Serial data transmission methods and standards RS 232-C: specifications connection and timing, 4-20 mA current loop, GPIB/IEEE-488, LAN, Universal serial bus, HART protocol, FoundationFieldbus, ModBus, Zigbee and Bluetooth.

Unit III: Data Acquisition with Op-Amps: Operational Amplifiers, CMRR, Slew Rate, Gain, Bandwidth. Zero crossing detector, Peak detector, Window detector. Difference Amplifier, Instrumentation Amplifier AD 620, Interfacing of IA with sensors and transducer, Basic Bridge amplifier and its use with strain gauge and temperature sensors, Filters in instrumentation circuits,

Unit IV: Data Acquisition System (DAS): Single channel and multichannel, Graphical Interface (GUI) Software for DAS, RTUs, PC-Based data acquisition system.

Unit V- Laboratory Work: Op-amp as a comparator and its application, Integrator and differentiator, Active filters, Simulation of the above applications using ORCAD, Instrumentation Amplifier/AD 620, Interfacing of sensors and transducers using DAQ cards.

Text Books:

1. Coughlin, R.F., Operational Amplifiers and Linear Integrated Circuits, Pearson Education (2006).

2. Kalsi, H.S., Electronic Instrumentation, Tata McGraw Hill (2002).

3. Gayakwad, R.A., Op-Amp and Linear Integrated Circuits, Pearson Education (2002).

4. Mathivanan, N., Microprocessor PC Hardware and Interfacing, Prentice Hall of India Private Limited (2007).

Reference Books:

1. Ananad, M.M.S., Electronic Instruments and Instrumentation Technology, Prentice Hall of India Private Limited (2004).

2. Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Private Limited (2006)

CIVX008	REMOTE SENSING AND GIS APPLICATIONS IN	L	Т	P	С	
	WATER RESOURCES MANAGEMENT	0	0	0	1	

Course Objective:

This course will enable the students to use RS and GIS tools in the integrated water resource management, oceanography, glaciology and watershed development.

Course Outcomes:

- To understand fundamental of Remote Sensing
- To investigate & determine the collective factors of water resource
- To design & planning various road through GIS
- To design the irrigation system various safety point of view

Unit I: Introduction: Hydrology – definition and its importance, hydrological cycle, water budgeting, water demand estimation, surface water bodies, water content in ocean, sea, ice, lakes, dams, tanks, rivers and ground, water resource scenario in India and Karnataka, RS and GIS applications in water resources development and management.

Unit II: Meteorology, Glaciology and Surface Fresh Water: Rainfall mapping, potential and actual evapo-transpiration, atmospheric water content, cloud mapping, rain forecasting, water quality parameters, cyclone forecasting; Glaciology: monitoring of snow melt and snow formation, snowmelt runoff estimation, estimation of damages; Surface Fresh Water: river diversion studies, site suitability for surface storages and hydro-electric power plants, storage yield analysis and reservoir sizing.

Unit III: Oceanographic studies: Definition, concepts and importance of ocean, ocean resources, ocean process, satellite and sensors for ocean studies, sea ice monitoring, estimation of wind velocity and direction, sea surface temperature, salinity, ocean colour, phytoplankton mapping, potential fishing zones, suspended sediment concentration mapping, bathymetry.

Unit IV: Irrigation and Watershed: Mapping and monitoring of catchment and command areas, land irrigability mapping, agriculture water demand estimation for different crops, tank information system, wetland mapping, siltation mapping;

Unit V: Watershed: delineation, morphometric analysis, rainfall-surface runoff model, reservoir

sedimentation, water-harvesting structures, watershed development planning, mapping of drought prone areas.

References:

- 1. GIS for Water Resources and Watershed Management John G Lyon
- 2. Application of GIS in Hydrology and Water Resources Management K.Kovar
- 3. Geographic Information Systems in Water Resources Engineering Lynn E.Johnson
- 4. Developments In Water Science Water Resources Systems Planning and Management Jain S.K and Singh V.P
- 5. Water, Waste water and Storm Water Systems U.M. Shamsi
- 6. Introduction to Environmental Remote Sensing Barrett E C
- 7. Remote Sensing principles and interpretation Sabins F. F.
- 8. Remote Sensing and Image Interpretation Thomas M Lillesand

CIVX009	UAV REMOTE SENSING AND APPLICATION	L	Т	Р	С
		0	0	0	1

CO1 : To Retrieve the information content of remotely sensed data

CO 2 : To Analyse the energy interactions in the atmosphere and earth surface features

CO 3 : To Interpret the images for preparation of thematic maps

CO 4 : To Apply problem specific remote sensing data for civil engineering applications

Unit I : Integrating Drones into Geomatics: Principles

UAV Photogrammetry and Remote Sensing Principles UAV Applications, UAV Technology and Imagery Acquisition, UAV Remote Sensing, UAV Photogrammetry / Orthophoto, Digital Elevation Models (DEM) and 3D Point Cloud Generation, UAV & Space Systems for Earth Observation, UAV Image Processing, Drones Remote Sensing - Utilities, Construction and Infrastructure Management

Unit II : Applications

Drones Remote Sensing - Oil and Gas Industry, Drones Remote Sensing - Precision Agriculture, Drones Remote Sensing - Marine Projects, Drones Remote Sensing - Surveying and 3D City Models, Drones for Surveillance and Search & Rescue, UAV Humanitarian, Drones Remote Sensing – Archaeology

Unit III: UAV Remote Sensing Mission Planning, Operations

UAV Operations and Mission Planning (Demo/Practical), UAV Technology, UAV Planning and Operations, UAV Autopilots.

Unit IVData Processing and Project Management

Autonomous Mission Planning, UAV Legislation and Legal Aspects UAV Remote Sensing Payload and Onboard Sensors (Demo/Practical),

Unit VImagery

Multispectral Imagery, Hyperspectral Imagery, Thermal Imagery, Lidar Imagery, RGB Imagery

Textbooks

- 1. Barnhart, R., Michael, M., Marshall, D., and Shappee, E. ed. 2016. Introduction to Unmanned Aircraft Systems, 2nd edition.
- 2. Fahlstrom, P. and Gleason, T. 2012. Introduction to UAV Systems. 4th edition. United Kingdom. John Wiley & Sons Ltd
- 3. Wolf, P., DeWitt, B., and Wilkinson, B. 2014. Elements of Photogrammetry with Applications in GIS, 4th edition. McGraw-Hill

CIVX010	EQUNDATION DESIGN	L	Τ	P	С
	FOUNDATION DESIGN	0	0	0	1

Course Outcomes:

After completion of the course student will be able to:

- 1. Understand various methods of Soil Exploration and its importance.
- 2. Analyze bearing capacity and settlement of soil for shallow foundation.
- 3. Design the various types of shallow foundation and understand the basics of deep foundation.
- 4. Understand the characteristics of well foundations and retaining wall.
- 5. Understand the concept of soil reinforcement.

Unit 1Introduction to soil exploration

Methods of boring and drilling, soil sampling and sampler, insitu tests, SPT, CPT, DCPT, geophysical methods; soil resistivity methods seismic refraction methods.

Unit 2Bearing capacity of shallow foundation

Design criteria, factors affecting bearing capacity, factors influencing selection of depth of foundation, modes of shear failures, types of shallow foundations, contact pressure under rigid and flexible footings, Terzaghi's, Meyerhof, Hansen's bearing capacity theories, IS code method Settlement of shallow foundations: components of settlement & its estimation, immediate, consolidation, & differential settlements.

Unit 3Design of shallow foundation;

Principles of design of footing, design of isolated footings and strip footing. Deep foundation; introduction, necessity of deep foundations, pile installation, pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, single and double under reamed piles.

Unit 4Introduction toshapes and characteristics of wells

Components of well foundation, forces acting on well foundation, sinking of wells, causes and remedies of tilts and shifts. Retaining walls: introduction, types of retaining structures, support systems for flexible retaining walls (struts, anchoring), construction methods, introduction and uses of sheet piles.

Unit 5 Geotechnical properties of reinforced soil

Use of soil reinforcement, shallow foundation on soil with reinforcement, design considerations, idealized soil, foundation and interface behaviour, elastic models of soil behaviour.

Reference Books:

1) Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi

2) Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai

3) Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.

4) Joseph E. Bowles: Foundation analysis and design.McGraw-Hill Higher Education

5) Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd.

6) Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi

7) B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.

8) V. N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants, Banglore

9) P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.

10) I.H. Khan – Text Book of Geotechnical Engineering

11) C. Venkataramaiah – Geotechnical Engineering

12) Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering

13) Gulati, S.K., "Geotechnical Engineering" McGraw Hill Education (India), Pvt. Ltd., Noida

CIVX011 INTEGRATED WASTE MANAGEMENT FOR A SMART CITY	L	T	Р	С	
		0	0	0	1

CO1: Describe membrane technologies for treatment of water & wastewater.

CO2: Explain Electro Chemical Technologies used for treating water and wastewater.

CO3: Describe Plant Based Treatment Technology used for water and wastewater treatment.

CO4: Describe Enhanced Biological Treatment Process treatment of water & wastewater

CO5: Explain combined technologies used for treating of water and wastewater.

Unit-1 Introduction:

Solid Waste Management- Definition, Concept of 4Rs (reduce, reuse, recycle and recover) of waste management, Elements of a waste management system, Current Issues in Solid Waste Management, Integrated Waste Management Hierarchy: Source reduction, Recycling, Waste-to-Energy and Landfilling. Review of waste management under Swachh Bharat Mission and Smart Cities Program.

Unit-2 Municipal Solid Waste:

Waste Composition and Quantities, Collection, Transportation, Segregation, and Processing.

Unit-3 Disposal of Municipal Solid Waste:

Landfill, Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste. Municipal Solid Waste (MSW) Rules 2016.

Unit-4 Construction and Demolition (C&D) Waste Management:

Overview, Components; C&D Waste Management Rules 2016, Beneficial Reuse of C & D Waste Materials.

Unit-5 Electronic Waste (E-Waste) Management

Issues and Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges. Hazardous Wastes: Definition, Classification, Risk assessment, Transportation of hazardous waste, Current Management Practices: Environmental audit, Containment, Remedial alternatives.

Books:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil, Integrated Solid Waste management, Tata McGraw Hill

2. Ramachandra T.V., Management of Municipal Solid Waste, 2009; by The Energy and Resource Institute, TERI

3. Sasikumar, K, Gopi Krishna, Sanoop, Solid Waste Management; 2009, PHI.

References:

1. Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO), India

2. MSW Management Rules 2016, Govt. of India, available online at CPCB website

3. Construction and Demolition Waste Management Rules, 2016, MoEF&CC

4. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.

5. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York

6. http://swachhbharatmission.gov.in/sbmcms/index.htm

7. http://swachhbharaturban.gov.in/

8. O P Gupta, " Element of hazardous waste management, Khanna Publishing House.

CIVX012	PRINCIPLE OF CONSTRUCTION MANAGEMENT	L	Т	Р	С
		0	0	0	1

Course Objectives:

- Understand the broad principles and concepts of construction management
- To create awareness of MIS techniques in construction industry
- Represent various works measurement standards

Course Outcomes:

- Ability to take responsibilities as construction manager
- Application of MIS technique in the real time construction operation
- Knowledge of work measurement application in construction industry

UNIT - I Introduction to management, science or art, history of construction management,

modern management, system approach and emergence of management thought, need, nature and purpose of construction management, major problems in construction industry, firm organization, chain of command, division of work, organization charts, functions and responsibilities of construction manager, case studies, future of construction management.

UNIT – II Principles of construction management; planning, organizing, staffing, leading, controlling. Decision making in construction industry, nature of managerial decision making, the rational model of decision making, challenges to the rational model, improving the effectiveness of decision making tools and techniques, benefit-cost analysis, replacement analysis, break even analysis, risk management in construction industry.

UNIT – III Site mobilization and demobilization aspects, various resource management based on funds availability, organization and monitoring of the construction work with respect to cost-time schedules, coordinating, communicating and reporting techniques, Application of MIS to construction, Training of Construction Managers.

UNIT – IV Work Study: Definition, Objectives, basic procedure, method study and work measurement, work study applications in Civil Engineering. Method study – Definition, Objective, Procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams.

UNIT - V Work measurement – Time and motion studies, Concept of standard time and various allowances, time study, equipment performance rating. Activity sampling, time - lapse photography technique, Analytical production studies.

References:

1. Tenah, K.A. (1985). "The Construction Management Process" Reston Publishing Company, Inc. Virginia, USA.

2. Roy Pilcher (1985) "Project Cost Control in Construction," Collins Professional and technical books, London.

3. Raina, C.M. "Construction Management and Practice." Tata McGrawHill, New Delhi, 1980.

4. Construction Planning & management By P S Gahlot& B M Dhir , New Age International Limited Publishers

5. Construction Project planning & Scheduling By Charles Patrick, Pearson, 2012

6. Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson, 2012

7. Construction management Fundamantals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill, 2nd Edition, 201

8. Modern construction management--.Harris, Wiley India.

9. Construction Management and Planning by Sengupta and Guha-Tata McGraw Hill publication.

10. Project Management – K Nagrajan – New age International Ltd.

11. Work study – Currie.

12. Professional Construction Management Barrie-Paulson-McGraw Hill Institute Edition.

13. Project Management – Ahuja H.N. – John Wiely, New York.

14. Construction Project Management Planning, Scheduling and Controlling-Chitakara- Tata McGraw Hill, New Delhi

15. Construction Management – Roy, Pilcher

16. Construction Management – O'Brien.

17. Project Management-Planning and Control---Rory Burkey 4th ed.— Wiley, India.

CIV0008	INTEGRATED WASTE MANAGEMENT FOR A SMART CITY	L	Т	Р	С
		0	0	0	1

CO1: Describe membrane technologies for treatment of water & wastewater.

CO2: Explain Electro Chemical Technologies used for treating water and wastewater.

CO3: Describe Plant Based Treatment Technology used for water and wastewater treatment.

CO4: Describe Enhanced Biological Treatment Process treatment of water & wastewater

CO5: Explain combined technologies used for treating of water and wastewater.

Unit-1 Introduction:

Solid Waste Management- Definition, Concept of 4Rs (reduce, reuse, recycle and recover) of waste management, Elements of a waste management system, Current Issues in Solid Waste Management, Integrated Waste Management Hierarchy: Source reduction, Recycling, Waste-to-Energy and Landfilling. Review of waste management under Swachh Bharat Mission and Smart Cities Program.

Unit-2 Municipal Solid Waste:

Waste Composition and Quantities, Collection, Transportation, Segregation, and Processing.

Unit-3 Disposal of Municipal Solid Waste:

Landfill, Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste. Municipal Solid Waste (MSW) Rules 2016.

Unit-4 Construction and Demolition (C&D) Waste Management:

Overview, Components; C&D Waste Management Rules 2016, Beneficial Reuse of C & D Waste Materials.

Unit-5 Electronic Waste (E-Waste) Management

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2. Ramachandra T.V., Management of Municipal Solid Waste, 2009; by The Energy and

Resource Institute, TERI

- 3. Sasikumar, K, Gopi Krishna, Sanoop, Solid Waste Management; 2009, PHI.
- **References:**

1. Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO), India

- 2. MSW Management Rules 2016, Govt. of India, available online at CPCB website
- 3. Construction and Demolition Waste Management Rules, 2016, MoEF&CC
- 4. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.

5. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York

6. http://swachhbharatmission.gov.in/sbmcms/index.htm

7. http://swachhbharaturban.gov.in/

8. O P Gupta, " Element of hazardous waste management, Khanna Publishing House.

CIV007	CIV007 WASTE WATER TREATMENT AND RECYCLING	L	Τ	Р	С
		0	0	0	1

Course Outcome(s):

CO1: Describe membrane technologies for treatment of water & wastewater.

CO2: Explain Electro Chemical Technologies used for treating water and wastewater.

CO3: Describe Plant Based Treatment Technology used for water and wastewater treatment.

CO4: Describe Enhanced Biological Treatment Process treatment of water & wastewater

CO5: Explain combined technologies used for treating of water and wastewater.

Unit-1 Introduction:

Solid Waste Management- Definition, Concept of 4Rs (reduce, reuse, recycle and recover) of waste management, Elements of a waste management system, Current Issues in Solid Waste Management, Integrated Waste Management Hierarchy: Source reduction, Recycling, Waste-to-Energy and Landfilling. Review of waste management under Swachh Bharat Mission and Smart Cities Program.

Unit-2 Municipal Solid Waste:

Waste Composition and Quantities, analysis of water Collection, Transportation, Segregation, and Processing.

Unit-3 Disposal of Municipal Solid Waste:

Landfill, Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste. Municipal Solid Waste (MSW) Rules 2016.

Unit-4 Construction and Demolition (C&D) Waste Management:

Overview, Components; C&D Waste Management Rules 2016, Beneficial Reuse of C & D Waste Materials.

Unit-5 Electronic Waste (E-Waste) Management

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3. Construction and Demolition Waste Management Rules, 2016, MoEF&CC

4. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.

5. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York

CIV18R012	FOUNDATION ENGINEERING	L	Т	Р	С
		0	0	0	1

Course Objectives:

To impart knowledge on common method of sub soil investigation and design of foundation. At the end of this course student acquires the capacity to investigate the soil condition and to select and design a suitablefoundation.

Course Outcomes:

CO1: Explain the vibration of elementary system.

- CO2: Explain the waves and wave propagation.
- CO3: Explain the dynamic behavior of foundations.
- CO4: Design machine foundations.
- CO5: Identify vibration isolation techniques

UNIT I- SITE INVESTIGATION AND SELECTION OF FOUNDATION

Scope and objectives –Methods of exploration –auguring and boring –Wash boring and rotary drilling –Depth of boring –Spacing of bore hole –Sampling techniques –Representative and undisturbed sampling

UNIT II- SHALLOW FOUNDATION

Introduction –Location and depth of foundation –Codal provisions –bearing capacity of shallow foundation on homogeneous deposits –Terzaghi"s formula and BIS formula –factors affecting bearing capacity – problems – Bearing capacity from in-situ tests (SPT, SCPT and plate load)Allowable bearing pressure

UNIT III- FOOTINGS AND RAFTS

Types of footings –Contact pressure distribution: Isolated footing –Combined footings –Types and proportioning –Mat foundation –Types and applications –Proportioning –Floating foundation –Seismic force consideration –Codal Provision.

UNIT IV- PILE FOUNDATION

Types of piles and their function –Factors influencing the selection of pile –Carrying capacity of single pile in granular and cohesive soil –static formula –dynamic formulae (Engineering news and Hileys) –Capacity from insitu tests (SPT and SCPT)

UNIT V- RETAINING WALLS

Plastic equilibrium in soils –active and passive states –Rankine's theory –cohesionless and cohesive soil –Coulomb'swedge theory –Condition for critical failure plane –Earth pressure on retaining walls of simple configurations –Culmann Graphical method –pressure on the wall due to line load –Stability analysis of retaining walls.

Reference Books:

1) Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi

2) Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai

3) Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.

4) Joseph E. Bowles: Foundation analysis and design.McGraw-Hill Higher Education

5) Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd.

6) Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi

7) B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.

8) V. N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants, Banglore

9) P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.

10) I.H. Khan – Text Book of Geotechnical Engineering

11) C. Venkataramaiah - Geotechnical Engineering

CIVX18R013	ADVANCED CONCRETE TECHNOLOGY	L	Т	Р	Credit
		2	0	2	3

12) Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering

13) Gulati, S.K., "Geotechnical Engineering" McGraw Hill Education (India), Pvt. Ltd., Noida.

Course outcome:

After Completing the course, the students will able to

CO1: Determine the properties of concrete ingredients i.e. cement, sand, coarse aggregate by conducting different tests.

CO2: Develop an advanced knowledge of the mechanical performance of cement based materials and how it can be controlled

CO3: Use various chemical admixtures and mineral additives to design cement based materials with tailor-made properties

CO4: Use advanced laboratory techniques to characterize cement-based materials.

CO5: Understand the mix design and engineering properties of special concretes such as high-performance concrete, self-consolidating concrete, fibre reinforced concrete, sprayed concrete, etc.

FRESH CONCRETE

Chemical composition, Hydration of cement, structure of hydrated cement, special cements, water, chemical admixtures, Workability –Need-Factors affecting work ability-Segregation Bleeding-Mixing of concrete- Compaction of concrete - Revibration-Self compacting concrete-Ready-mixed concrete – effect of retarders in slump retention in transportation of transit mixer—Pumped concrete-Preplaced concrete-Shotcrete-Analysis of fresh concrete

HARDENED CONCRETE

Factors affecting strength of concrete-Curing-Maturity of concrete-High strength concrete-Ultra High strength concrete-Properties of Hardened concrete and their significance-Structure of concrete-Structure concrete relationships in hydrated cement paste-Dimensional stability-Durability-Transition zone in concrete - Micro structure of concrete-Autogeneous healing-Evaluation of heat of hydration and expansion-Creep-Shrinkage-Elasticity

TESTING OF CONCRETE

Workability-Compression-Tension-Flexure-Bond strength-Factors affecting the results-Accelerated strength results-Stress strain characteristics -Pull off test- Modulus of Elasticity-In site strength determination-Durability testing of concrete-structural health monitoring of concrete – types of sensors for various applications

CONCRETE MIX DESIGN

Basic consideration-Factors in the choice of mix proportions-Mix design methods- A.C.I .Method - I.S. Method - British Method - Correction for moisture content-Bulking-Yield of concrete-Design of High strength concrete and Self compacting concrete- EFNARC Specifications and Design of SCC mixes- Design of concrete mix using mineral admixtures – Design mix for pumpability and effect of super plasticizers in water reduction

SPECIAL CONCRETES

Properties of constituents materials and applications - Light weight concrete-Aerated concrete-No fines concrete-Heavy weight concrete for radiation shield- Fiber reinforced concrete-Polymer concrete-Geopolymer concrete--High volume flyash concrete-High performance concrete-self curing concrete-Concrete admixtures – Nano materials used in the construction industry- protective coating to save energy – energy saving materials

References

1.A. M. Neville, J. J. Brooks, Concrete Technology, Pearson Education, 2013

- 2.A. R. Shantha Kumar, Concrete Technology, Oxford University Press, 2007
- 3.M. S. Shetty, Concrete Technology, S. Chand & Co., 2010

4.Raft Siddique, Spacial Structural Concrete, Galgotia Publication, 2008

5.N. Krishna Raju, Design of Concrete Mixes, C.B.S. Publication, 2002