

**Scheme, Structure & Evaluation for R-20 Regulations**  
**[ w.e.f. AY 2020-21 ]**

# **CIVIL ENGINEERING**



**R.V.R & J.C. COLLEGE OF ENGINEERING (AUTONOMOUS),**  
**GUNTUR-522019**

## B.TECH. CIVIL ENGINEERING

(w.e.f. the batch of students admitted from the academic year 2020-21)

**Three Weeks Orientation Programme is Mandatory before starting Semester I [First Year]**

### B.Tech. Semester I [First Year]

### COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE111	Mathematics-I	3	0	0	30	70	3	BS
2	CE112	Engineering Chemistry	3	0	0	30	70	3	BS
3	CE113	English for Communication Skills	3	0	0	30	70	3	HS
4	CE114	Engineering Mechanics	3	0	0	30	70	3	ES
5	CE151	Engineering Chemistry Lab	0	0	3	30	70	1.5	BS
6	CE152	English Language Communication Skills Lab	0	0	3	30	70	1.5	HS
7	CE153	Engineering Graphics & Design Lab	1	0	4	30	70	3	BS
8	CE154	Computer Aided Civil Engineering Drawing Lab	0	0	3	30	70	1.5	ES
9	CEMC1	Constitution of India	2	0	0	100	-	0	MC
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>13</b>	<b>340</b>	<b>560</b>	<b>19.5</b>	
10	3 Weeks Orientation Programme								

### B.Tech. Semester II [First Year]

### COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE121	Mathematics-II	3	0	0	30	70	3	BS
2	CE122	Engineering Physics	3	0	0	30	70	3	BS
3	CE123	Solid Mechanics-I	3	0	0	30	70	3	ES
4	CE124	Programming for Problem Solving	3	0	0	30	70	3	ES
5	CE161	Engineering Physics Lab	0	0	3	30	70	1.5	BS
6	CE162	Programming for Problem Solving Lab	0	0	3	30	70	1.5	ES
7	CE163	Engineering Workshop Practice	1	0	4	30	70	3	BS
8	CE164	Material Testing Lab	0	0	3	30	70	1.5	ES
9	CEMC2	Environmental Sciences	2	0	0	100	-	0	MC
<b>TOTAL</b>			<b>15</b>	<b>0</b>	<b>13</b>	<b>340</b>	<b>560</b>	<b>19.5</b>	

### B.Tech. Semester III [Second Year]

### COURSE STRUCTURE

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE211	Fluid Mechanics	3	0	0	30	70	3	BS
2	CE212	Water Supply Engineering	3	0	0	30	70	3	PC
3	CE213	Solid Mechanics-II	3	0	0	30	70	3	PC
4	CE214	Building Materials and Construction	3	0	0	30	70	3	PC
5	CE215	Concrete Technology	3	0	0	30	70	3	PC
6	CE251	Environmental Engineering Lab	0	0	3	30	70	1.5	PC
7	CE252	Concrete Technology Lab	0	0	3	30	70	1.5	PC
8	CE253	Surveying Field Work Lab	<b>0</b>	<b>0</b>	<b>3</b>	30	70	<b>1.5</b>	PC
9	CESL1	Skill Oriented Course - I	<b>2</b>	<b>0</b>	<b>0</b>	100	-	<b>2</b>	SC
10	CEMC4	Ethics & Human Values	2	0	0	100	-	0	MC
<b>TOTAL</b>			<b>19</b>	<b>0</b>	<b>9</b>	<b>440</b>	<b>560</b>	<b>21.5</b>	

**B.Tech. Semester IV [Second Year]**
**COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE221	Mathematics-III	3	0	0	30	70	3	BS
2	CE222	Engineering Geology	3	0	0	30	70	3	ES
3	CE223	Hydraulics and Hydraulic Machines	3	0	0	30	70	3	PC
4	CE224	Structural Analysis	3	0	0	30	70	3	PC
5	CE225	Waste Water Engineering	3	0	0	30	70	3	PC
6	CE261	Communicative English Laboratory	0	0	3	30	70	1.5	ES
7	CE262	Engineering Geology laboratory	0	0	3	30	70	1.5	PC
8	CE263	Fluid Mechanics Laboratory	0	0	3	30	70	1.5	PC
9	CESL2	Skill Oriented Course - II	1	0	2	100	-	2	SC
10	CEMC3	Design Thinking and Product Innovation	2	0	0	100	-	0	MC
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>11</b>	<b>440</b>	<b>560</b>	<b>21.5</b>	
Internship 3 to 4 weeks (minimum 3 weeks-Mandatory) during summer vacation (to be evaluated during next semester)									
Honors/Minor course (Maximum Two courses can be registered)			4	0	0	30	70	4	HR/MR

**B.Tech. Semester V [Third Year]**
**COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE311	Soil Mechanics	3	0	0	30	70	3	PC
2	CE312	Design of RC Structural Elements	3	0	0	30	70	3	PC
3	CE313	Highway Engineering	3	0	0	30	70	3	PC
4	CE314	Professional Elective-I	3	0	0	30	70	3	PE
5	CE315	Open / Job-Oriented Elective-I	3	0	0	30	70	3	OE
6	CE351	Soil Mechanics Lab	0	0	3	30	70	1.5	PC
7	CE352	Computer Programming in Civil Engineering Lab	0	0	3	30	70	1.5	PC
8	CE353	Summer Internship	0	0	0	100	-	1.5	PR
9	CESL3	Skill Oriented Course-III	1	0	2	100	-	2	SC
<b>TOTAL</b>			<b>16</b>	<b>0</b>	<b>8</b>	<b>410</b>	<b>490</b>	<b>21.5</b>	
Honors/Minor course (Maximum Two courses can be registered)			4	0	0	30	70	4	HR/MR

**B.Tech. Semester VI [Third Year]**
**COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE321	Foundation Engineering	3	0	0	30	70	3	PC
2	CE322	Design of Steel Structural Elements	3	0	0	30	70	3	PC
3	CE323	Hydrology & Irrigation Engineering	3	0	0	30	70	3	PC
4	CE324	Professional Elective-II	3	0	0	30	70	3	PE
5	CE325	Open / Job-Oriented Elective-II	3	1	0	30	70	3	OE
6	CE361	Highway Engineering Lab	0	0	3	30	70	1.5	PC
7	CE362	Computer Aided Analysis and Design of Structures Lab	0	0	3	30	70	1.5	PC
8	CE363	Computer Aided Detailing Lab	0	0	3	30	70	1.5	PC
9	CESL4	Skill Oriented Course-IV	1	0	2	100	-	2	SC
<b>TOTAL</b>			<b>16</b>	<b>1</b>	<b>11</b>	<b>340</b>	<b>560</b>	<b>21.5</b>	
Internship 6 to 8 weeks (minimum 6 weeks-Mandatory) during summer vacation (to be evaluated during next semester)									
Honors/Minor course (Maximum Two courses can be registered)			4	0	0	30	70	4	HR/MR

**B.Tech. Semester VII [Fourth Year]****COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE411	Humanities and Social Sciences Elective	3	0	0	30	70	3	HS
2	CE412	Professional Elective-III	3	0	0	30	70	3	PE
3	CE413	Professional Elective-IV	3	0	0	30	70	3	PE
4	CE414	Professional Elective-V (MOOC's)	0	0	0	-	100	3	PE
5	CE415	Open / Job-Oriented Elective-III	3	0	0	30	70	3	OE
6	CE416	Open / Job-Oriented Elective-IV (MOOC's)	0	0	0	-	100	3	OE
7	CE451	Internship / Certification	0	0	0	100	-	3	PR
8	CESL5	Skill Oriented Course-V	1	0	2	100	-	2	SC
<b>TOTAL</b>			<b>13</b>	<b>0</b>	<b>2</b>	<b>320</b>	<b>480</b>	<b>23</b>	
<b>Honors/Minor course (Maximum Two courses can be registered)</b>			<b>4</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>70</b>	<b>4</b>	HR/MR

**B.Tech. Semester VIII [Fourth Year]****COURSE STRUCTURE**

SNo.	Course Details		Scheme of Instruction			Scheme of Examination			Category Code
	Code No.	Subject Name	Periods per week			Maximum Marks		Credits	
			L	T	P	SES	EXT		
1	CE461	Project Work, Seminar and Internship in Industry	0	0	0	30	70	12	PR
<b>TOTAL</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>70</b>	<b>12</b>	

**Professional Elective Courses**

Code No.	Subject Name
CEEL01	Advanced Structural Analysis
CEEL02	Advanced Environmental Engineering
CEEL03	Environment Impact Assessment
CEEL04	Surface Hydrology
CEEL05	Design of Reinforced Concrete Structures
CEEL06	Railway, Airport and Harbor Engineering
CEEL07	Water Shed Management
CEEL08	Remote Sensing and GIS
CEEL09	Irrigation Structures
CEEL10	Prestressed Concrete
CEEL11	Finite Element Method
CEEL12	Earthquake Resistant Design of Structures
CEEL13	Design of Steel Structures
CEEL14	Ground Improvement Techniques
CEEL15	Repair and Rehabilitation of Structures
CEEL16	Bridge Engineering

### Skill Oriented Courses

Code No.	Subject Name
CESL-A	Surveying
CESL-B	Building Planning and Drawing
CESL-C	GIS Lab
CESL-D	Soft Skills
CESL-E	Quantity Estimation and Project Management Lab

### Humanities and Social Sciences Elective Courses

Code No.	Subject Name
HSEL1	Industrial Management and Entrepreneurship
HSEL2	Economics for Engineers
HSEL3	Introduction to Industrial Management
HSEL4	Project Management and Entrepreneurship
HSEL5	Human Resources and Organizational Behavior
HSEL6	Project Management
HSEL7	Disaster Management

### Open / Job-Oriented Elective Courses

Code No.	Subject Name
<b>Open Elective Courses</b>	
CEOL01	Basic Surveying
CEOL02	Building Materials and Construction
CDOL1	Python for Data Science
<b>Job-Oriented Elective Courses</b>	
JOEL11	Geospatial Technology
JOEL12	Building Planning
JOEL13	Quantity Estimation
JOEL23	Valuation of property

## General Minors

S.No.	Code No.	Subject Name
1.	CEMR1	Geomatics (Survey, GIS & GPS)
2.	CEMR2	Construction Engineering & Management
3.	CEMR3	Fundamentals of Structural Engineering
4.	CEMR4	Water Resource Engineering
5.	CEMR5	Environmental Engineering
6.	CEMR6	Geotechnical Engineering
7.	CEMR7	Transportation Engineering

## Honors - Courses

	Code No.	Subject Name	Offered Semester
Pool-1	CEH11	Theory of Elasticity	IV Semester
	CEH12	Geodesy & GPS	
	CEH13	Quality Control and Quality Assurance	
	CEH14	Advanced Concrete Technology	
Pool-2	CEH21	Advanced Highway Materials	V Semester
	CEH22	Air Pollution and Control	
	CEH23	Dynamics of Structures	
	CEH24	Modern Construction Materials	
Pool-3	CEH31	Advanced Theory and Design of RCC Structures	VI Semester
	CEH32	Traffic Engineering	
	CEH33	Industrial Pollution Control	
	CEH34	Rock Mechanics	
Pool-4	CEH41	Ground Water Development & Management	VII Semester
	CEH42	Experimental Stress Analysis	
	CEH43	Geospatial Technology Applications	
	CEH44	Geosynthetics and Reinforced Soil Structures	

**CE111**

**MATHEMATICS-I**  
(Calculus & Matrix Theory)  
**Semester I [First Year]**

**L T P C Int Ext**  
**3 - - 3 30 70**

**COURSE OBJECTIVES:**

1. To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
2. To equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

**COURSE OUTCOMES:**

**After successful completion of the course, the students are able to**

1. evaluate certain improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. know fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. understand Fourier series and deal with functions of several variables.
4. do problems on matrices and linear algebra in a comprehensive manner.

**UNIT I**

[CO:1] (15)

Evolutes and Involutives, Evaluation of improper integrals: Integrals without infinite limits of integration, Beta function, Gamma function, Relation between beta and gamma functions (without proof), Applications of definite integrals to evaluate surface areas and volumes of revolutions.

**UNIT II**

[CO:2] (15)

Rolle's theorem (without proof), Lagrange's mean value theorem (without proof), Taylor's and Maclaurin series (without proof), Sequences, Series, Series of positive terms, Convergence tests: Comparison test (limit form) D'Alembert's ratio test, Raabe's test for convergence.

**UNIT III**

[CO:3] (15)

Fourier series: Half range sine and cosine series, Parseval's formula. Multivariable Calculus: Limit, continuity and partial derivatives, total derivative, Maxima, minima and saddle points of two variables, Method of Lagrange multipliers. Scalar and vector point functions, Gradient, directional derivative divergence and curl, del applied twice to point and product of point functions (without proofs).

**UNIT IV**

[CO:4] (15)

Rank of a matrix, Normal form, Inverse by Gauss Jordan method, System of linear equations: non homogeneous, Homogeneous systems, Rank-nullity theorem (without proof), Eigenvalues and eigenvectors, Cayley-Hamilton Theorem (without proof), Diagonalization of matrices, reduction of quadratic form to canonical form.

**LEARNING RESOURCES:****TEXT BOOK:**

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

**REFERENCE BOOK(s):**

1. G.B. Thomas and R.L. Finney - Calculus and Analytic geometry, Pearson, 2002.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.

3. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons, 2006.

**WEB RESOURCES:**

<http://nptel.iitm.ac.in/courses/>



**CE112****ENGINEERING CHEMISTRY****L T P C Int Ext****3 - - 3 30 70****Semester I [First Year]****COURSE OBJECTIVES:**

1. To imparts concepts involved in molecular structure and intermolecular forces.
2. To Understands the chemistry behind electrochemical energy systems.
3. To understand the chemical concepts involved in Water treatment and Corrosion.
4. To understand the about the major organic reactions and end products like conducting polymers.
5. To learn the analytical methods useful in characterization of compounds.

**COURSE OUTCOMES:****After successful completion of the course, the students are able to**

1. Student can identify stable complexes and suitable electrochemical energy systems for end usage.
2. apply his knowledge for effective water treatment and corrosion prevention.
3. identify chemical reactions that are used in the synthesis of molecules and polymers
4. distinguish the ranges of the electromagnetic spectrum and characterize a given compound using analytical techniques..

**UNIT I****[CO:1] (15)****Molecular structure, Intermolecular forces and Energy systems:**

Crystal field theory-salient features, energy level diagrams-tetrahedral and octahedral complexes, crystal field stabilization energies and magnetic properties.

Ionic, dipolar, Vander Waal's interaction and Hydrogen bonding, critical phenomena-Andrew's isotherms of CO<sub>2</sub>, derivation of critical constants from Vander Waal's equation.

Electrode potential, electrochemical series, Nernst equation and its applications. Batteries-Primary (Dry cell) and secondary (Lead acid), Lithium battery (Li-MnO<sub>2</sub>)- advantages, Fuel cell (H<sub>2</sub>- O<sub>2</sub> cell).

**UNIT II****[CO:2] (15)****Water Chemistry and Corrosion :**

Water Chemistry - WHO standards, Municipal water treatment-Removal of suspended impurities - Sedimentation, Co-agulation and Filtration-Disinfection of water by chlorine, Break point chlorination, Dechlorination, Purification by ion-exchange method and reverse osmosis.

Corrosion-Introduction, Electrochemical theory of corrosion, galvanic corrosion, differential aeration corrosion, Factors-temperature, pH, overvoltage. Cathodic protection by sacrificial anodic method and impressed current method. Electroplating (Cu), Electrolessplating (Ni).

**UNIT III****[CO:3] (15)****Organic reactions and Polymers :**

Types of organic reactions-Substitution(SN<sup>1</sup>and SN<sup>2</sup>), Elimination (E<sup>1</sup>and E<sup>2</sup>), Addition-Markownikoff's rule and anti-Markownikoff's rule, Cyclisation (Diel's Alder reaction), Synthesis of aspirin.

Polymers - Functionality, Degree of Polymerization, Tacticity-Addition and condensation polymerization, Relationship between Structure and Properties of polymers (Strength, Crystallinity, Elasticity, Plastic Deformation, Glass transition temperature (T<sub>g</sub>)), Factors affecting T<sub>g</sub>.

Conducting polymers: Introduction, Examples, General applications, Mechanism of conduction in polyacetylene.

**UNIT IV****[CO:4] (15)****Spectroscopic techniques and its applications :**

Beer-Lambert's law, limitations, colorimetric determination of Fe(III) UV-VIS spectroscopy - electronic transitions, shifts-blue and red, Block diagram - brief introduction of components, Applications - purity and differentiation of conjugated and non-conjugated dienes.

IR Spectroscopy - condition to be IR active, vibrational modes of - AB<sub>2</sub>, Block diagram-brief introduction of components, IR spectrum of CO<sub>2</sub> and H<sub>2</sub>O molecules, General applications. Fluorescence and its applications in medicine.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. P.C.Jain and Monica Jain- Engineering chemistry, 16th edition, Dhanpat Rai Publishing Company.
2. Wiley Engineering chemistry, 2nd edition, Wiley India Private Limited.

**REFERENCE BOOK(s):**

1. Bruce H. Mahan, University Chemistry, 3rd edition, Narosa Publishing House..
2. Shashi Chawla - A text book of Engineering chemistry, 3rd edition, Dhanpat Rai Publishing Company..

**WEB RESOURCES:**

1. Engineering Chemistry (NPTEL Web Book by B.L. Tembe, Kamaluddin & M.S. Krishnan).
2. <http://www.powerstream.com/BatteryFAQ.html#lec>
3. <http://freevidelectures.com/Course/3029/Modern-Instrumental-Methods-ofAnalysis>.

CE113

ENGLISH FOR COMMUNICATION SKILLS

L T P C Int Ext

3 - - 3 30 70

**Semester I [First Year]****COURSE OBJECTIVES:**

1. To enable students improve their lexical and communicative competence and to equip students with oral and written communication skills.
2. To help students understand and learn the correct usage and application of Grammar principles.
3. To get them acquainted with the features of successful professional communication.
4. To enable students acquire various specific features of effective written communication.

**COURSE OUTCOMES:****After successful completion of the course, the students are able to**

1. use vocabulary contextually.
2. compose effectively the various forms of professional communication.
3. apply grammar rules efficiently in spoken and written forms.
4. improve clarity to locate and learn the required information.

**UNIT I**

[CO:1] (8)

**Vocabulary Building**

- 1.1 - Root words from foreign languages and their use in English.
- 1.2 - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.3 - Synonyms, antonyms, and standard abbreviations.
- 1.4 - One word substitutes.

**UNIT II**

[CO:1,2,3] (8)

**Writing Skills**

- 2.1 - Proposal writing
- 2.2 - Letter-writing
- 2.3 - Techniques for writing precisely (precis writing)
- 2.4 - E-mail writing

**UNIT III**

[CO:3] (8)

**Identifying Common Errors in Writing**

- 3.1 - Subject-verb agreement
- 3.2 - Noun-pronoun agreement
- 3.3 - Articles
- 3.4 - Prepositions
- 3.5 - Tenses
- 3.6 - Redundancies

**UNIT IV**

[CO:1,2,3,4] (8)

**Nature and Style of Sensible Writing**

- 4.1 - Description & Narration (Paragraph Writing). [CO:1,2,3]

4.2 - Essay Writing (Expository Essay). [CO:1,2,3]

4.3 - Note-Making and Note-Taking. [CO:1,2,4]

4.4 - Methods of preparing notes. [CO:1,2,4]

**LEARNING RESOURCES:**

**TEXT BOOK:**

Communication Skills. Sanjay Kumar and Pushpa Lata.Oxford University Press.

**REFERENCE BOOK(s):**

1. Remedial English Grammar. F.T. Wood. macmillan.2007
2. On Writing Well. William Zinsser. Harper ResourceBook. 2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasley.Cambridge University Press.2006.
4. Practical English Usage.Michael Swan. OUP. 1995Press

CE114

**ENGINEERING MECHANICS**

L T P C Int Ext

3 - - 3 30 70

**Semester I [First Year]****COURSE OBJECTIVES:****This course will enable students to**

1. To introduce principles of statics and to study concurrent forces in a plane
2. To study parallel forces in a plane and to study general case of forces in a plane
3. To understand force systems in space and to introduce principle of virtual work
4. To know moments of areas and moments of inertia

**COURSE OUTCOMES:****By the end of the course, the students will be able to**

1. apply principles of statics and solve problems involving concurrent forces in a plane
2. solve problems involving parallel forces and general case of forces in a plane
3. solve problems with forces oriented in three-dimensions and apply principle virtual work to system of rigid bodies
4. calculate moments of areas and moments of inertia

**COURSE ARTICULATION MATRIX**

PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	3	2	0	0	0	0	0	0	3	1
CO2	3	3	1	1	3	2	0	0	0	0	0	0	3	1
CO3	3	3	1	1	3	2	0	0	0	0	0	0	3	1
CO4	3	3	1	1	3	2	0	0	0	0	0	0	3	1

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (15)**

**Concurrent Forces in a Plane:** Principles of statics, Rectangular components of a force, Resultant and equilibrium of concurrent forces in a plane, Method of projections. (8 hours).

**Parallel Forces in a Plane:** Moment of a force about a point, Couple, Resultant and equilibrium of parallel forces in a plane, Centre of parallel forces and centre of gravity, Centroids of composite plane figures and curves. (7 hours)

**UNIT II****[CO: 2] (13)**

**General Case of Forces in a Plane:** Resultant and equilibrium of general case of parallel forces in a plane, Statically determinate plane trusses-Method of joints and Method of sections. (8 hours).

**Friction :**Types of friction, Dry friction - Mechanism of friction, Types of friction problems. (5 hours)

**UNIT III**

**[CO: 3] (12)**

**Force Systems in Space (using vector notation):** Position vector, Unit vector, Force vector, Component of a force about an axis, Moment of a force about a point, Moment of a force about an axis, Couple, Resultant and equilibrium of concurrent forces in space, Resultant and equilibrium of parallel forces in space, Centre of parallel forces and centre of gravity.(8 hours)

**Principle of virtual work:** Equilibrium of ideal systems, Stable and Unstable equilibrium. (4 hours)

**UNIT IV**

**[CO: 4] (13)**

**Moments of Inertia of Plane Figures:** Moment of inertia of a plane figure with respect to an axis in its plane ; Moment of Inertia with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem.(8 hours).

**Moments of Inertia of Material Bodies:** Moment of inertia of a rigid body; Moment of inertia of a lamina; Moments of inertia of three- dimensional bodies.(5 hours)

**LEARNING RESOURCES:**

**TEXT BOOK(s):**

Engineering mechanics by S.Timoshenko, D.H.Young, J.V.Rao, Sukumar Pati, 5th Edition, McGraw Hill Education(India), 2017.

**REFERENCE BOOK(s):**

1. Engineering Mechanics by V.Jaya Kumar and M.Kumar,1st Edition, PHI Learning, 2012.
2. Engineering Mechanics by B.Bhattacharyya, 2nd Edition, Oxford University Press, 2014.
3. Engineering mechanics: Statics by J. L. Meriam and L. Kraige, 7th Edition, John Wiley & Sons,2013.
4. Engineering Mechanics by R.C.Hibbeler,14th Edition, Pearson Education ( India),2017.
5. Vector Mechanics for Engineers by Beer and Johnston, 11th Edition, McGraw Hill Education(India), 2017.

**WEB RESOURCES:**

<http://nptel.ac.in>

CE151

ENGINEERING CHEMISTRY LAB

L T P C Int Ext

- - 3 1.5 30 70

**Semester I [First Year]****COURSE OBJECTIVES:**

1. To learn the concepts of equivalent weight, molecular weight, normality, molarity, weight percent, volume percent.
2. To know the methods of determining hardness and chloride ion content of water sample.
3. To learn the redox methods to determine Fe<sup>2+</sup> ions present in solution.
4. To know principles and methods involved in using instruments like conductivity bridge and potentiometer
5. To know the molecular properties like surface tension, viscosity.
6. To know synthetic methods for preparation of drugs and polymer

**COURSE OUTCOMES:****After successful completion of the course, the students will be able to**

1. estimate the Fe(II) content of a given solution and chloride/hardness content of water.
2. measure molecular properties such as surface tension, viscosity.
3. measure conductance of solutions, redox potentials of a cell.
4. synthesize a small drug molecule and polymer.

**List of Experiments:**

1. Estimation of Mohr's salt using KMnO<sub>4</sub>.
2. Estimation of Mohr's salt using K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
3. Determination of chloride ion content of water.
4. Determination of Hardness of water using EDTA method.
5. Determination of Fe(II) strength using K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> potentiometrically.
6. Determination on strength of NaOH using HCl conductometrically.
7. Determination of surface tension.
8. Determination of Viscosity.
9. Determination of Saponification / acid value of oil.
10. Preparation of p-bromo acetanilide.
11. Preparation of Phenol Formaldehyde resin.
12. Determination of partition co-efficient of I<sub>2</sub> in water.
13. Determination of R<sub>f</sub> value using TLC.
14. Verification of Freundlich isotherm using adsorption of acetic acid on activated charcoal.

**Note:** A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

**CE152**                      **ENGLISH LANGUAGE COMMUNICATION SKILLS LAB**                      **L T P C Int Ext**  
- - 3 1.5 30 70

**Semester I [First Year]**

**COURSE OBJECTIVES:**

1. To Identify speaker's purpose and tone; make inferences and predictions about spoken discourse, discuss and respond to content of a lecture or listening passage orally and/or in writing.
2. To acquaint the students with the Standard English pronunciation, i.e., Receive Pronunciation (RP), with the knowledge of stress and intonation.
3. To develop production and process of language useful for social and professional life.
4. To develop in them communication and social graces necessary for functioning. Improve the dynamics of professional presentations.
5. To develop critical reading and comprehension skills at different levels.

**COURSE OUTCOMES:**

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

1. comprehend relationships between ideas and make inferences and predictions about spoken discourse.
2. speak English with a reasonable degree of accuracy in pronunciation.
3. develop appropriate speech dynamics in professional situations.
4. use effective strategies and social graces to enhance the value of communication.
5. develop effective communication and presentation skills and using language effectively to face interviews with success.

**List of Exercises / Activities:**

Oral Communication

(This unit involves interactive practice sessions in Language Lab).

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Interviews.
5. Formal Presentations.
6. Reading Comprehension.

**REFERENCE BOOK(S) :**

1. Communication Skills. Sanjay Kumar and Pushpa Lata. Oxford University Press.
2. Practical English Usage. Michael Swan. OUP. 1995 Press
3. Exercises in Spoken English. Parts.I- III. CIEFL, Hyderabad. Oxford University
4. Technical English .M. Sambaiah, Wiley Publications, New Delhi



**CE153****ENGINEERING GRAPHICS & DESIGN LAB****L T P C Int Ext****1 - 4 3 30 70****Semester I [First Year]****COURSE OBJECTIVES:**

1. Expose the students to standards and conventions followed in preparation of engineering drawings.
2. Make them understand the concepts of orthographic and isometric projections.
3. Develop the ability of conveying the engineering information through drawings.
4. Make them understand the relevance of engineering drawing to different engineering domains.
5. Develop the ability of producing engineering drawings using drawing instruments.
6. Enable them to use computer aided drafting packages for the generation of drawings.

**COURSE OUTCOMES:****After successful completion of the course, the students are able to**

1. Prepare engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Produce computer generated drawings using CAD software..
3. Use the knowledge of orthographic projections to represent engineering information / concepts and present the same in the form of drawings.
4. Develop isometric drawings of simple objects reading the orthographic projections of those objects.
5. Convert pictorial and isometric views of simple objects to orthographic views.

**COURSE ARTICULATION MATRIX**

CO \ PO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PSO														
CO1		3	2	0	0	0	0	0	0	0	0	0	0	2	2
CO2		3	2	0	0	0	0	0	0	0	0	0	0	2	2
CO3		3	2	0	0	0	0	0	0	0	0	0	0	2	2
CO4		3	2	0	0	0	0	0	0	0	0	0	0	2	2
CO5		3	2	0	0	0	0	0	0	0	0	0	0	2	2

(Units I to IV shall be taught in conventional drawing method and Unit V shall be taught with the aid of computer )

**UNIT I**

General : Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering.

Conic sections : Construction of Ellipse, Parabola, Hyperbola and Rectangular Hyperbola. (General method only)

Curves : Cycloid, Epicycloid, Hypocycloid and Involute and Scales

**UNIT II**

Method of Projections : Principles of projection - First angle and third angle projection of points, Projection of straight lines inclined to both planes. Traces of lines.

Projections of planes : Projections of planes inclined to both the planes, projections on auxiliary planes.

**UNIT III**

Projections of Regular Solids : Projections of solids (Prism, Pyramid, Cylinder and Cone) with varying positions.

Sections of Solids : Sections of Prisms, Pyramids, cylinders and Cones. True shapes of sections. (Limited to the cutting plane perpendicular to one of the principal plane).

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

**UNIT IV**

Isometric Projections: Principles of Isometric projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids

Orthographic Projections : Conversion of pictorial views into Orthographic views and Vice-versa. (Treatment is limited to simple castings).

Perspective Projections : Introduction to Perspective Projection

**UNIT V**

Over view of Computer Aided drafting (AutoCAD) : Introduction, starting and customizing AutoCAD screen, usage of different menus, toolbars(drawing, editing, dimension, text, object properties..etc), tabs (Object, snap, grid, polar, ortho, otrack..etc) and command prompt. Setting units, limits, layers and viewports (Isometric, Top, Front, back..etc). 2D drawings of various mechanical and structural components, electrical and electronic circuits. Orthographic and Isometric views of mechanical castings and simple structures.

**LEARNING RESOURCES:****TEXT BOOK:**

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

**REFERENCE BOOK(s):**

1. Shah, M.B. & Rana B.C. - Engineering Drawing and Computer Graphics, Pearson Education, 2008.
2. Agrawal B. & Agrawal C. M. - Engineering Graphics, TMH Publication, 2012.
3. Narayana, K.L. & P Kannaiah - Text book on Engineering Drawing, Scitech Publishers, 2008.
4. (Corresponding set of) CAD Software Theory and User Manuals

**CE 154                      COMPUTER AIDED CIVIL ENGINEERING DRAWING LABORATORY    L T P C Int Ext**  
**- - 2 1 40 60**

**Semester I [First Year]**

**COURSE OBJECTIVES:**

1. To learn Basic commands of Auto CAD software
2. To draw conventional signs, symbols of materials and building services
3. To draw plan, section and elevations of buildings and various building components.
4. To create 3D building model and rendering the model.

**COURSE OUTCOMES:**

**After the successful completion of the course, students are able to**

1. Basic Auto CAD commands
2. Various conventional signs, symbols of materials and building services
3. Drawing plan, section and elevations of buildings and various building components
4. Basics of creating 3D building model and rendering the model.

**COURSE ARTICULATION MATRIX**

CO \ PO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	0	0	0	2	0	0	0	0	0	0	0	2	3
CO2	3	0	0	0	2	0	0	0	0	0	0	0	2	3
CO3	3	0	0	0	2	0	0	0	0	0	0	0	2	3
CO4	3	0	0	0	2	0	0	0	0	0	0	0	2	2

**EXPERIMENTS:**

1. Learning basic commands of CAD software & drawing various geometrical Shapes using
  - a) Draw commands
  - b) Editing commands
  - c) Creating text
  - d) Dimensioning
2. Draw Conventional signs for building materials and symbols for sanitary installations and fittings.
3. Draw symbols for Doors & Windows and Electrical Installations.
4. Draw Elevation and Sections of Door & Window.
5. Draw Cross section of load bearing wall over spread footing.
6. Draw plan & sectional elevation of Dog-Legged staircase.
7. Draw Pitched roof (King post truss).
8. Draw plan of a single storied residential building showing furniture & cub-boards using layers and blocks in CAD software.
9. Draw plan of a single storied residential building showing Electrical and Sanitary features using layers and blocks in CAD software.
10. Draw Plan, Section & Elevation of single storied residential building.
11. Learning basic commands in 3-D, creating pre-defined solid primitives and applying Boolean operations.
12. Create a two roomed ground floor building in 3-D and render the model.

**CEMC1**

**CONSTITUTION OF INDIA**  
 [MANDATORY NON-CREDIT COURSE]  
**Semester I [First Year]**

**L T P C Int Ext**  
**2 - - - 100 -**

**COURSE OBJECTIVES:**

**To provide basic information about Indian Constitution.**

**COURSE OUTCOMES:**

**After successful completion of the course, the students are able to**

1. understand the significance of many provisions of the Constitution as well as to gain insight into their back ground. They will also understand number of fundamental rights subject to limitations in the light of leading cases.
2. Study guidelines for the State as well as for the Citizens to be followed by the State in the matter of administration as well as in making the laws. It also includes fundamental duties of the Indian Citizens in Part IV A (Article 51A).
3. Understand administration of a State, the doctrine of Separation of Powers.
4. Know how the State is administered at the State level and also the powers and functions of High Court.
5. Understand special provisions relating to Women empowerment and also children. For the stability and security of the Nation, Emergency Provision are Justified.
6. Understand election commission as an independent body with enormous powers and functions to be followed both at the Union and State level. Amendments are necessary, only major few amendments have been included.

**UNIT I**

[CO:1] (10)

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III, Leading Cases. Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

**UNIT II**

[CO:2,3] (10)

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

**UNIT III**

[CO:3,5] (10)

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

**UNIT IV**

[CO:6] (10)

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

**LEARNING RESOURCES:****TEXT BOOK:**

Durga Das Basu: "Introduction to the Constitution of India" (student edition) Prentice - Hall EEE, 19th/20th Edition, 2001.

**REFERENCE BOOK(s):**

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

2. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI, Learning Pvt.Ltd., New Delhi, 2011.

**CE121****MATHEMATICS-II****L T P C Int Ext**

(Calculus, Ordinary Differential Equations and Complex Variable)

**3 - - 3 30 70****Semester II [First Year]****COURSE OBJECTIVES:**

**The objective of this course is to familiarize the prospective engineers with techniques in Multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.**

**COURSE OUTCOMES:**

**After successful completion of the course, the students are able to**

1. solve differential equations which model physical processes..
2. evaluate multiple integrals and their usage.
3. integrate vector functions.
4. understand differentiation and integration of functions of a complex variable and apply them in various engineering problems.

**UNIT I****[CO:1] (15)**

Differential equations of first order-Linear equations, Bernoulli's equation, exact equations, equations reducible to exact equations.

Differential equations of higher order - Second order linear differential equations with constant coefficients - Method of variation of parameters, Cauchy's homogeneous linear equation and Legendre's linear equation.

**UNIT II****[CO:2] (15)**

Multiple Integrals - Double integrals (Cartesian and polar), Change of order of integration, Change of variables Cartesian to polar coordinates.

Area by double integrals, Triple integrals (Cartesian), Volume by triple integrals.

**UNIT III****[CO:3] (15)**

Integration of vectors - Line integrals, surface integrals, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Volume integrals, Gauss divergence theorem (without proof).

Complex variables - Differentiation, Cauchy Riemann equations (Cartesian and polar-without proof), analytic functions.

**UNIT IV****[CO:4] (15)**

Harmonic functions, finding harmonic conjugate - Milne Thomson method.

Complex integration - Cauchy Integral Theorem (without proof), Cauchy Integral Formula (without proof).

**LEARNING RESOURCES:****TEXT BOOK:**

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

**REFERENCE BOOK(s):**

1. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.

**WEB RESOURCES:**

<http://nptel.iitm.ac.in/courses/>

CE122

ENGINEERING PHYSICS

L T P C Int Ext

(Mechanics)

3 - - 3 30 70

Semester II [First Year]

**COURSE OBJECTIVES:**

The aim and objective of the course on Mechanics is to introduce the students of B. Tech. to the formal structure of vector mechanics, harmonic oscillators, and mechanics of solids so that they can use these in Engineering as per their requirement.

**COURSE OUTCOMES:**

After successful completion of the course, the students are able to

1. understand the vector mechanics for a classical system.
2. understand the basics of Harmonic oscillators
3. analyze the planar rigid body dynamics and 3-Dimensional rigid body motion.
4. acquire the knowledge of basic concepts of mechanics of solids.

**UNIT I***Text Book - 1 (15)*

**Vector mechanics of particles:** Transformation of scalars and vectors under rotation, Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law. Introduction to Cartesian, spherical and cylindrical coordinate system. Conservative and non-conservative forces, Central forces (basic definition with some examples); Potential energy function;  $F = -\text{Grad}V$ , equipotential surfaces, Conservation of Angular Momentum, Centripetal and Coriolis forces (basic concepts); Foucault pendulum.

**UNIT II***Text Book - 2 (15)*

**Damped and forced oscillations :** Harmonic oscillators, Damped harmonic oscillator, Equation of damped harmonic oscillator, Different damping oscillations - Over or heavy, critical and light or under damping, energy and power dissipations in a damped harmonic oscillator, quality factor, forced oscillations, resonance with some examples.

**UNIT III***Text Book - 3 (15)*

**Planar rigid body Mechanics :** Definition of rigid body, translational and rotational motion of a rigidbody, angular momentum of a body rotating about a fixed axis, moment of inertia, theorems of moment of inertia, Euler's laws of motion. Brief introduction to three- dimensional rigid body motion, rate of change of a vector rotating with angular velocity, Moment of inertia tensor.

**UNIT IV***Text Book - 3 (15)*

**Mechanics of solids :** Friction, limiting friction, law of limiting friction, Concept of stress and strain at a point; Concepts of elasticity, plasticity, stress-strain curve; Hooke's law, three moduli of elasticity, Poisson's ratio, Torsion pendulum, determination of rigidity modulus of the material of a wire, bending of beams, uniform and non-uniform bending.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. M.N. Avadhanulu, P.G. Kshirasagar - Engineering Physics, S. Chand & Company Ltd.
2. S.L Gupta & Sanjeev Gupta - Unified physics : Waves & Oscillations
3. S.L Gupta & Sanjeev Gupta - Unified physics : Mechanics & Properties of Matter



**REFERENCE BOOK(s):**

1. Engineering Mechanics, 2nd ed. - MKHarbola.
2. Introduction to Mechanics - MKVerma
3. An Introduction to Mechanics - D Kleppner& RKolenkow
4. Principles of Mechanics - JL Synge & BA Griths
5. Mechanics - JP DenHartog
6. R.K. Gaur & S.L.Gupta - Engineering Physics, Dhanpat Rai Publications Ltd

**WEB RESOURCES:**

Online course:

**CE123****SOLID MECHANICS-I****L T P C Int Ext****3 - - 3 30 70****Semester II [First Year]****COURSE OBJECTIVES:**

1. To study stress and strain in axially loaded bars
2. To study stress and strain in biaxially/triaxially loaded bodies
3. To visualize internal forces in beams
4. To study normal and shear stresses in beams
5. To study torsion of circular bars

**COURSE OUTCOMES:****By the end of the course the students will be able to**

1. Understand the basic concepts of stress and strain in materials, including normal and shear stresses in axially loaded bars.
2. Determine shear force and bending moment in beams using equilibrium equations.
3. Apply the elastic flexure formula to calculate normal stresses in beams under bending, including unsymmetric bending.
4. Analyze shear stresses in beams and torsion in circular shafts, and calculate power transmission by circular shafts.

**COURSE ARTICULATION MATRIX:**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	0	0	0	0	0	0	0	0	0	3	1
CO2	3	2	0	0	0	0	0	0	0	0	0	0	3	1
CO3	3	2	0	0	0	0	0	0	0	0	0	0	3	1
CO4	3	2	0	0	0	0	0	0	0	0	0	0	3	1

**UNIT I***Text Book - 1 [CO:1,2](15)*

Stress: Introduction; Method of sections; Definition of stress; Normal stresses in axially loaded bars; Shear stresses ; Analysis for normal and shear stresses; Stresses on inclined sections in axially loaded bars; Allowable stress and factor of safety. Strain:Introduction; Normal strain; Stress-strain diagrams; Hooke's law; Deformation of axially loaded bars; Thermal strain and deformation; statically indeterminate axially loaded bars; Shear strain; Hooke's law for shear stress and shear strain. Generalized Hooke's law and Pressure vessels Poisson's ratio; Generalized Hooke's law for isotropic materials; Relationship between Modulus of elasticity and Modulus of rigidity; Dilatation and Bulk modulus; Thin-walled pressure vessels- Cylindrical and spherical vessels.

**UNIT II***Text Book - 1 [CO:3](15)*

Internal forces in beams:Introduction; Diagrammatic conventions for supports and loads; Calculation of beam reactions; Application of method of sections; Shear force in beams; Bending moment in beams; Shear force and bending moment diagrams; Differential equations of equilibrium for a beam element.

**UNIT III***Text Book - 1 [CO:4](15)*

Normal stresses in beams: Introduction; Basic assumptions; The elastic flexure formula ; application of flexure formula; Unsymmetric bending- Bending about both principal axes of a beam with symmetric cross section.

**UNIT IV***Text Book - 1 [CO:4,5](15)*

Shear stresses in beams: Introduction; Shear flow; The shear stress formula for beams; Shear stress in beam flanges; Shear centre. Torsion: Introduction; Application of the method of sections; Torsion of circular elastic bars- Basic assumptions, the torsion formula ; Power transmission by circular shafts

**LEARNING RESOURCES:****TEXT BOOK(s):**

Mechanics of Materials by Pytel and Kiusalaas , Cengage Learning, SI Edition, 2017.

**REFERENCE BOOK(s):**

1. Mechanics of materials by E.P. Popov , Pearson Education(India) ,2015
2. Engineering mechanics of solids by E.P. Popov, Pearson Education(India) ,2015.
3. Elements of strength of materials by S.P.Timoshenko and D.H.Young, Affiliated East-West Press Pvt.Ltd.,2005.
4. Mechanics of materials by R.C.Hibbeler, SI Edition, Pearson Education(India) ,2018
5. Mechanics of materials by P.Beer and E.R.Johnston, 7th Edition, McGraw-hill Education (India) Pvt.Ltd., 2017

CE124

PROGRAMING FOR PROBLEM SOLVING

L T P C Int Ext

3 - - 3 30 70

## Semester II [First Year]

**COURSE OBJECTIVES:**

1. To understand the basic problem solving process using Flow Charts and algorithms.
2. To understand the basic concepts of control structures in C.
3. To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. To use the concepts of structures, unions, files and command line arguments in C.

**COURSE OUTCOMES:**

**After successful completion of the course, the students are able to**

1. Develop algorithms and flow charts for simple problems.
2. Use suitable control structures for developing code in C.
3. Design modular programs using the concepts of functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

**COURSE ARTICULATION MATRIX:**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	3	2	0	0	0	0	0	0	3	1
CO2	3	3	1	1	3	2	0	0	0	0	0	0	3	1
CO3	3	3	1	1	3	2	0	0	0	0	0	0	3	1
CO4	3	3	1	1	3	2	0	0	0	0	0	0	3	1

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I**

[CO:1] (15)

**Introductory concepts:** Block Diagram of Computer, Computer Characteristics, Hardware vs Software, How to Develop a Program, Software Development Life Cycle, Structured Programming, Types of Programming Languages, Introduction to C program, Program Characteristics.

**Introduction to C Programming:** Character set, Identifiers and Keywords, Data types, Constants, type qualifiers, Declaration and Initialization of variables.

**Operators & Expressions:** Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, Conditional Operator, Input/ Output functions.

**UNIT II**

[CO:2] (15)

**Control Statements :** Branching, Looping, Nested Control Structures, Switch Statement, Break Statement, continue Statement, and Goto Statement .

**Arrays:** Defining an Array, Processing an Array, Multidimensional Arrays & Strings.

**UNIT III**

[CO:3] (15)

**Functions :**Defining a Function, Accessing a Function, Function prototypes, Passing Arguments to a Function, Passing Arrays to Functions, Recursion, Storage Classes

**Pointers :** Fundamentals, Pointer Declarations, Passing Pointers to a Function, Pointers and Arrays, Dynamic memory allocation, Operations on Pointers, Arrays of Pointers.

**UNIT IV**

[CO:4] (15)

**Structures and Unions** : Defining a Structure, Processing a Structure, User-Defined Data Types, Structures and Pointers, Passing Structures to Functions, Self Referential Structures, Unions.

**Files handling** : Opening and Closing a Data File, Reading and Writing a Data File, Processing a Data File, Unformatted Data Files, Accessing the File Randomly. Command line arguments, C-preprocessor directives.

**LEARNING RESOURCES:**

**TEXT BOOK:**

Byron Gottfried - Programming with C (Schaum's Outlines), Third Edition, Tata McGraw-Hill.

**REFERENCE BOOK(s):**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Programming in C by Stephen G. Kochan, Fourth Edition, Pearson
3. C Complete Reference, Herbert Sheildt, TMH., 2000.
4. Programming with C by K R Venugopal & Sudeep R Prasad, TMH., 1997.

**WEB RESOURCES:**

1. <http://cprogramminglanguage.net/>
2. <http://lectures-c.blogspot.com/>
3. [http://www.coronadoenterprises.com/tutorials/c/c\\_intro.htm](http://www.coronadoenterprises.com/tutorials/c/c_intro.htm)
4. [http://vf.u.bg/en/e-Learning/Computer-Basics--computer\\_basics2.pdf](http://vf.u.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf)

CE161

ENGINEERING PHYSICS LAB

L T P C Int Ext

- - 3 1.5 30 70

**Semester II [First Year]****COURSE OBJECTIVES:**

**Physics lab provides students the first-hand experience of verifying various theoretical concepts learnt in theory courses.**

**COURSE OUTCOMES:**

**After successful completion of the course, the students will be able to**

1. use CRO, Function generator, Spectrometer for making measurements
2. test the optical instruments using principles of interference and diffraction
3. understand the concepts learned in the Physics theory.
4. carrying out precise measurements and handling sensitive equipment.
5. draw conclusions from data and develop skills in experimental design.

**List of Experiments:**

1. Measurements using Vernier Calipers, Screw Gauge and Spherometer.
2. Newton's rings - Measurement of radius of curvature of plano-convex lens.
3. Determination of Energy band gap of a Semiconductor.
4. Optical fibers - Determination of Numerical Aperture.
5. Diffraction grating - Measurement of wavelengths using Spectrometer.
6. Magnetic field in Helmholtz coil.
7. PhotoVoltaic Cell - Determination of fill factor.
8. Series LCR resonance circuit - Determination of Q - factor.
9. Four probe method apparatus for measurements of resistivity and conductivity.
10. Determination of wavelengths using diffraction grating.
11. Variation of magnetic field along the axis of a circular current carrying coil.
12. Carey Foster's bridge - Determination of Specific Resistance.

**REFERENCE BOOK :** Physics Lab Manual , R.V.R. & J.C. CE, Guntur

**Note:** A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

**CE162****PROGRAMING FOR PROBLEM SOLVING LAB****L T P C Int Ext****- - 3 1.5 30 70****Semester II [First Year]****COURSE OBJECTIVES:**

1. To understand the basic problem solving process using Flow Charts and algorithms.
2. To understand the basic concepts of control structures in C.
3. To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. To use the concepts of structures, unions, files and command line arguments in C.

**COURSE OUTCOMES:****After successful completion of the course, the students are able to**

1. develop algorithms and flow charts for simple problems.
2. use suitable control structures for developing code in C.
3. design modular programs using the concepts of functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

**List of Exercises / Activities:**

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

**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.

**Note:** A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

**CE163****ENGINEERING WORKSHOP PRACTICE****L T P C Int Ext****1 - 4 3 30 70****Semester II [First Year]****COURSE OBJECTIVES:**

**Engineers, whatever be their line of activity, must be proficient with all aspects of manufacturing, however it should not be forgotten that practice without theory is blind and the theory without practice is lame.**

1. Students involved in acquiring manufacturing skills must have balanced knowledge of theory as well as practice.
2. Imparts basic knowledge of various tools and their use in different sections of manufacture such as fitting, carpentry, tin smithy, moulding, casting, welding, electrical wiring, PCB work on electronic circuits and practice with machine shop tools & equipments.

**COURSE OUTCOMES:**

**After successful completion of the course, the students will be able to**

1. will gain knowledge of the different manufacturing processes which are commonly employed in the industry to fabricate components using different materials.

**Lectures and Videos: [10 hours]**

1. Manufacturing Methods: Introduction to various types of manufacturing methods - casting - forming - various machining operations such as turning, milling, shaping, drilling, slotting etc., - various joining methods such as welding, brazing, soldering etc.,- Advanced manufacturing methods (3 Lectures).
2. CNC machining and Additive manufacturing (1 Lecture).
3. Fitting operations and power tools (power hack saw, table mounted circular saw, wood turning lathe, bench grinder, concrete mixer, concrete vibrator etc.,) (1 Lecture).
4. Basic principles involved in electrical circuits and electronic PCB circuits(1 Lecture).
5. Carpentry (1 Lecture).
6. Welding(arc welding & gas welding) (1 Lecture).
7. Metal casting(1 Lecture).
8. Plastic moulding, glass cutting (1 Lecture).

**Text book:**

1. Hajra Choudhury S, K., Hajra Choudhury A.K and Nirjhar Roy S.K. - Elements of Workshop Technology, Volumel and Volume II,2010, Media promoters and publishers private limited, Mumbai.

**Reference books:.**

1. Kalpakjian S and Steven S.Schmid. - Manufacturing Engineering and Technology, 4th edition, Pearson Education, India, 2002.
2. Rao P.N. - Manufacturing Technology, Volume I &II, Tata McGrawHill House, 2017.

**Work shop Practice: (60 hours)****Objectives:**

Students acquiring practical knowledge on various manufacturing techniques and will be able to fabricate components with their own hands.

**Outcomes:**

Up on completion of laboratory, students will be able to gain the manufacturing skills and get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.



**List of Exercises - Trade wise Experiments:**

1. Welding shop(both arc & gas welding)
  - Square butt joint
  - Lap joint
  - Single v butt joint
  - Gas welding & Cutting
2. Fitting Shop & Casting
  - Inclined fit
  - Half round fit
  - V fit
  - Moulding and casting of Hand wheel
3. Practice on electrical wiring and Electronic circuit boards
  - One bulb controlled by one switch & one bulb controlled by two switches
  - Two bulbs controlled by one switch (Stair case connection)
  - Tube light connection
  - Measurement of resistance, voltage and current with the help of a multi-meter & soldering on an electronic PCB circuit.
4. Machine Shop
  - Practice of machining operations on Lathe, Milling, Shaping, Drilling and Slotting Machines.
5. Carpentry
  - Lap joint
  - Cross lap joint
  - Dovetail joint
  - Turning on wood turning Lathe
6. Tin Smithy
  - Rectangular tray
  - Funnel
  - Pipe joint
  - Rectangular Scoop

**Plastic moulding and glass cutting**

**Note:** A minimum of 2 (Two) from each trade - Total 12 (Twelve) experiments - have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

**CE164****MATERIAL TESTING LABORATORY****L T P C Int Ext****- - 3 1.5 30 70****Semester II [First Year]****COURSE OBJECTIVES:**

1. To find the strength properties of materials like steel, wood etc under direct tension, compression, shear, torsion and bending by conducting relevant tests.
2. To find young's modulus, modulus of rigidity of the given materials.
3. To find hardness, impact resistance of the given materials by conducting relevant tests
4. To determine the compressive strength and percentage of water absorption of bricks

**COURSE OUTCOMES:****After the successful completion of the course, students are able to**

1. Behavior of materials like steel, wood, concrete etc under direct tension, compression, shear, torsion and bending.
2. Finding properties like young's modulus, modulus of rigidity of materials.
3. Determining hardness, impact resistance of the given materials by conducting relevant tests.
4. Determining the percentage of water absorption of bricks.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	0	2	2	0	0	0	2	0	0	0	3	0
CO2	3	2	0	2	2	0	0	0	2	0	0	0	3	0	
CO3	3	2	2	2	2	0	0	0	2	0	0	0	3	0	
CO4	3	2	2	2	2	0	0	0	2	0	0	0	3	0	

**EXPERIMENTS:**

1. Study of stress-strain characteristics of mild steel bars by UTM
2. Study of stress-strain characteristics of HYSD bars by UTM
3. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam
4. Determination of modulus of elasticity of the material of the beam by conducting bending test on cantilever beam
5. Determination of modulus of rigidity by conducting torsion test on solid circular shaft
6. Determination of hardness of the given material by Brinell's hardness test
7. Determination of hardness of the given material by Rockwell hardness test
8. Determination of hardness of the given material by Vickers hardness test.
9. Determination of impact strength of the given material by conducting Charpy/Izod test
10. Determination of ultimate shear strength of steel by conducting double shear test
11. Determination of modulus of rigidity of the material of closely coiled helical spring.
12. Determination of compressive strength of wood with grain parallel / perpendicular to loading.
13. Determination of compressive strength of CLAY/ FAL-G bricks
14. Determination of water absorption of bricks

**Note\*\*:****A minimum of 10 experiments shall be done and recorded**

**CEMC2****ENVIRONMENTAL SCIENCES****L T P C Int Ext**

[MANDATORY NON-CREDIT COURSE - ACTIVITY BASED]

**2 - - - 100 -****Semester II [First Year]****COURSE OBJECTIVES:****To enable the students to**

1. understand that humans are an integral part of environment and hence their activities reflect on the environment.
2. realize and appreciate the importance of ancient practices and their importance in the present times
3. appreciate the contribution of individuals for the upkeep of environmental standards, in turn help the humans live better.

**COURSE OUTCOMES:****After successful completion of the course, the students are able to**

1. evaluate the implications of human activities and thereby promote ecofriendly technologies.
2. promote awareness among the members of the society for a sustainable environment.
3. include and give priority to environmental protection in all developmental projects.

**A. AWARENESS ACTIVITIES - SMALL GROUP MEETINGS**

- I. Source of water for human consumption/activities:
  - a. collection of information pertaining to water resources and consumption in Andhra Pradesh
  - b. Water resource on campus: General / Laboratory use and
  - c. Drinking water - understand the background and adopt judicious management.
  - d. Recycled water for Gardening - Particularly Lawns.
  - e. Cut down wastage of electricity in class rooms / labs / hostels etc. by avoiding misuse.
- II. After the group meetings and exposure to the local issues and healthy practices, students motivated to make:
  - a. Posters
  - b. Slogans/One liners for promoting awareness
- III. Lectures from Experts (at least 2 in the course duration)
- IV. A walk in the neighborhood to promote a chosen theme on environmental consciousness.

**B. ACTUAL ACTIVITIES**

1. Plantation on Campus and on the sides of approach road.
2. Distribution of saplings to the local colony dwellers and encourage plantation.
3. Development of Kitchen garden on campus - Cultivation of atleast leafy vegetables and creepers like cucumber etc. for use in college canteen/hostels etc.
4. Adoption of "NO PLASTICS" on campus.
5. Field trip to gain knowledge of biodiversity, water shed, mining, pollution and other local issues.
6. Preparation of working models for energy generation/transformation etc.

**C. THEORY SYLLABUS FOR ASSESSMENT****Part-I**

1. Introduction to Environmental Studies, Scope and Importance.
2. Natural resources Renewable and Non-Renewable; Definition and importance of the following resources in detail: a. Forest b. Water c. Land d. Energy
3. Sustainable development - Concept and Measures.
4. Biodiversity - Definition, Types of Biodiversity, Values and threats to Biodiversity, Conservation of biodiversity, IUCN classification: Endangered, Threatened, Vulnerable, Rare species; Endemic and Exotic species.
5. Climate change - Global warming, Ozone depletion and Acid rain.

**Part-II**

6. Water shed, water shed management in detail.
7. Solid wastes and Solid waste management.
8. Environmental Legislation, Environmental acts - Wild life protection act, Water act, Forest conservation act, Air act and Environmental protection act.
9. Case studies: Chernobyl nuclear disaster, Bhopal gas tragedy, Narmada bachao andolan, Silent valley, Story of Tuvalu, Story of Ganga.
10. Earth summit and Kyoto protocol; Measures at individual level for conservation of natural resources and sustainable development.

**Text Books**

1. Anubha Kaushik and C.P.Kaushik - Environmental Studies, 3rd Edition, New Age International Publishers, New Delhi., 2012.
2. R. Rajagopalan - Environmental studies from crisis to cure, 3rd Edition, Oxford University press, 2012.

**ASSESSMENT**

1. Two assessments each of 40 marks will be done in the semester. The split up of each assessment is as follows:
  - a. Two internal theory examinations will be conducted for 18 marks each.
  - b. Evaluation of the prepared activity sheets and working models will be done for 12 marks (continual evaluation) twice in the semester in line with the theory examination.
  - c. 5 Marks for attendance and 5 marks for oral test.

**Note: Weightages for a, b & c will be taken as per the assessment guidelines of the R-20 curriculum and projected to 100 marks.**

**CE211****FLUID MECHANICS****L T P C Int Ext****2 1 - 3 30 70****Semester III [Second Year]****COURSE OBJECTIVES:**

1. To understand properties of fluids and Hydrostatic principles.
2. To derive the basic governing equations of fluid flow.
3. To find the discharge using various flow measuring devices by applying governing equations of flow
4. To analyze and design simple pipe systems

**COURSE OUTCOMES:****By the end of the course the students will be able to**

1. Understand properties of fluids and Hydrostatic principles.
2. Derive the basic governing equations of fluid flow.
3. Find the discharge using various flow measuring devices by applying governing equations of flow
4. Analyze and design simple pipe systems

**COURSE ARTICULATION MATRIX:**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	0	0	0	0	0	0	0	0	0	0	1	0
CO2	2	2	0	0	0	0	0	0	0	0	0	0	1	0
CO3	3	2	1	2	0	0	0	0	0	0	0	0	2	0
CO4	3	2	1	1	0	0	0	0	0	0	0	0	2	1

**UNIT I****Text Book-1,2 [CO:1] (15)**

Introduction Dimensions and units; Physical properties of fluids: specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion; Fluid Statics: Variation of static pressure; Absolute and gauge pressure; Pressure measurement by manometers; Pressure on plane surfaces and curved surfaces. Buoyancy; Stability of submerged bodies and floating bodies; Metacentre and metacentric height.

**UNIT II****Text Book-1,2 [CO:2] (15)**

Fluid Kinematics: Methods of describing fluid motion; Classification of flows; Steady, unsteady, uniform and non-uniform flows; Laminar and turbulent flows; One, two and three dimensional flows; Irrotational and rotational flows; Streamline; Pathline; Streakline; Equation for acceleration; Convective acceleration; Local acceleration; Continuity equation; Velocity potential and stream function; Flow net; Fluid Dynamics: Euler's equation of motion; Bernoulli's equation; Energy correction factor; Momentum principle; Applications of momentum equation - Force exerted on a pipe bend.

**UNIT III****Text Book-1,2 [CO:3] (15)**

Flow Measurement in Pipes: Discharge through venturimeter, orificemeter and flow nozzle; Measurement of velocity by pitot tube. Flow through Orifices and Mouthpieces: Flow through orifices; Determination of coefficients for an orifice; Flow through large rectangular orifice; Flow through submerged orifice; Classification of mouthpieces; Flow through external and internal cylindrical mouth piece. Flow over Notches and Weirs: Flow through rectangular, triangular and trapezoidal notches and weirs; End contractions; Velocity of approach; Broad crested weir.

**UNIT IV****Text Book-1,2 [CO:4] (15)**

Analysis of Pipe Flow: Laws of Fluid friction-Darcy's equation, Minor losses-pipes in series-pipes in parallel-branched pipes; Total energy line and hydraulic gradient line, Hydraulic power transmission through a pipe; Siphon; Water hammer. Laminar Flow: Reynold's experiment; Characteristics of laminar flow; Steady laminar flow through a circular pipe (Hagen Poiseuille equation). Turbulent Flow in Pipes: Characteristics of turbulent flow, Hydro dynamically smooth and rough boundaries, Velocity distribution, Friction factor for pipe flow, Variation of friction factor with Reynolds number-Moody's chart.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P. N. Modi and S. M. Seth, 22<sup>nd</sup> Edition, Standard Book house, New Delhi, 2019.
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Revised 9<sup>th</sup> Edition, Laxmi Publications, 2015.

**REFERENCE BOOK(s):**

1. Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi, 2008.
2. Flow in Open channels by K. Subramanya, 5<sup>th</sup> Edition, Tata McGraw-Hill, 2019.

**WEB RESOURCES:**

[www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

**CE212****WATER SUPPLY ENGINEERING****L T P C Int Ext****3 - - 3 30 70****Semester III [Second Year]****COURSE OBJECTIVES:**

1. To estimate the quantity of water required for meeting various demands and to predict future population and to select a suitable source.
2. To design pipe diameter by using various hydraulic formulae and to discuss the method of laying and testing of pipes.
3. To discuss methods for determining the physical, chemical and biological characteristics of water and to ascertain suitability of water for drinking purpose based on BIS standards for drinking water.
4. To understand theory and design aspects of water treatment facilities-sedimentation, coagulation, filtration.
5. To discuss various methods of disinfection with special emphasis on chlorination
6. To introduce methods for water softening, defloridation, various layouts of distribution networks and analyzes distribution networks by Hardy-cross method

**COURSE OUTCOMES:****After completion of the course the students will be able to**

1. Predict future population, determine the quantity of water required to meet various demands and select a suitable source.
2. Design water supply mains and lay and test the pipes.
3. Test the water quality and check the suitability of water for drinking purpose based on water quality standards.
4. Design various water treatment units, select a suitable method of disinfection and acquire knowledge on more advanced methods of treatment
5. Determine the storage capacity of reservoir and analyse complex water distribution networks using Hardy Cross method.

**COURSE ARTICULATION MATRIX**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	0	0	2	0	0	0	0	0	0	2	0
CO2	3	1	1	0	0	2	0	0	0	0	0	0	2	2
CO3	2	1	2	0	0	3	0	0	0	0	0	0	2	1
CO4	3	2	2	0	0	3	2	0	0	0	0	0	3	2
CO5	3	3	2	0	0	2	1	0	0	0	0	0	3	2

**UNIT I****Text Book-1, R1, R2 [CO:1,2] (12)**

**Introduction to Water Supply Engineering and Quantity of Water:** Objectives & planning of public water supply system; Role of Environmental Engineer; Estimating water demand & Types of Demands; Design period, Per capita consumption-Factors affecting per capita consumption; Fluctuations in demand; Population forecasting methods.

**Sources of water supply & Intakes:** Surface & Ground water sources- types, comparison, choice of source; Intake structures- Location of intake; River, reservoir and canal intakes.

**Transportation and Pumping of Water:** Types of conduits; Capacity and design transmission mains, Materials for pipes, Pipe laying; jointing & testing of pipeline; Classification of pumps; Choice of pumps.

**UNIT II****Text Book-1, R1, R2, R3 [CO:3,4] (10)**

**Quality of Water:** Types of impurities & their effects; Water borne diseases; Analysis of water- Physical, Chemical & Bacteriological analysis; BIS Standards for drinking water.

**Water treatment:** Objectives, Unit operations, treatment flow-sheets for raw water from various sources.

**Aeration, Plain Sedimentation and Coagulation:** Aeration-purposes & types; Theory of sedimentation; Stoke's law; Sedimentation tanks; Design aspects; Tube settlers; Principle of coagulation; Chemicals used for coagulation; Optimum Dose of Coagulant.

**UNIT III****Text Book-1, R1, R3, R5 [CO:4] (10)**

**Filtration of Water:** Theory of filtration; Filter materials; Slow sand and rapid sand filters; Construction and design; Slow sand filters verses rapid sand filters; Troubles in rapid sand filters; Pressure filters.

**Disinfection of Water:** Different methods of disinfection; Chlorination: Disinfection action; Forms of chlorine; Types of chlorination.

**UNIT IV****Text Book-1, R1, R4 [CO:5] (12)**

**Advanced methods of treatment:** Water softening: Methods of removing temporary and permanent hardness; Defluoridation; Iron & manganese removal; Membrane filtration in water treatment-Microfiltration, Ultrafiltration, nanofiltration and reverse osmosis.

**Distribution System:** General requirements; Classification; Methods of supply; Available pressure in the distribution system; Layouts of distribution networks; Distribution reservoirs; Functions; Types; Capacity of balancing tank; Analysis of distribution system by Hardy-cross method, Service connection, Sluice valves; Check valve; Air valve; Drain valve; Water Meters.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Elements of Environmental engineering by K. N. Duggal, S. Chand & Company Ltd., 2010

**REFERENCE BOOK(s):**

1. Environmental Engineering Vol. I - Water supply engineering by S. K. Garg; Khanna Publishers, Delhi, 2010
2. Environmental Engineering by Peavy and Rowe, McGraw Hill 7th Edition, 1987
3. Water Supply and Sewerage by E.W. Steel and Terence J. Mc Ghee, McGraw Hill Publishers, New York 4.
4. Water & Wastewater Technology by Mark J. Hammer; John Wiley & Sons
5. Manual on Water Supply & Treatment; CPH and EEO, Ministry of Urban Development; Govt. of India, New Delhi.

**WEB RESOURCES:**

[www.nptel.iitk.ac.in](http://www.nptel.iitk.ac.in)



CE213

SOLID MECHANICS-II

L T P C Int Ext

3 - - 3 30 70

Semester III [Second Year]

**COURSE OBJECTIVES:**

1. To understand superposition of stresses
2. To study transformation of plane-stress
3. To apply work and strain energy method
4. To study failure theories
5. To determine deflection of statically determinate beams
6. To study buckling of columns

**COURSE OUTCOMES:**

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

1. Understand and apply the principles of compound stresses, including superposition of normal and shear stresses.
2. Analyze plane stress problems using the transformation equations for principal stresses and maximum shear stresses.
3. Evaluate and compare various failure theories, including maximum normal stress theory and maximum distortion energy theory.
4. Analyze the deflection of statically determinate beams using various methods, including the Direct Integration Method, Moment Area Method, and Conjugate Beam Method.

**COURSE ARTICULATION MATRIX:**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	0	0	0	0	0	0	0	0	0	3	1
CO2	3	2	0	0	0	0	0	0	0	0	0	0	3	1
CO3	3	1	0	0	0	0	0	0	0	0	0	0	3	1
CO4	3	2	0	0	0	0	0	0	0	0	0	0	3	1

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****Text Book-1, R1 [CO:1] (13)**

**Compound stresses:** Introduction; Superposition and its limitation; Superposition of normal stresses; Stresses in a dam-middle-third rule; Eccentrically loaded short columns; Core or kernel of a section; Superposition of shear stresses; Stresses in closely coiled helical springs; Deflection of closely coiled helical springs

**UNIT II****Text Book-1, R1, R2[CO:2,3](12)**

**Analysis of Plane-Stress:** Introduction; The basic problem; Equations for transformation of plane-stress; Principal planes and Principal stresses ; Maximum shear stresses ; Mohr's circle of stress ; Construction of Mohr's circle Work and Strain Energy: Introduction; Elastic strain energy for uni-axial stress; elastic strain energy in pure bending; Strain energy of beams in shear; Strain energy of circular shafts in torsion; Work and strain energy method; Determination of displacements by work and strain energy method

**UNIT III****Text Book-1, R2, R3[CO:3,4,5](12)**

**Failure Theories:** Introduction; maximum normal stress theory; maximum shearing stress theory; maximum strain energy theory; maximum distortion energy theory; comparison of theories. Buckling of columns: Introduction; Examples of instability; Criteria for stable equilibrium; Euler load for column with pinned ends; Euler loads for columns with different end restraints; Limitations of the Euler's formulae; Generalized Euler buckling load formulae; Eccentric loads and the secant formula

**UNIT IV****Text Book-1, R3, R4[CO:6](13)**

**Deflection of statically determinate beams:** Introduction; strain-curvature and Moment-Curvature relation ; Governing differential equation for deflection of elastic beams; Solution of beam deflection problem by Direct integration; Introduction to moment area method; Derivation of Moment area theorems ; conjugate-beam method; slope and deflection of beams using moment area method.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Mechanics of Materials by Pytel and Kiusalaas , Cengage Learning, SI Edition, 2017

**REFERENCE BOOK(s):**

1. Mechanics of materials by E.P. Popov , Pearson Education(India) ,2015.
2. Engineering mechanics of solids by E.P. Popov, Pearson Education(India) ,2015.
3. Elements of strength of materials by S.P. Timoshenko and D.H.Young, Affiliated East-West Press Pvt.Ltd.,2005
4. Mechanics of materials by R.C.Hibbeler, SI Edition, Pearson Education(India) ,2018
5. Mechanics of materials by P.Beer and E.R.Johnston, 7th Edition, McGraw-hill Education (India) Pvt.Ltd., 2017

**WEB RESOURCES:**

[www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

CE214

BUILDING MATERIALS AND CONSTRUCTION

L T P C Int Ext

3 - - 3 30 70

## Semester III [Second Year]

**COURSE OBJECTIVES:**

1. To teach the basics involved in selection of good quality building materials for construction.
2. Imparting the knowledge of plastics and paints.
3. To demonstrate brick masonry works including types of bonds, specifications of plastering and acoustics of building.
4. To give knowledge about various building components and their specifications, types of form work and rehabilitation work of building

**COURSE OUTCOMES:**

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

1. Demonstrate knowledge on different tests for bricks and timber treatment to ensure material quality in construction projects.
2. Understand the properties, fabrication methods, and applications of plastics and coatings commonly used in buildings, including reinforced plastics.
3. Understand the terminology, methods, and materials used in brick masonry and plastering, including the specifications for cement mortar plastering.
4. Understand shoring, underpinning, scaffolding, and formwork techniques, and apply them in construction for structural support and stability.

**COURSE ARTICULATION MATRIX:**

PO RSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	0	0	1	1	0	0	0	0	0	1	1	0	2	2
CO2	0	0	2	1	1	2	0	0	0	1	2	0	2	2
CO3	0	0	2	1	1	2	3	1	0	1	3	0	2	2
CO4	0	0	2	1	1	2	3	2	0	1	3	0	2	1

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I**

Text Book-1, 2, R2 [CO:1] (15)

**Clay bricks:** Brick clay, Preparation of bricks, Types of bricks, Dimensions of bricks, Weight of bricks, Storing of bricks, Brick substitutes, Classification of bricks, Tests for bricks.

**Timber:** Classification of trees, Structure of wood, seasoning and con-version of timber, Market forms of timber, Defects of timber, Treatment of timber, Classification of timber.

**Glass:** Manufacture and Classification, Uses of glass, testing for quality

**UNIT II**

Text Book-1, 2, R2 [CO:2] (15)

**Plastics:** Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics.

**Paints:** Types of paints, Composition of paints, Considerations in choosing paints, Paints commonly used in buildings. Damp Proofing and water proofing materials and uses, white washing and distempering.

**UNIT III**

Text Book-3, R1, R3 [CO:3] (15)

**Brick Masonry:** Terms used in brickwork, Mortars to be used, bonding of bricks, Method of laying bricks.

**Plastering:** Plastering method, Specifications for plastering with cement mortar.

**Stairs and lifts:** Terminology used in stairs, Types of stairs, Recommendations for RCC stair case, lifts

**Acoustics:** Basic theory, Reverberation and echoes, Sound isolation, Acoustical materials, Recommendations for different types of buildings

#### UNIT IV

**Text Book-3, R1, R3 [CO:4] (15)**

**Building Components:** Lintels, arches, vaults, Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Prefabricated roofs.

**Shoring, Underpinning, Scaffolding and Formwork:** Shoring, Types of shores; Underpinning - Pit method, Pile method; Scaffolding -Types of scaffolding; Formwork-requirements of formwork, formwork for columns, beams, slabs

#### LEARNING RESOURCES:

##### TEXT BOOK(s):

1. Engineering Materials by Rangwala, Charotar Publications, Fortieth Edition: 2013
2. Building Materials by P.C. Verghese, 1st Edition, PHI, 2009.
3. Building construction by Rangwala, Charotar Publications ,33rd Edition:2017

##### REFERENCE BOOK(s):

1. Building construction by P.C. Verghese, 1st Edition, PHI, 2009.
2. Building material by S K Duggal – New Age International Publishers; Second Edition
3. Building construction by BC Punmia et al., 10th Edition, Laxmi Publications, 2008.

##### WEB RESOURCES:

[www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

CE215

**CONCRETE TECHNOLOGY**

L T P C Int Ext

3 - - 3 30 70

**Semester III [Second Year]****COURSE OBJECTIVES:**

1. To know about the composition, manufacturing process, types and testing of cement and properties of materials used for making concrete.
2. To study the properties and behaviour of concrete during fresh state and hardened state by various theories, concepts and tests.
3. To understand the composition and effects of admixtures and construction chemicals used to improve the properties of concrete.
4. To know about special concretes and studying the design mix procedure as per IS10262 code

**COURSE OUTCOMES:****By the end of the course the students will be able to**

1. Demonstrate knowledge on composition, manufacturing process, types and testing of cement and properties of materials used for making concrete.
2. Understand the properties and behaviour of concrete during fresh state and hardened state by various theories, concepts and tests.
3. Understand the composition and effects of admixtures and construction chemicals used to improve the properties of concrete.
4. Demonstrate knowledge on special concretes and able to design concrete mix as per IS10262 code.

**COURSE ARTICULATION MATRIX:**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	0	1	0	0	1	0	0	2	0	0	0	0	1	1
CO2	0	1	0	0	2	0	0	1	0	0	0	0	2	1
CO3	0	2	0	3	3	0	0	1	0	0	0	0	3	2
CO4	0	3	0	2	3	0	0	3	0	0	0	0	3	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****Text Book-1,2[CO:1](12)**

**Cement:** General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, heat liberation from a setting cement, structure of hydrated cement, water requirements for hydration,

**Types Of Cements:** Ordinary Portland cement, Portland pozzolana cement, Rapid hardening cement, Sulphate resisting cement, Slag cement, Quick setting cement, Super sulphated cement, Air entraining cement, Coloured cement, Expansive cement, High alumina cement.

**Testing Of Cement:** Fineness of cement using sieve test and air-permeability method, Normal consistency and setting times using Vicat apparatus, Soundness test using Le-chatlier apparatus, Compressive strength of cement.

**Aggregates:** Classification, source, size and shape texture and influence of texture on strength, specific gravity of aggregates, moisture in aggregates, bulking of fine aggregate, grading of aggregates, sieve analysis of fine and coarse aggregates.

**Water:** Permissible limit for solids as per IS456-2000, use of sea water for mixing concrete.

**UNIT II****Text Book-1,2[CO:2,3](12)**

**Fresh Concrete:** Workability, factors affecting workability, slump test, Kelly ball test, V-B test, compaction factor test, segregation, bleeding, volume batching and weigh batching, hand mixing, machine mixing, mixing time, compaction of concrete, hand compaction, compaction by vibration, internal vibrator, form work vibrator, table vibrator, platform vibrator, surface vibrator.

**Admixtures:**

**Chemical Admixtures:** Plasticizers and super plasticizers, Retarders, Accelerators, Air-entraining admixtures. Effect of mineral admixtures on fresh and hardened concrete.

**Mineral admixtures:** Fly ash, silica fume, Slag, Effect of mineral admixtures on strength and durability of concrete.

**UNIT III****Text Book-1,2[CO:2](12)**

**Hardened Concrete:** General; Effect of water-cement ratio on strength, Gain of strength with age, Compressive strength, Effect of height/diameter ratio on compressive strength; Flexural strength of concrete; Tensile strength of concrete; Non-destructive testing methods. Elastic properties of concrete, Factor's affecting modulus of elasticity, Poisson's ratio.

**Durability Of Concrete:** Cracks in concrete, Sulphate attack and methods of controlling sulphate attack, Chloride attack, Corrosion of steel and its control.

**UNIT IV****Text Book-1,2[CO:4](12)**

**Special Concretes:** Fibre reinforced concrete, High strength concrete, Light-weight concrete, High performance concrete, Self compacting concrete.

**Proportioning Of Concrete Mixes:** Concept of mix design, Variables in proportioning, Different methods of mix design, Nominal mix and design mix, Indian standard method of mix design as per IS-10262:2009.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Concrete technology by A.R.Santhakumar, 1st Edition, Oxford University Press, 2006.
2. Concrete technology by M.S.Shetty, S.Chand & Company Pvt. Ltd., New Delhi, 2005

**REFERENCE BOOK(s):**

1. Properties of concrete by A.M.Neville, Pearson Education, 2007
2. Concrete technology by M.L.Gambhir, Tata McGraw-Hill, 2009.

**WEB RESOURCES:**

1. <http://nptel.iitm.ac.in/video.php?subjectId=105102088>
2. <http://www.engineeringcivil.com/theory/concrete-engineering/>

CE251

ENVIRONMENTAL ENGINEERING LABORATORY

L T P C Int Ext

- - 3 1.5 30 70

Semester III [Second Year]

**COURSE OBJECTIVES:**

1. To determine the physical, chemical, biological characteristics of drinking water/Sewage.
2. To determine the chlorine dosage and residual chlorine in treated water sample.
3. To estimate optimum dosage of coagulant.
4. To train the student in using instruments like pH meter, turbid meter, Noise meter, UV- Visible spectrophotometer etc.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Conduct tests for physical, chemical, biological quality of water/sewage.
2. Use the instruments with appropriate precautions to obtain maximum precision in the readings.
3. Conduct jar test to determine the exact quantity of coagulant needed at treatment plant based on the turbidity of the given sample.
4. Ascertain whether the given water is fit for drinking purpose or not by comparing the quality parameters with BIS standards (IS 10500-2012).

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	2	2	2	2	0	0	0	0	0	0	0	3	3
CO2		3	2	2	2	2	0	0	0	0	0	0	0	3	3
CO3		3	2	2	2	2	0	0	0	0	0	0	0	3	3
CO4		3	2	2	2	2	0	0	0	0	0	0	0	2	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**List of Experiments:**

1. Determination of total, suspended and dissolved solids in water / sewage sample
2. Determination of fixed and volatile solids in water / sewage sample
3. Determination of Settleable Solids
4. Determination of turbidity of water / sewage sample
5. Determination of pH value of water / sewage sample
6. Determination of optimum dose of coagulant
7. Determination of residual chlorine
8. Determination of temporary and permanent hardness of water sample
9. Determination of chloride concentration of water / sewage sample
10. Determination of acidity of water sample
11. Determination of alkalinity of water sample
12. Determination of fluorides in water sample
13. Determination of Dissolved Oxygen of water / sewage sample
14. Determination of Biochemical Oxygen Demand (BOD) of waste water

**Note:** A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Standard Methods for examination of Water and Wastewater by APHA.

**REFERENCE BOOK(s):**

1. Chemistry for Environmental Engineers by Sawyer & Mc Carty, McGraw-Hill International Edition
2. Water & Wastewater Technology by Mark J. Hammer; John Wiley & Sons.

CE252

CONCRETE TECHNOLOGY LABORATORY

L T P C Int Ext

- - 3 1.5 30 70

## Semester III [Second Year]

**COURSE OBJECTIVES:**

1. To conduct tests to find the quality of concrete making materials like cement fine aggregate and coarse aggregates.
2. To determine the fresh and hardened concrete properties.
3. To estimate the quality and strength of concrete using non-destructive testing on concrete
4. To understand the flow properties of Self Compacting Concrete fibre reinforced concrete.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Determining the properties of concrete making materials like cement, fine aggregate and coarse aggregate for design mix of concrete
2. Properties and behavior of concrete in fresh and hardened states
3. Using non destructive testing methods to estimate quality of concrete
4. The properties of self compacting concrete and fibre reinforced concrete

**COURSE ARTICULATION MATRIX**

CO \ PO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PSO														
CO1		3	0	2	3	3	0	0	0	0	0	0	0	3	3
CO2		3	0	3	3	3	0	0	0	0	0	0	0	3	3
CO3		3	0	3	2	3	0	0	0	0	0	0	0	3	3
CO4		3	0	3	3	3	0	0	0	0	0	0	0	3	3

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**List of Experiments:**

1. Determination of (a) Normal consistency of cement (b) Fineness of cement using 90 microns IS sieve.
2. Determination of Initial setting and final setting time of cement
3. Determination of (a) Specific gravity of cement (b) soundness of cement.
4. Determination of Fineness modulus of (a) Fine aggregate (b) Coarse aggregate
5. Determination of workability of concrete by conducting Slump cone test
6. Determination of workability of concrete by conducting Compaction factor / Vee-Bee consistometer test
7. Determination of (a) Cube compressive strength (b) Cylinder compressive strength
8. Determination of (a) Split tensile strength of concrete (b) Flexural strength of concrete
9. Determination of modulus of elasticity of concrete by conducting compression test on concrete cylinder.
10. Determination of Bulk density and Specific gravity of (a) fine aggregate (b) coarse aggregates.
11. Determination of maximum percentage of Bulking of fine aggregate.
12. Study of the effect of Super plasticizer on workability of concrete.
13. Study on flow properties of self compacting concrete.
14. Non-destructive test on concrete using Rebound Hammer
15. Non-destructive test on concrete using Ultrasonic Pulse Velocity Tester
16. Location of reinforcement bar in concrete using profile meter.
17. Tests on Fibre reinforced Concrete (Cube crushing, Split tensile and Modulus of rupture tests)
18. Demonstration of concrete design mix as per IS 10262:2019.

**Note:** A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.



**CE253****SURVEYING FIELD WORK LABORATORY****L T P C Int Ext****- 3 1 .5 30 70****Semester III [Second Year]****COURSE OBJECTIVES:**

1. To measure the elevation difference between two points using any leveling Instrument.
2. To measure the horizontal and vertical angles of various points by theodolite.
3. To introduce Total Station instrument for regular field survey purpose.
4. To make every student familiar with Total Station and all of the experiments which are done by mechanical instruments before are now done with Total station.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Perform basic field surveys.
2. Use Auto level, theodolite instruments.
3. Use the Total Station Instrument by avoiding manual errors.
4. Set out the curves using Total station.
5. Demonstrate knowledge on drone survey.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	2	0	2	2	0	0	0	2	2	0	0	2	2
CO2		3	0	0	2	2	0	0	0	2	2	0	0	2	2
CO3		3	2	2	2	2	0	0	0	2	2	0	0	2	2
CO4		3	2	2	2	2	0	0	0	2	2	0	0	2	2
CO5		3	2	2	2	2	0	0	0	2	2	0	0	2	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**List of Experiments:**

1. Measurement of area and direction by conventional methods
2. Measurement of elevation difference between two points using any leveling Instrument (Fly Leveling)
3. Elevation difference between two points by Reciprocal leveling method.
4. Measurement of horizontal angles and vertical angles using theodolite.
5. Study of Total station Instrument
6. Determination of Distances, Directions and Elevation by Total station
7. Determination of Boundaries of a Field and computation of area by Total station
8. Determination of Boundaries of a Field and computation of volume by Total station
9. Determination of Heights of objects by Total station
10. Stake out and point to line by Total station
11. Setting out for building foundation by using Total station
12. Setting of a simple circular curve using Total Station.
13. Study and demo on Drone survey

**Note:** A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

**CEMC4****ETHICS & HUMAN VALUES****L T P C Int Ext**

(Mandatory Course)

**2 - - - 100 -****Semester III [Second Year]****COURSE OBJECTIVES:**

1. Creating awareness to deal their own inner nature for staying peacefully, utilizing energies in balanced manner, dealing activities in ethical manner and giving respect to their neighbours for making peaceful, prosperous and happier surroundings.
2. Giving subject information such a way that students can be able to discriminate what is moral and what is immoral in engineering aspects. Through that students can be able to perform their knowledge time and energies for wellbeing of people.
3. Giving information regarding safety and risk and their consequences in industry and day to day life.
4. Creating awareness regarding environmental loss, standards and codes fixed by professionals for smooth running of industries and meeting national and international interests

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Understand how to prospective engineer should behave in his field, society etc.
2. Differentiate how an engineer should live in moral and immoral in his/ her profession.
3. Deal product design processes and services by incorporating safety/ risk aspects.
4. Know regarding various aspects of environmental standard codes.

**UNIT I****Text Book- [CO: ] (15)**

**Human Values :** Morals, Values And Ethics, Integrity, Work Ethics, Service Learning, Civic Virtue- Respect For Others, Living Peacefully, Caring, Sharing, Honesty, Courage, Valuing Time, Co-Operation, Commitment, Empathy, Self Confidence, Character, Spirituality.

**UNIT II****Text Book- [CO: ] (15)**

**Engineering Ethics:** Senses of Engineering Ethics, Variety Of Moral Issues, Types Of Inquiry, Moral Dilemmas, Moral Autonomy, Kohlberg's Theory, Gillian's Theory, Consensus And Controversy, Professions And Professionalism, Professional Ideals And Virtues, Theories About Right Action, Self- Interest, Customs And Religion, Uses Of Ethical Theories.

**UNIT III****Text Book- [CO: ] (15)**

**Engineering As Social Experimentation:** Engineering as Experimentation, Engineers as Responsible Experimenters, Codes of Ethics, Balanced Outlook on Law.

**Safety, Responsibilities and Rights:** Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Collegiality And Loyalty, Respect For Authority , Collective Bargaining, Confidentiality, Conflicts Of Interest, Occupational Crime, Professional Rights, Employee Rights, Intellectual Property Rights (IPR), Discrimination

**UNIT IV  
(15)****Text Book- [CO: ]**

**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 Ethics Like ASME, ASCE, IEEE, Institution Of Engineers (India), Indian Institute Of Materials Management, Institution Of Electronics And Telecommunication Engineers (IETE), India Etc.,.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Mike martin and Ronald Schinzinger, "Ethics in Engineering" McGraw-Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V.S., "Engineering Ethics", PHI, New Delhi,

2004

**REFERENCE BOOK(s):**

1. Charles D,Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint).
2. Charles E Harris, Michael S.Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases" Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available).
3. John R Boatright, "Ethics and the conduct of business" Pearson, New Delhi, 2003.
4. Edmund G.Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers" Oxford University Press, Oxford, 2001.

CE221

MATHEMATICS-III

L T P C Int Ext

(Transform Calculus and Numerical Methods)

3 - - 3 30 70

Semester IV [Second Year]

**COURSE OBJECTIVES:**

The objective of this course is to familiarize the prospective engineers with techniques in transform calculus and numerical methods. It aims to equip the students with standard concepts and tools of integral transforms and numerical techniques that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

**COURSE OUTCOMES:**

**By the end of the course the students will be able to:**

1. Finding Laplace and inverse transforms of a function.
2. How integral transforms can be used in engineering.
3. Solving system of equations numerically.
4. How to apply numerical methods to solve the mathematical models.

**UNIT I  
(15)**

Text Book-1 [CO:1]

**Laplace transforms** – Introduction, properties of Laplace transforms, Evaluation of integrals by Laplace transforms, Laplace transform of periodic function.

**Inverse Laplace transforms** – Method of partial fractions, other method of finding inverse

transforms - 
$$tf(t) = L^{-1} \left[ -\frac{d}{ds} F(s) \right],$$
 Convolution theorem.

**UNIT II**

Text Book-1 [CO:2] (15)

**Applications to differential equations** – Solving second order ordinary differential equations with constant coefficients using Laplace transforms.

**Fourier transforms** – Fourier transforms, Fourier sine and cosine transforms and inverse transforms.

**UNIT III  
(15)**

Text Book-1 [CO:3]

**Numerical solution of equations** – Newton Raphson method, Gauss-Seidal method.

**Finite differences** – Forward and backward differences, differences of a polynomial.

**Interpolation** – Newton's forward and backward interpolation formulae (without proof).

**Lagrange's interpolation formula** (without proof), inverse interpolation.

**Numerical differentiation** – Finding first and second order derivatives using Newton's forward and backward differences formulae.

**UNIT IV**

Text Book-1 [CO:4] (15)

**Numerical Integration** – Trapezoidal rule and Simpson's one third rule.

**Numerical solution of first order ordinary differential equations**–Taylor's series method, Euler's method, Runge Kutta method of fourth order.

**Numerical solution of partial equations** – Classification of second order equations, solutions of Laplace and Poisson's equations.

**LEARNING RESOURCES:**

**TEXT BOOK(s):**

1. B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition.

**REFERENCE BOOK(s):**

1. Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.

**WEB RESOURCES:**

<http://nptel.iitm.ac.in/courses/>

CE222

**ENGINEERING GEOLOGY**

L T P C Int Ext

3 - - 3 30 70

**Semester IV [Second Year]****COURSE OBJECTIVES:**

1. Develops the ability to understand the importance of geology in civil engineering
2. Develops the skills for site investigations for projects like dams, tunnels etc and solution solutions for various geological problems

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Understand the importance of geology in civil engineering
2. Familiarize with identifying the geological process of the region related to the civil engineering works
3. Evaluate the formation and properties of the minerals , rocks and soil as building materials and site material
4. Understand the site and solutions for different geological problems using geological and geophysical tools.

**COURSE ARTICULATION MATRIX:**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	0	0	0	1	0	0	0	0	0	1	2
CO2	2	2	1	0	0	0	1	0	0	0	0	0	1	2
CO3	2	2	2	0	1	3	2	0	0	0	0	0	1	2
CO4	2	2	2	0	1	2	1	0	0	0	0	0	1	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****Text Book-1 [CO:1,2] (10)****INTRODUCTION:** Branches of geology, Importance of geology in Civil engineering.**PHYSICAL GEOLOGY:** Geological processes; Weathering, Erosion, Importance of the process of Weathering and Erosion.**MINERALOGY:** Definition of mineral; Significance of different physical properties in mineral identification; Study of physical properties, structure and chemical composition of following common rock forming and economic minerals: Feldspar, Quartz, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Apatite , Kyanite, Garnet, Beryl, Talc, Calcite, Dolomite, Pyrite, Hematite, Magnetite, Galena, Graphite, Magnesite , Bauxite and Clay minerals**UNIT II****Text Book-1 [CO:3] (10)****PETROLOGY:** Introduction; Civil engineering importance of petrology; Rock cycle, Geological Classification of rocks**IGNEOUS ROCKS:** Forms, Structures and textures of igneous rocks. Megascopic description and civil engineering uses of Granite, Basalt, Dolerite, Pegmatite and Charnockite**SEDIMENTARY ROCKS:** Formation; Structures and textures of sedimentary rocks. Megascopic description and civil engineering uses of Laterite, Conglomerate, Sand stone, Lime stone and Shale**METAMORPHIC ROCKS:** Types of metamorphism; Structures and textures of metamorphic rocks. Megascopic description and civil engineering uses of Gneiss, Schist, Quartzite, Marble and slate

**UNIT III****Text Book-1 [CO:2,4] (10)**

**STRUCTURAL GEOLOGY:** Introduction; Causes for development of structures; Out crop, Strike and dip; Folds; Faults; Joints; Unconformities.

**IMPORTANCE OF GEOLOGICAL STRUCTURES:** Effects of folds, faults, joints, unconformities and their civil engineering importance.

**EARTHQUAKES:** Classification and causes; Intensity and magnitude and their measuring scales; Effects of earthquakes; Seismic belts; Civil Engineering considerations in seismic areas; Seismic zones of India.

**Land Slides:** Classification; Causes and effects; Preventive measures.

**UNIT IV****Text Book-1 [CO:4] (10)**

**GEOPHYSICAL INVESTIGATIONS:** Geophysical methods of investigation –Civil engineering importance of geophysical methods; Electrical resistivity method and Seismic refraction method.

**DAMS:** Geological considerations for the selection of dam sites; Stages of investigation; Case histories of some dam failures; Geology of some Indian dam sites.

**TUNNELS:** Effects of tunneling; Geological considerations for tunneling; Over break; Geology of some tunnel sites;

**IMPROVEMENT IN PROPERTIES OF ROCK MASS:** Materials and Methods of Grouting, Principles and mechanism of Rock bolting

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. A text Book of Engineering Geology by N. Chennakesavulu, Trinity Press 2<sup>nd</sup> Edition.

**REFERENCE BOOK(s):**

1. Engineering Geology For Civil Engineers by D. Venkata Reddy; Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
2. Engineering and General Geology by Parbin Singh; S. K. Kataria & Sons, New Delhi.
3. Rock Mechanics for Engineers by Dr.B.P.Varma, Khana Publishers, Delhi-6.
4. Engineering Geology an environmental approach by P Harahn, PHI
5. Principles of Petrology by G W Tyrrell, B.I Publications Delhi-1
6. Principles of Engineering Geology by K M Bangar, Standard Publishers and Distributers

**WEB RESOURCES:**

1. NPTEL COURSE- Developed by Prof. Debasis Roy, IIT, Kharagpur - 721302
2. <http://www.eos.ubc.ca/academic/undergraduate/appsci.html>
3. <http://web.mst.edu/~rogersda/umrcourses/ge341/>
4. [http://web.env.auckland.ac.nz/course\\_pages/geology771/](http://web.env.auckland.ac.nz/course_pages/geology771/)

CE223

**HYDRAULICS AND HYDRAULIC MACHINES**

L T P C Int Ext

2 1 - 3 30 70

**Semester IV [Second Year]****COURSE OBJECTIVES:**

1. To understand the basic concepts of uniform flow and transitions in open channel.
2. To study different GVF profiles and characteristics of hydraulic jump.
3. To analyze hydraulic models and to find action of jets on plates by applying momentum principles.
4. To study the working principle and characteristics of pelton turbine, Francis turbine and centrifugal pump.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Analyze and design of open channel flows.
2. Analyze gradually and rapidly varied flow problems in open channels.
3. Construct and test models using similarity laws and find impact of jets on plates.
4. Apply momentum principle in the analysis of flow through turbines and pumps.

**COURSE ARTICULATION MATRIX:**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	3	0	0	0	0	0	0	0	0	0	0	3	1
CO2	3	3	0	0	0	0	0	0	0	0	0	0	3	1
CO3	3	3	0	0	0	0	0	0	0	0	0	0	3	0
CO4	3	3	1	0	0	0	0	0	0	0	0	0	3	1

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****Text Book-1,2 [CO:1] (15)****Open Channel Flow - Uniform Flow**

Introduction, Classification of flows, Types of channels; Chezy, Manning's, Kutter's Equations; Hydraulically efficient channel sections - Rectangular, Trapezoidal and Circular channels; Velocity distribution; Energy and momentum correction factors; Pressure distribution.

**Open Channel Flow - Non - Uniform Flow**

Concept of specific energy; Specific energy curves; Critical flow; Critical flow in a rectangular channel; Critical slope; Different slope conditions; Channel transitions- hump;

**UNIT II****Text Book-1,2 [CO:2] (15)****Open Channel Flow - Gradually Varied Flow**

Dynamic equation; surface profiles; Computation of length of surface profiles by single step method; Back water curves and Draw down curves; Examples of various types of water surface profiles.

**Open Channel Flow - Rapidly Varied Flow**

Hydraulic jump; Momentum principle applied to open channel flow; Specific force. Relation between sequent depths; Energy loss in a hydraulic jump (For rectangular channel only); Types of hydraulic jump.

**UNIT III****Text Book-1,2 [CO:3] (15)****Dimensional Analysis and Similitude**

Dimensional homogeneity; Rayleigh's method; Buckingham  $\pi$ -method ; Geometric, Kinematic and Dynamic similarities; Reynold's, Froude, Euler, Mach and Weber numbers; Reynold's and Froude Model laws; Scale effect; Distorted models.



**Momentum Principles**

Action of jets on stationary and moving flat plates and curved vanes; Angular momentum principle; Torque in roto dynamic machines.

**UNIT IV****Text Book-1,2 [CO:4] (15)****Hydraulic Turbines**

Classification; Impulse; Reaction; Radial, Axial, mixed and tangential flow turbines; Pelton, Francis turbines; Runner profiles; Velocity triangles; Head and efficiency; Draft tube theory; Concept of specific speed and unit quantities; Selection of Turbines; Operational characteristics.

**Centrifugal Pumps**

Manometric head; Losses and efficiencies; Work done; Working Principle; Priming; Velocity triangles; specific speed; characteristic curves; Cavitation effects;

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P. N. Modi and S. M. Seth, 22<sup>nd</sup> Edition, Standard Book house, New Delhi, 2019.
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Revised 9<sup>th</sup> Edition, Laxmi Publications, 2015.

**REFERENCE BOOK(s):**

1. Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi, 2008.
2. Flow in Open channels by K. Subramanya, 5<sup>th</sup> Edition, Tata McGraw-Hill, 2019.

**WEB RESOURCES:**

[www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

CE224

**STRUCTURAL ANALYSIS**

L T P C Int Ext

3 - - 3 30 70

Semester IV [Second Year]

**COURSE OBJECTIVES:**

1. Students will learn to analyze three hinged and two hinged, circular arches for static and moving loads.
2. Students will learn about establishing different types of structures and degree of determinacy, calculating reactions and internal forces (axial force, shear, and bending moment) for determinate and indeterminate structures and its components.
3. Students will learn about calculating deflections for beams and frames using energy methods.
4. Let the students understand the behavior of various buildings, bridges, and catenary cable systems so that they can reasonably select and analyze a type of building, bridge, or catenary cable system in structural design.
5. Students will learn about constructing influence lines for beams, trusses and three hinged arches.
6. To analyze the statically indeterminate structures like fixed beams, continuous beams, two hinged arches and influence lines for continuous members by Muller Breslau's principle.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Analyze determinate arches subjected to various loads like circular and parabolic arches .
2. Determine the tension in anchor and cable for suspension bridges.
3. Determine deflections for statically determinate structures by the use of energy methods.
4. Construct influence lines for beams, trusses and three hinged arches for bending moment and shear force etc.
5. Analyze fixed beams
6. Analyze multi storied frames by approximate methods using portal and cantilever methods.

**COURSE ARTICULATION MATRIX**

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	0	1	0	0	0	0	0	0	0	0	3	0
CO2	3	3	0	1	0	0	0	0	0	0	0	0	3	0
CO3	3	3	0	1	0	0	0	0	0	0	0	0	3	0
CO4	3	3	0	1	0	0	0	0	0	0	0	0	3	0
CO5	3	3	0	1	0	0	0	0	0	0	0	0	3	0
CO6	3	3	0	1	0	0	0	0	0	0	0	0	3	0

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****Text Book-1 [CO:1] (15)**

**Arches:** Theoretical and actual arch, Eddy's theorem Types of arches, Three-hinged arches. Two-hinged arches.

**Cables:** Equation of the cable subjected to uniformly distributed load, Horizontal tension in the cable, Tension in the cable supported at different levels, Length of the cable, Effect of change in temperature.

**UNIT II****Text Book-1 [CO:2] (15)**

Displacements of statically determinate structures by Energy Methods, Virtual Work, Betti's and Maxwell's laws of reciprocal deflections, Applications of virtual work, Deflection of trusses and frames, Castigliano's theorems. Rolling loads and Influence Lines Maximum shear

force and bending moment in simply supported beams due to single concentrated load, uniformly distributed load longer than span, uniformly distributed load shorter than span, two concentrated loads, series of concentrated loads; Concept of influence line, Influence Lines for reaction, shear force and bending moment in simply supported beams, Influence lines for simple trusses and three-hinged arches.

**UNIT III****Text Book-1 [CO:3] (15)**

Statically Indeterminate Structures – Compatibility methods, Degree of indeterminacy and stability of structures, Fixed beams, Theorem of three moments, Influence lines for continuous members- Muller-Breslau's principle.

**UNIT IV****Text Book-1 [CO:4] (15)**

Statically Indeterminate Structures – Approximate Methods, Indeterminate trusses, Portal frames, Continuous beams, Building frames subjected to gravity loads, Building frames subjected to lateral loads - Portal method, Cantilever method.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Basic structural analysis by KU Muthu et.al. , IK International, 2011.

**REFERENCE BOOK(s):**

1. Basic structural analysis by CS Reddy, 3rd Edition, Tata McGraw-Hill, 2010
2. Intermediate structural analysis by CK Wang, Tata McGraw-Hill, 2010.
3. Structural Analysis by Devdas Menon, Narosa Publishing House, 2008.
4. Structural analysis by RC Hibbeler, 6th Edition, Pearson Education

**WEB RESOURCES:**

1. <http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Structural%20Mechanic%20II/Course%20Objective.html>.
2. [http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New\\_index1.html](http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New_index1.html)

**CE225****WASTE WATER ENGINEERING****L T P C Int Ext****3 - - 3 30 70****Semester IV [Second Year]****COURSE OBJECTIVES:**

1. To estimate quantities of sewage and drainage and to design sewerage system.
2. To determining the quality and characteristics of waste water.
3. To design primary and secondary waste water treatment units viz., grit chambers, sedimentation tanks, Trickling Filters and Activated Sludge Process, Oxidation ponds.
4. To design wastewater treatment and disposal in un-sewered areas, septic tanks.
5. To learn methods of ultimate sewage disposal.
6. sludge handling and disposal along with sanitary fittings and plumbing systems of drainage

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Estimate the quantity of drainage and sewage produced from a community and design sewers with all its appurtenances
2. Asses the quality and characteristics of wastewater
3. Design septic tanks, primary and secondary treatment units of wastewater.
4. Understand the process of anaerobic digestion and select suitable method of disposal of treated and untreated sewage and sludge
5. Plan plumbing system for various types of residential buildings

**COURSE ARTICULATION MATRIX:**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	3	3	0	0	0	0	0	3	2
CO2	3	2	2	3	0	3	3	0	0	0	0	0	3	1
CO3	3	3	3	0	0	3	3	0	0	0	0	0	3	3
CO4	2	1	1	0	0	3	3	0	0	0	0	0	3	2
CO5	2	1	2	0	0	3	3	0	0	0	0	0	3	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****Text Book-1, R1 [CO:1] (13)**

Introduction, Quantity of Sewage and Storm water, Sanitation; Sewerage systems; Relative merits and Suitability, Sanitary Sewage: Factors affecting sanitary sewage; Determination of quantity of sanitary sewage; Storm Water Sewage: Factors affecting storm water sewage; Determination of quantity of storm water sewage; Sewers design, Sewer Appurtenances and Sewage Pumping; Types of sewers; Design; Laying and Testing; Maintenance of sewers. Sewer appurtenances – Man holes, Drop manholes, Inverted siphons; Street inlets; Catch basins; Storm water regulators; Sewage pumping; Types of pumps.

**UNIT II****Text Book-1, R1, R6 [CO:2,3] (12)**

Quality and Characteristics of Sewage; Characteristics of sewage; Decomposition of sewage; Carbon and nitrogen cycles of decomposition; Physical and chemical analysis of sewage; BOD, BOD equation, COD; Septic Tank- Septic tank design; Septic tank effluent disposal, soak pits, leaching cesspools; Primary Treatment of Sewage; Screens; Grit chamber; Grease traps; Skimming tanks; Sedimentation tanks.

**UNIT III****Text Book-1, R2, R6 [CO:3] (12)**

Secondary Treatment of Sewage- Trickling filters: Principles of action; Filter types; Design parameters, Operational problems and remedies; Activated sludge process: Principle of action; Organic loading parameters; Methods of aeration: Diffuse dair system; Mechanical aeration; Combined system; Activated sludge process vs Trickling filter process; Sludge bulking; Sludge volume index, Secondary Settling Tanks, Oxidation Ponds.

**UNIT IV****Text Book-1,R4,R5 [CO:4,5] (13)**

Sewage Disposal-Objects; Methods; Disposal by dilution; Disposal by irrigation; Sewage sickness. Sludge Treatment and Disposal; Characteristics of sewage sludge; Anaerobic sludge digestion process; Stages of sludge digestion; Factors affecting sludge digestion; Sludge digestion tank; Methods of de-watering the sludge; Methods of sludge disposal. House Plumbing; House drainage - Sanitary fittings, Traps; Plumbing system of drainage–Single stack, One pipe and Two pipe systems; Principles.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Elements of Environmental Engineering by K. N. Duggal, S. Chand & Company Ltd., 2010.

**REFERENCE BOOK(s):**

1. Environmental Engineering vol.II –Sewage disposal and air pollution engineering by S.K.Garg; Khanna Publishers, Delhi. 2010.
2. Wastewater Engineering: Treatment, Disposal & Reuse by Met Calf, McGraw-Hill.
3. Environmental Engineering by Peavy and Rowe, McGraw-Hill (India), 2013.
4. Water & Wastewater Technology by Hammer and Hammer, PHI, 2010.
5. Water Supply and Sewerage by E.W. Steel and Terence J. Mc Ghee, McGraw-Hill, 1991.
6. Manualon Sewerage & Sewage treatment; CPH and EEO, Ministry of Works and Housing; Govt.of India; New Delhi.

**WEB RESOURCES:**

[www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

**CEMC3****DESIGN THINKING AND PRODUCT INNOVATION****L T P C Int Ext**

(Mandatory Course)

**2 - - - 100 -****Semester IV [Second Year]****COURSE OBJECTIVES:**

1. Identify the design thinking processes and methods.
2. Plan research activities to gather and empathize from a user's viewpoint.
3. Ideate techniques to help arrive at the best solution and evaluation.
4. Identify design thinking approaches for business challenges.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Interpret the concepts of Design thinking.
2. Investigate a problem to determine its root cause.
3. Take part in group thinking and experiment with different solutions.
4. Develop innovative thinking and creative problem solving.

**COURSE ARTICULATION MATRIX:**

PO PSC CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	0	2	0	0	0	0	0	0	0	2	3	3
CO2	0	3	3	2	0	0	0	2	0	0	0	2	3	3
CO3	0	3	3	2	0	0	0	2	0	0	0	2	3	3
CO4	0	0	0	3	3	3	3	0	0	0	0	2	3	3

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****Text Book-1,2 [CO:1] (12)**

Introduction to Design Thinking – Origin of Design Thinking, Features & Principles of Design Thinking, Applications of Design Thinking, Role of Research in Design Thinking.

**UNIT II****Text Book-3 [CO:2] (12)**

Modules of Design Thinking – Inspiration – methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity.

**UNIT III****Text Book-3 [CO:3] (12)**

Modules of Design Thinking – Ideation & Implementation – methods & tools used in Experiment, Engage and Evolve phases of Design Thinking, Case study-activity.

**UNIT IV****Text Book-4 [CO:4] (12)**

Design Thinking applied in Business & Strategic Innovation – Ten Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization, Creative Culture, Strategy & Organization – Design Thinking approaches.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress.

2. "Change by design", Tim Brown, Harper Collins, 2009
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan.
4. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013).

**REFERENCE BOOK(s):**

1. "Design Thinking Business Innovation", Rio de Janeiro – 2012 1st edition, MJV press.
2. "Design Thinking- Understanding How Designers Think and Work" by Nigel Cross, Berg publishers.

**WEB RESOURCES:**

1. IDEO: Design Thinking for Educators toolkit <https://designthinkingforeducators.com/>.
2. <https://dschool.stanford.edu/resources/a-virtual-crash-course-in-design-thinking>
3. <https://dschool-old.stanford.edu/groups/designresources/wiki/4dbb2/> (wallet Project)

**CE261****COMMUNICATIVE ENGLISH LABORATORY****L T P C Int Ext****- - 3 1.5 30 70****Semester IV [Second Year]****COURSE OBJECTIVES:**

1. To build confidence and enable students speak better English.
2. To motivate students to use English in different situations and contexts.
3. To enable students understand the importance of preparation and practice in presentations.
4. To enable them to understand the basic nuances for effective language communication.
5. Practice comprehensible pronunciation of English.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Recognize the need of good communication skills for professional courses.
2. Understand the basic tenets of communication.
3. Articulating syllables clearly, speaking fluently with correct pronunciation.
4. Develop their self awareness.
5. Understand the importance of group dynamics

**List of Experiments:****Basics of Presentations**

1. Ice breaking session
2. Student Presentation-I

**Learning about Presentations**

1. Presentation structure
2. Managing nerves in a presentation
3. Mini Presentations
4. Feedback on presentations

**Professional and Personal Grooming**

1. Functional English
2. Non Verbal Communication
3. Stage Manners
4. Understanding and preparing a Presentation
5. Team presentations

**Speech Nuances**

1. Pronunciation
2. MTI-Mother Tongue Influence
3. Stress in English
4. Tempo of Speech
5. Indianisms and Often Made Mistakes
6. Idioms & Phrasal verbs

**Free Talk**

1. Dilemma Questions
2. Paraphrasing an article or a video in student's own words (Team task)
3. Impromptu speeches
4. Introducing TED TALKS
5. Movie based Learning-Karate Kid Movie-Understanding Life Skills



**LEARNING RESOURCES:**

**REFERENCE BOOK(s):**

1. Making Successful Presentations: A Self-Teaching Guide-Terry C. Smith, 19846
2. Professional Presentations -Malcom Goodale
3. Giving Presentations -Jo Billing ham
4. APA ART Speak Well I
5. Handouts

CE262

ENGINEERING GEOLOGY LABORATORY

L T P C Int Ext

-- 3 1.5 30 70

Semester IV [Second Year]

**COURSE OBJECTIVES:**

1. Develops the ability to understand the importance of geology in Civil Engineering.
2. Develops the skills for site investigations for projects like dams, tunnels etc and findingsolutions for various geological problems.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Understand the applications of Toposheets, satellite imageries for site selection
2. Select good quality building materials and their sourcing
3. Solve the field problems

**COURSE ARTICULATION MATRIX**

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PSO														
CO1		2	2	2	0	2	2	1	0	0	0	0	0	2	2
CO2		2	2	2	0	2	2	1	0	0	0	0	0	2	2
CO3		2	2	2	0	2	2	1	0	0	0	0	0	2	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**List of Experiments:**

1. Study of Survey of India toposheets
2. Study of minerals by physical properties(2 Experiments)
  - a) Silicates
  - b) Non Silicates
3. Identification and textual study of rocks( 3 Experiments)
  - a) Igneous rocks
  - b) Metamorphic rocks
  - c) Sedimentary rocks
4. Study of structural geology problems strike and dip
5. Thickness of beds determination problems
6. Study of geological maps and their cross section.
7. Electrical resistivity method for analysis of data for the identification of ground water potential, its quality and determination of thickness of strata.
8. Seismic Hammer sounding method to determine thickness and type of sub surface strata.
9. Study and interpretation of satellite imageries.

**Note:**A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

**LEARNING RESOURCES:****REFERENCE BOOK(s):**

- 1 Studentsreference manual: Dept.of Civil Engineering, RVR&JC College ofEngg.
- 2 Online Resources: vlabs.edu.in

CE263

## FLUID MECHANICS LABORATORY

L T P C Int Ext

- - 3 1.5 30 70

## Semester IV [Second Year]

**COURSE OBJECTIVES:**

To verify theoretical concepts with experimental results of flow measuring devices and to study the performance of the turbines and pumps.

**COURSE OUTCOMES:**

By the end of the course the students will be able to:

1. Determine the discharge using various flow measuring devices.
2. Compute the minor and major losses in pipes.
3. Obtain performance curves of turbines and pumps.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1		2	3	0	0	0	0	0	0	0	0	0	0	2
CO2		2	3	0	0	0	0	0	0	0	0	0	0	2	0
CO3		2	3	0	2	0	0	0	0	0	0	0	0	2	0

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**List of Experiments:**

1. Verification of Bernoulli's theorem.
2. Venturi meter: Determination of Coefficient of discharge.
3. Orifice meter: Determination of Coefficient of discharge.
4. Orifices: Determination of Coefficient of discharge by steady and unsteady flow methods.
5. Mouth pieces: Determination of Coefficient of discharge by steady and unsteady flow methods.
6. Characterization of laminar and turbulent flows by Reynold's apparatus.
7. Determination of friction factor of Pipes.
8. Determination of loss of head in pipes due to bend /sudden contraction/ sudden expansion.
9. Determination of Coefficient of discharge for rectangular notch / V – notch.
10. Determination of Manning's and Chezy's coefficients in open channel.
11. Study of characteristics of hydraulic jump.
12. Measurement of force due to impact of jets on vanes of different types.
13. Performance studies on pelton turbine
14. Performance studies on Francis/Kaplan turbine
15. Performance studies on single stage centrifugal pump.
16. Performance studies on reciprocating pump.
17. Verification of Bernoulli's theorem
18. Determination of velocity of flow in a pipe by Pitot static tube.

**Note:** A minimum of 10 (Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CE311

**SOIL MECHANICS**

L T P C Int Ext

3 - - 3 30 70

**Semester V [Third Year]****COURSE OBJECTIVES:****This course will enable students to**

1. Understand the significance of the basic principles of soil mechanics and their applications.
2. Understand basic definitions, simple tests, plasticity characteristics, flow of water through soils, permeability, seepage and effective stress principle.
3. Bring out the importance of concepts of stresses due to vertical loads, compression, consolidation and shear strength of soil and their applications.

**COURSE OUTCOMES:****By the end of the course, the students will be able to**

1. Understand index properties of soils
2. Classify the soil, calculate the effective stress, permeability
3. Calculate the seepage flow through soil using flow nets. Able to determine the vertical stress increase due to applied loads and compaction characteristics of soil.
4. Assess engineering properties of soils like compaction, consolidation, shear strength and their importance.

**COURSE ARTICULATION MATRIX:**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	0	0	0	0	0	0	0	0	1	3
CO2	3	2	1	2	0	0	0	0	0	0	0	0	2	3
CO3	3	3	1	2	0	0	0	0	0	0	0	0	2	2
CO4	3	2	1	2	0	0	0	0	0	0	0	0	2	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****[CO:1] (13)****Introduction:** Soil formation and soil types; Regional soil deposits of India**Basic Definitions and Relations:** Phase diagrams; Simple definitions; some important relationships**Index Properties:** Grain size distribution, Atterberg Limits, Relative density, Significance of other Soil Aggregate properties**UNIT II****[CO:2] (12)****Soil Classification:** Introduction; Particle size classification as per IS-code; Unified soil classification system; Indian standard soil classification system, Applications of Soil Classification.**Principles of Effective Stress:** Introduction, Principle of effective stress; physical meaning of effective stress; capillarity in soil

**Permeability of Soils:** Darcy's law and its Validity; Determination of coefficient of permeability: constant and variable head methods, Factors affecting permeability; Permeability of stratified soil deposits.

### UNIT III

[CO:3] (12)

**Seepage through Soils:** Head, Gradient and Potential; Seepage pressure, Quick sand condition; Two dimensional flow- Laplace's equation; flow nets-properties and uses; seepage calculation; graphical method for obtaining flow nets; unconfined flow; seepage in anisotropic condition; protective filters.

**Vertical Stresses Below Applied Loads:** Introduction; Boussinesq's equation; vertical stress distribution diagrams; vertical stress beneath loaded areas- point load, line load, strip load, Circular, rectangular load; Newmark's influence chart; Approximate stress distribution methods for loaded areas; Westergaard's equation.

**Compaction of Soils:** Introduction; Laboratory tests; Factors affecting compaction; Structure and engineering behaviour of compacted cohesive soils; Compaction in the field; Compaction specifications and field control.

### UNIT IV

[CO:4] (11)

**Compressibility of Soil and Consolidation:** Introduction; Compressibility; Spring Analogy, Time-rate of consolidation, Mechanics of consolidation and Terzaghi's one dimensional consolidation; Consolidation test; Computation of settlement; Secondary consolidation settlement.

**Shear Strength of Soils:** Introduction; Stress at a point- Mohr Circle of stress; Mohr-coulomb Failure Criterion; Modified failure envelope; Measurement of Shear Strength-Direct shear test, Triaxial test, Unconfined compression test and Vane shear tests; Shear strength of Clayey soils; Shear Strength of Sands; Drainage conditions and Strength parameters; liquefaction.

### LEARNING RESOURCES:

#### TEXT BOOK(s):

1. Basic and Applied Soil Mechanics - Gopal Ranjan and A.S.R.Rao, New Age International Publishers, 4th Edition, 2022.

#### REFERENCE BOOK(s):

1. A Textbook of Soil Mechanics and Foundation Engineering by K.R.Arora, Standard Publishers & Distributors, 7th Edition, Reprint 2019.
2. Soil Mechanics and Foundation Engineering by B.N.D. Narasinga Rao, Wiley Publishers, 3<sup>rd</sup> Edition, 2019
3. A Textbook of Soil Mechanics and Foundations by B.C. Punmia, Laxmi Publications, 17<sup>th</sup> Edition, 2021
4. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning Publishers, 2<sup>nd</sup> Edition, 2018
5. Geotechnical Engineering: A Practical Problem Solving Approach, J. Ross Publishing, Edition 2010.

**CE312****DESIGN OF RC STRUCTURAL ELEMENTS****L T P C Int Ext****3 - - 3 30 70****Semester V [Third Year]**

(Use Limit state method as per IS456:2000)

**COURSE OBJECTIVES:**

1. To design beams for flexure, shear and torsion using limit state method.
2. To check serviceability limit states.
3. To design and detail of simply supported oneway slab and twoway slab.
4. To design of columns.

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Design beams for flexure.
2. Design beams for shear, torsion and serviceability.
3. Design and detailing of simply supported one way slab and two way slab.
4. Design columns.

**COURSE ARTICULATION MATRIX:**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	1	2	0	0	0	0	0	0	0	0	0	1
CO2	3	2	1	2	0	0	0	0	0	0	0	0	0	2	3
CO3	3	3	1	2	0	0	0	0	0	0	0	0	0	2	2
CO4	3	2	1	2	0	0	0	0	0	0	0	0	0	2	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (12)**

**Introduction:** Role of structural engineer; Reinforced concrete; Structural elements; Loads on structures; Strength and serviceability; Methods of design; Codes of practice: IS456-2000.

**Design of beams for Flexure:** Assumptions; Limit states; Partial safety factors; Modes of failure; Maximum depth of neutral axis; Analysis and design for flexure of singly reinforced, doubly reinforced and flanged sections.

**UNIT II****[CO:2] (12)**

**Design of beams for Shear and Torsion:** Shear in a homogeneous beam; Shear in R.C. beams; Diagonal tension and diagonal compression; Design for shear; Torsion - Introduction, Effect of torsion, IS Code provisions; Design for torsion.

**Design of beam for Bond and Development length:** Anchorage bond; flexural bond; Design for bond; Check for development length.

**Deflection and Cracking:** Span/Effective depth ratio; Calculation of Short-term and Long-term deflections; Cracking; Bar spacing controls.

### UNIT III

[CO:3] (12)

**One way and Two way slabs:** Design and detailing of simply supported one way slab and cantilever slab, Design and detailing of two way slabs.

### UNIT IV

[CO:4] (12)

Columns: Assumptions; Design of axially loaded columns; Design of rectangular columns (short and Long) subjected to axial load and uniaxial moment/ biaxial moment using Interaction diagrams (SP-16 Charts).

### LEARNING RESOURCES:

#### TEXT BOOK(s):

1. Reinforced Concrete (limit state design) by Ashok K. Jain, 7<sup>th</sup> Edition, 2012, Nem Chand & Bros., Roorkee.

#### REFERENCE BOOK(s):

1. Reinforced concrete design by Pillai and Menon, 3<sup>rd</sup> Edition, 2017, Tata McGraw-Hill.
2. Reinforced Concrete , Vol.1 by H. J. Shah, 12<sup>th</sup> Edition, 2021, Charotar publishing house Pvt.Ltd.

#### WEB RESOURCES:

<http://nptel.ac.in/courses/105105105/>

**CE313****HIGHWAY ENGINEERING****L T P C Int Ext****3 - - 3 30 70****Semester V [Third Year]****COURSE OBJECTIVES:**

1. To emphasize on highway development planning and various surveys to be conducted.
2. Introduction to the design concepts, vehicle loading criteria and to demonstrate how they are combined to design and construct road pavements.
3. To understand the principles of geometric design, both vertical and horizontal
4. Emphasize on various traffic control operations and regulations

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Plan road network by linking of various surveys and to evaluate and develop master plans for a better road network
2. Analyze geometric design components in relation to safety and driver comfort, focusing on horizontal and vertical alignment
3. Select appropriate materials and perform road pavement design and analysis by various IRC methods
4. Develop traffic signals and help to properly regulate the traffic and better use of road network.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1		2	1	1	1	0	0	0	0	0	0	2	0	2
CO2		2	1	2	0	0	3	0	0	0	0	0	0	3	1
CO3		2	1	2	0	0	3	0	0	0	0	0	0	3	2
CO4		2	1	2	3	0	2	1	0	0	0	2	0	3	1

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (10)****Highway Development and Planning:**

Brief Introduction; necessity of highway planning surveys preparation of master plan highway planning in India.

**Highway alignment:** Factors controlling alignment; Engineering surveys, Drawing & report.



**UNIT II****[CO:2] (12)**

**Highway Geometric Design:** Highway cross section elements; Sight distance; Design of horizontal alignment; Design of vertical alignment.

**Highway materials:** Sub grade soils- CBR tests; Stone aggregates; Bitumen materials; Paving mixes.

**UNIT III****[CO:3] (13)****Design of Highway Pavements:**

Design factors; Design of flexible pavements - IRC method, IRC recommendations; Design of Rigid pavements -Westergard's stress equation for wheel loads and temperatures stress; IRC recommendations.

**Highway construction and maintenance:**

Construction of water bound macadam roads; bituminous pavements and cement concrete pavements; Construction of joints in cement concrete pavements; Maintenance of highways- Water bound macadam roads, Bituminous pavements, Cement concrete pavements.

**UNIT IV****[CO:4] (12)**

**Highway Drainage:** Importance of highway drainage; Requirements; Surface drainage; Sub-surfacedrainage; Road construction in water logged areas and black cotton soils.

**Traffic Engineering:** Introduction; Traffic characteristics- Road user, vehicular & travel pattern; Traffic operation- signal design; Types of inter-sections; Design of rotary intersection.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Highway Engineering by S. K. Khanna & C. E. G. Justo; A Veeraragavan & Brothers, Revised 10th Edition 2018.

**REFERENCE BOOK(s):**

1. Principles of Transportation Engineering by Partha Chakroborty & Animesh Das, PHI Learning, 2<sup>nd</sup> edition 2017.
2. Principles of Transportation Engineering and highway engineering by G. Venkatappa Rao, Tata McGraw-Hill, 2<sup>nd</sup> edition 2000.

**WEB RESOURCES:**

1. <http://nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=105101087>
2. [www.irc.org.in](http://www.irc.org.in) (for various journals and manuals and code provisions)
3. [www.springerlink.com](http://www.springerlink.com) (for various e journals)

**CE351****SOIL MECHANICS LAB****L T P C Int Ext**  
**- - 3 1.5 30 70****Semester V [Third Year]****COURSE OBJECTIVES:****This course will enable students to**

1. Determine physical properties like water content, specific gravity, bulk unit weight, Atterberg limits and gradation analysis.
2. Determine engineering properties of soils like permeability, compaction, consolidation and shear strength of soils.

**COURSE OUTCOMES:****By the end of the course, the students will be able to**

1. Classify the soil.
2. Study of suitability of soil for various Civil engineering projects by conducting various laboratory tests.

**COURSE ARTICULATION MATRIX CO-PO-PSO**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	2	1	0	0	0	0	0	0	0	0	0	2
CO2	3	2	2	1	0	0	0	0	0	0	0	0	0	2	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**EXPERIMENTS:**

1. Determination of water content by oven drying method.
2. Determination of specific gravity soil using pycnometer.
3. Determination of grain size analysis by sieve analysis.
4. Determination of Atterberg limits.
5. Determination of free swell index.
6. Determination of field unit weight by
  - (a) Core cutter method.
  - (b) Sand replacement method.
7. Determination of permeability coefficient by
  - (a) Constant head permeability test.
  - (b) Variable head permeability test.
8. Determination of shear strength
  - (a) Direct shear test.
  - (b) Vane shear test.
  - (c) Unconfined compression test.
11. Determination of OMC & MDD by IS - Light compaction test.
12. Determination of relative density.

**TEXT BOOK(s)**

Soil Testing: Laboratory Manual & Question Bank, First Edition, Laxmi Publications January 2016.

**REFERENCE BOOK(s)**

1. IS 2720-2 Method of Test for Soil, Part-2 Determination of Water Content
2. IS 2720-3 Method of Test for Soil, Part 3- Determination of Specific Gravity
3. IS 2720-4 Method of Test for Soil Part-4- Grain Size Analysis
4. IS 2720-5 Method of Test for Soil Part-5 - Determination of Liquid and Plastic Limit
5. IS 2720-6 Method of Test for Soil Part 6- Determination of Shrinkage Factor
6. IS 2720-7 Method of Test for Soil Part-7- Light/ Standard Proctor Compaction Test of soil.
7. IS 2720-10 Method of Test for Soil Part-10- Determination of Unconfined Compressive Strength.
8. IS 2720-13 Method of Test for Soil Part-13 - Direct Shear test
9. IS 2720-14 Method of Test for Soil Part-14 - Determination of relative density of cohesionless soil.
10. IS 2720-17 Method of Test for Soil Part-17 - Laboratory determination of Permeability.
11. IS 2720-28 Method of test for soil Part-28 - Determination of Dry density of soil by sand replacement method
12. IS 2720-29 Methods of Test for Soils, Part 29- Determination of in-situ density by Core Cutter method.
13. IS 2720-30 Method of test for soil Part-30 - Laboratory vane shear test.
14. IS 2720-40 Method of test for soil Part-40 Determination of free swell index of soil.

**CE352 COMPUTER PROGRAMMING IN CIVIL ENGINEERING****L T P C Int Ext****3 - - 3 30 70****Semester V [Third Year]****COURSE OBJECTIVES:**

1. To write a computer program to solve various problems in Structural engineering, GTE, irrigation structures, surveying etc.

**COURSE OUTCOMES:**

After the successful completion of the course, students are able to

1. Develop programs for analysis and design of various structural elements.
2. Develop programs to solve different problems in different civil engineering fields.

**COURSE ARTICULATION MATRIX CO-PO-PSO**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	3	0	0	0	0	0	0	0	3	3
CO2	3	3	3	0	3	0	0	0	0	0	0	0	3	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**PROGRAMS:**

Students are required to write computer programs to execute the following problems using **C or C++ language or MATLAB/JAVA or MS-Office or Python Softwares.**

1. Design of Reinforced Beam for flexure by limit state method.
2. Design of Reinforced beam for Shear by limit state method.
3. Design of RC Column for axial load.
4. Design of RC Column for uniaxial moment.
5. Design of one way RC slab.
6. Design of two way RC slab.
7. Classification of soil by Indian standard classification system.
8. Determination of index properties of soil.
9. Analysis of water distribution networks (Hardy cross method).
10. Estimation of length of gradually varied flow profile.
11. Determination of the height of the building when base is accessible & inaccessible.
12. Conversion of whole circle bearing into reduced bearing.

**CE321****FOUNDATION ENGINEERING****L T P C Int Ext****3 - - 3 30 70****Semester VI [Third Year]****COURSE OBJECTIVES:****This course will enable students to**

1. Introduce the methods of soil exploration and earth pressure theories for the design of retaining walls.
2. Introduce concepts of stability of slopes useful for design of earthen embankments and dams.
3. Determine the bearing capacity of shallow foundations.
4. Determine the bearing capacity of pile foundations.

**COURSE OUTCOMES:****By the end of the course, the students will be able to**

1. Select a suitable method of soil exploration and calculate earth pressures to design retaining walls.
2. Check stability of various slopes.
3. Determine bearing capacities of shallow foundations.
4. Determine bearing capacities of pile foundations.

**COURSE ARTICULATION MATRIX**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	0	0	0	0	0	0	0	0	1	3
CO2	3	2	1	2	0	0	0	0	0	0	0	0	2	3
CO3	3	3	1	2	0	0	0	0	0	0	0	0	2	2
CO4	3	2	1	2	0	0	0	0	0	0	0	0	2	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (14)**

**Soil Exploration:** Introduction; Methods of exploration; Methods of Boring; Soil Samples; Soil samples and Sampling; Number and disposition of trial pits and borings; Depth of exploration; Plate load test; Penetration tests- SPT, SCPT and DCPT; Geophysical methods- Electrical resistivity and seismic refraction methods; Bore logs; Site investigation report.

**Earth Pressures & Retaining Walls:** Introduction; Effect of wall movement on Earth Pressure; Earth Pressure at rest; Rankine's theory of Earth pressure; Coulomb's theory of earth pressure; Culmann's graphical method for active earth pressure; Friction circle method; Types of retaining walls, selection of backfill and placement condition, drainage in retaining walls, Design considerations for retaining walls.

**UNIT II****[CO: 2] (10)**

**Stability of Slopes:** Introduction; Infinite slopes and translational slides; Definitions of factor of safety; Finite slopes- Types of slip surface; Total stress and Effective stress methods of analysis;  $\phi_u=0$  ; Analysis (Total Stress Analysis); c- $\phi$  Analysis- Method of slices; Location of most Critical Circle; Stability of Earth Dam Slopes; Friction Circle Method; Taylor's Stability Number;

**Shallow Foundations:** Concept of Foundations; Types of foundations and their applicability; General requirements of foundations; Location and Depth of foundation

**UNIT III****[CO: 3] (12)**

**Bearing Capacity of Shallow Foundation:** Terminology relating to bearing capacity; Bearing Capacity of Shallow Foundations - Terzaghi's Bearing Capacity theory, Skempton's Bearing Capacity theory for Clay soils; IS-Code Recommendations for Bearing Capacity; Influence of water table on bearing capacity.

**Settlement Analysis:** Settlement of Shallow foundation - Types; Settlements of foundations on granular soils, Allowable settlements, Methods to reduce differential settlements, Allowable Bearing Pressure based on SPT Number- Teng's correlation and IS recommendation.

**UNIT IV****[CO: 4] (12)**

**Pile Foundations:** Introduction; Uses of Piles; Types of Piles; Pile load carrying capacity in compression - Static Pile Load formula, Dynamic Pile formulae; static pile load test; Correlations with Penetration test data; Group action of Piles - load carrying capacity and settlement; Negative skin friction.

**Well Foundations:** Types of wells; Components of well foundation; Shapes of wells; Depth of a well foundation, Forces acting on well foundation; Construction and Sinking of wells.

**LEARNING RESOURCES:****TEXT BOOK(s):**

Basic and Applied Soil Mechanics - Gopal Ranjan and A.S.R.Rao, New Age International Publishers, Third Edition, 2016.

**REFERENCE BOOK(s):**

1. Foundation Analysis & Design by Bowles, J.E., McGraw- Hill, 7<sup>th</sup> edition, 1995.
2. Geotechnical Engineering by SK Gulati & Manoj Datta, Tata McGraw- Hill, 2010.
3. Principles of Foundation Engineering by B.M. Das., PWS Publishing Company, 4th edition, 1999.
4. Foundation Engineering by Varghese, P.C., Printice Hall of India, New Delhi, Eastern Economy Edition, 2000.
5. Soil Mechanics and Foundation Engineering by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications Pvt., Ltd., New Delhi, 17<sup>th</sup> edition, 2017.
6. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers Distributors, Pvt., Ltd., New Delhi, 7th edition, 2019.

**WEB RESOURCES:**

[www.iitm.ac.in](http://www.iitm.ac.in)

**CE322****DESIGN OF STEEL STRUCTURAL ELEMENTS****L T P C Int Ext****2 1 - 3 30 70****Semester VI [Third Year]****COURSE OBJECTIVES:**

1. To introduce basic concepts of steel structures and structural steel fasteners
2. To design tension and compression members
3. To design beams
4. To design beam-column and column splices/bases

**COURSE OUTCOMES:****By the end of the course, the students will be able to**

1. Understand the basic elements of steel structures and the fundamentals of structural steel fasteners
2. Design steel tension members and compression members
3. Design steel beams
4. Design beam-columns, column splices and bases

**COURSE ARTICULATION MATRIX**

PO PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	2	0	0	0	0	0	0	0	0	2
CO2	3	3	3	0	2	0	0	0	0	0	0	0	0	2
CO3	3	3	3	0	2	0	0	0	0	0	0	0	0	2
CO4	3	3	3	0	2	0	0	0	0	0	0	0	0	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (13)**

**Introduction:** What are steel structures?; What a steel structure consists of?; Structural steel; Products of structural steel; Standards, Codes and Specifications; Fatigue; Brittle fracture; Corrosion protection of steel structures; Design philosophies; Methods of structural analysis; Plate(Local) buckling; Classification of sections.

**Structural Steel Fasteners:** Introduction; Welding - Shield metal arc-welding, Automatic submerged arc-welding, Types of welds, Quality of welds, Weld symbols and notation, Specifications for welding; Bolting-Types of failure, Design specifications, High-strength bolts; Problems.

**UNIT II****[CO:2] (12)**

**Tension Members:** Introduction; Net area; Shear-lag; Design of tension members.

**Compression Members:** Introduction; Euler's buckling theory; Behavior of real columns; Types of section; Design of columns; Validity of design strength calculations; Design of compression members; Design Procedure; Built-up compression members.

**UNIT III**

**[CO:3] (13)**

**Beams:** Introduction; Flexural behaviour of beams which does not undergo lateral buckling; Flexural behaviour of beams which undergo lateral buckling; Shear behaviour; Web buckling and Crippling; Design strength in bending; Design strength in shear; Limit state serviceability – Deflection.

**UNIT IV**

**[CO:4] (12)**

**Beam-Columns:** Introduction; Analysis of beam-columns; Modes of failure; Design specifications; Column Splices and Bases: Introduction; Column splices; Column bases.

**LEARNING RESOURCES:**

**TEXT BOOK(s):**

1. Design of steel structures by K.S.Sai Ram, Pearson Education, 2020

**REFERENCE BOOK(s):**

1. Design of steel structures by N.Subramanian, Oxford University Press, 2016.
2. Limit state design of steel structures by M.R.Shiyekar , PHI Learning,2017.
3. Limit state design of steel structures by S.K.Duggal, McGraw-Hill,2017.

**WEB RESOURCES:**

<http://nptel.iitm.ac.in>



**CE 323      HYDROLOGY AND IRRIGATION ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Int</b>	<b>Ext</b>
3	-	-	3	30	70

**Semester VI [Third Year]****COURSE OBJECTIVES:**

1. To study the process and determination of various components of Hydrologic cycle.
2. To measure the stream flows by different methods and to study well hydraulics.
3. To study various methods of irrigation and estimation of water requirement of crops.
4. To study the reservoir planning, calculation of capacity & yield and to introduce functions of various components of Hydel scheme.

**COURSE OUTCOMES:**

1. Construct hydrograph of a catchment.
2. Measure the stream flows and calculate yield of wells under steady state.
3. Estimate irrigation requirements of crops and canal carrying capacity.
4. Plan selection of site & capacity of a reservoir and identify the functions of components of hydro power plants.

**COURSE ARTICULATION MATRIX CO-PO-PSO**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	3	2	1	0	0	0	0	0	0	0	0	0	3
CO2	3	3	2	1	0	0	0	0	0	0	0	0	0	3	1
CO3	3	3	2	1	0	0	0	0	0	0	0	0	0	3	1
CO4	3	3	2	1	0	0	0	0	0	0	0	0	0	3	1
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Slightly correlated: 1;      Moderately correlated: 2;      Substantially correlated: 3

**UNIT – I**

[CO:1] (12)

**Hydrology**

Hydrologic cycle; Precipitation types; Rain gauges; Computation of average rain fall over a basin; Abstraction from rainfall; evaporation, factors affecting evaporation, measurement of evaporation by pan evaporation method; Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices; Runoff; Factors affecting runoff; Computation of runoff; Design flood, Estimation of maximum rate of runoff.

**Hydrographs**

Hydrograph analysis; Unit hydrograph; Construction of UH for an isolated storm, Application of UH to the construction of a flood hydrograph resulting from rainfall of unit duration; Construction

of unit hydrograph of different unit duration from a unit hydrograph of some given unit duration by superposition method and S-curve method.

## **UNIT – II**

[CO:2] (12)

### **Stream Gauging**

Necessity; Selection of gauging sites; Discharge measurement- Area-Velocity method; Slope-Area method; Tracer method, Electromagnetic induction method, ultrasonic method; Measurement of depth – Sounding rod, Echo-sounder; Measurement of velocity; Floats – Surface float, Sub-surface float, Velocity rod, Current meter; Measurement of stage – Staff gauge, wire gauge and stage-discharge curve.

### **Ground Water Hydrology**

Introduction; Aquifer; Aquiclude; Aquifuge; Specific yield; Specific retention; Divisions of sub-surface water; Water table; Types of aquifers; Well hydraulics- Steady radial flow to a well– Dupuit's theory for confined and unconfined aquifers; Tube wells - Open wells; Yield of an open well–Constant level pumping test and Recuperation test.

## **UNIT – III**

[CO:3] (12)

### **Introduction to Irrigation**

Definition; Necessity; Benefits & Ill-effects of irrigation; Types of irrigation.

### **Methods of Irrigation**

Methods of applying water to crops; Uncontrolled or wild flooding; Free flooding; Contour laterals; Border strip method; Check flooding; Basin flooding; Zigzag method; Furrow method; Contour Farming; Sub-surface irrigation; Sprinkler irrigation; Drip irrigation.

### **Water Requirement of Crops**

Functions of irrigation water; Classes and availability of soil water; Saturation capacity; Field capacity; Wilting point; Available moisture and readily available moisture; Moisture equivalent; Soil – moisture deficiency; Limiting soil moisture conditions; Depth and frequency of irrigation; Duty and Delta; Base period; Relation between Duty and Delta; Factors affecting duty; Methods of improving duty; Gross command area; Culturable command area; Culturable cultivated and uncultivated area; Kor depth and Kor period; Consumptive use of water ; Irrigation efficiencies – Water conveyance efficiency, Water application efficiency, Water distribution efficiency and Consumptive use efficiency; Determination of irrigation requirements of crops; crop rotation, Assessment of Irrigation water.

## **UNIT – IV**

[CO:4] (12)

### **Reservoir Planning**

Introduction; Investigations for reservoir planning; Selection of site for a reservoir; Zones of storage in a reservoir; Storage capacity and yield; Mass inflow curve and demand curve; Calculation of reservoir capacity for a specified yield from the mass inflow curve; Determination of safe yield from a reservoir of a given capacity; Sediment flow in streams; Reservoir sedimentation; Life of reservoir; Reservoir sediment control; Multipurpose reservoir; Flood

routing; Methods of flood routing – Inflow - Storage Discharge Curves method and Trial and error method (Description only).

### **Water Power Engineering**

Introduction; Hydropower - Advantages and disadvantages; Estimation of hydropower; Flow duration curve; Power duration curve; Load curve; Load factor; Capacity factor; Utilization factor; Diversity factor; Load duration curve; Firm Power; Secondary power; Types of hydel schemes; Forebay; Intake structures; Penstocks; Surge tank; Tail race; Turbines; Selection of suitable type of turbine.

### **NOTE**

*Two questions of 14 marks each will be given from each unit out of which one is to be answered. Fourteen questions of one mark each will be given from entire syllabus which is a compulsory question.*

### **TEXT BOOK(s)**

- Irrigation and water power Engineering by B.C. Punmia and Pande B.B. Lal; 17<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2021.

### **REFERENCE BOOK(s)**

1. Irrigation Engineering and Hydraulic structures by S. K. Garg; Khanna Publishers, Delhi, 2011.
2. Irrigation, Water Resources and Water Power Engineering by P.N. Modi, 7<sup>th</sup> Edition, Standard Book House, 2008.
3. Irrigation, water power and water resources Engineering by K R Arora, Standard Publishers, 2010.
4. Engineering Hydrology by K. Subramanya, 4<sup>th</sup> Edition, Tata McGraw-Hills, 2013.
5. A text book of Hydrology by P. Jayarami Reddy, 3<sup>rd</sup> edition, Laxmi Publications, 2011.
6. Applied Hydrology by Ven Te Chow, Maidenment and Mays, Mc Graw Hill Publications, 2017.

### **WEBREFERENCES:**

[www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

**CE361****HIGHWAY ENGINEERING LAB****L T P C Int Ext****- - 3 1.5 30 70****Semester VI [Third Year]****COURSE OBJECTIVES:**

1. present the major strength and shape parameters involved in selection of aggregate for various types of construction works
2. Know various tests conducted on aggregate in order to propose it for suitable construction work
3. Detail investigation on sub-base course (soil) by conducting a laboratory test for evaluation of pavement thickness
4. Deals with the various properties of bitumen and the tests required to determine them.

**COURSE OUTCOMES:****By the end of the course, the students will be able to**

1. Select aggregate for different construction components.
2. Evaluate and conduct the required tests on the given aggregate and propose the suitable inference.
3. Evaluate the grade of bitumen by conducting the required tests and propose it for suitable region and place of pavement construction.
4. Evaluate the bearing ratio's of soils.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1		2	3	1	0	0	0	0	0	0	0	0	0	3
CO2		3	3	3	2	2	0	0	0	0	0	0	0	3	3
CO3		3	3	2	2	2	0	0	0	0	0	0	0	3	3
CO4		3	3	3	2	3	0	0	0	0	0	0	0	2	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**EXPERIMENTS**

1. Determination of bearing capacity of soil by using California Bearing Ratio Test (C.B.R).
2. Determination of crushing value of given aggregate sample.
3. Determination of impact value of given aggregate sample.
4. Determination of Los Angeles abrasion of given aggregate sample.
5. Determination of Deval's attrition value of given aggregate sample.
6. Determination of Shape test a) Flakiness index test b) Elongation index test c) Angularity number test.
7. Determination of Specific gravity of given aggregate sample.
8. Determination of Penetration value of given bitumen sample.
9. Determination of Softening point value of given bitumen sample.
10. Determination of Flash and fire point value of given bitumen sample
11. Determination of Ductility value of given bitumen sample.
12. Determination of Viscosity value of given bitumen sample.
13. Determination of Specific gravity value of given bitumen sample.

## **DEMONISTRATION EXPERIMENTS**

1. Bitumen Extractions Test.
2. Marshall stability test.

## **LEARNING RESOURCES:**

### **TEXT BOOK(s):**

1. Highway Engineering by S. K. Khanna & C. E. G. Justo; A Veeraragavan Brothers, Revised 10<sup>th</sup> edition 2018.

**CE362 COMPUTER AIDED ANALYSIS AND DESIGN OF STRUCTURES LAB L T P C Int Ext**

- - 3 1.5 30 70

**Semester VI [Third Year]****COURSE OBJECTIVES:**

1. To analyze various structural elements by using software packages.
2. To design various structural elements as per relevant IS code provisions by using software packages.

**COURSE OUTCOMES:**

By the end of this course students are able to

1. Analyze various structural elements using software packages.
2. Design various structural elements as per relevant IS code provisions using software packages.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	2	2	0	2	2	0	0	0	0	0	0	0	3
CO2	3	2	2	0	2	2	0	0	0	0	0	0	0	3	3
CO3	3	2	2	0	2	2	0	0	0	0	0	0	0	3	3
CO4	3	2	2	0	2	2	0	0	0	0	0	0	0	3	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

Students are required to analyse and design the following structures using software packages like STAAD Pro/Etabs/STRUDS/STRAP/MSEXCEL etc.

1. Analysis of a two span continuous beam with one side fixed and other side overhang.
2. Analysis of a single bay single storied plane frame with vertical legs subjected to gravity and lateral loads.
3. Analysis of a reinforced concrete framed building (3D) subjected to 1.2(DL+LL+/-EQX).
4. Analysis and design of a steel roof truss of an industrial shed subjected to (DL+/-WL).
5. Design of beam for flexure
6. Design of beam for shear.
7. Design of reinforced concrete one way solid slab.
8. Design of reinforced concrete two way solid slab.
9. Design of isolated RC rectangular footing.
10. Design of reinforced concrete columns.
11. Design of cantilever retaining wall.
12. Design of tension members.
13. Design of compression members.
14. Design of column splice.
15. Design of slab base/gusset base.

**CE363****COMPUTER AIDED DETAILING LAB****L T P C Int Ext****- - 3 1.5 30 70****Semester VI [Third Year]****COURSE OBJECTIVES:**

1. To draw the reinforcement and other details of various RC structural elements.
2. To draw the details of various steel structural elements.

**COURSE OUTCOMES:**

By the end of this course students are able to

1. Draw the reinforcement and other details of various RC structural elements using a software package.
2. Draw the details of various steel structural elements using a software package.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	0	3	0	3	2	0	0	0	3	0	0	3	3
CO2	3	0	3	0	3	2	0	0	0	3	0	0	3	3	

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**Students are required to draw the details of the following structural elements using software packages like Auto CAD, RIVET etc.**

1. Detailing of cantilever beam.
2. Detailing of continuous beam with one end overhang with varied depth.
3. Detailing of continuous beam with both ends fixed.
4. Detailing of isolated square footing.
5. Detailing of isolated Rectangular footing.
6. Detailing of combined footing for two columns.
7. Detailing of three pile cap.
8. Detailing of one way slab.
9. Detailing of two way slab.
10. Detailing of RC column.
11. Typical detailing of reinforced footing with steel column.
12. Detailing of beam to column framed connection.
13. Detailing of beam to column moment resistant connection (using bolts).
14. Detailing of column splice.
15. Detailing of slab base/gusset base.

**CEEL01****ADVANCED STRUCTURAL ANALYSIS****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

Following are the Course Objectives

1. To develop a technical competence in the fundamental concepts and application of displacement methods of statically indeterminate, structures
2. Awareness for solving statically indeterminate beams and frames by using, moment distribution method
3. To know how to analyses the structures like beams and simple frames using stiffness methods
4. To know how to analyses the structures like beams and simple frames using flexibility matrix methods
5. To understand the plastic behavior of structures and collapse load analysis of the structures.

**COURSE OUTCOMES:**

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

1. Formulate, and analyze indeterminate structures like continuous beams single bay, single story rigid jointed plane frame by moment distribution method.
2. Identify, formulate, and analyse indeterminate structures like continuous beams single bay, single story rigid jointed plane frame for internal forces using flexibility matrix
3. Identify, formulate slope deflection equations and analyse indeterminate structures like continuous beams single bay, single story rigid jointed plane frame for internal forces using stiffness matrix method.
4. Analyze the behavior of structures beyond yield load- Analysis of continuous beams and portal frames by plastic analysis method.

**COURSE ARTICULATION MATRIX**

CO \ PO	PO														
	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	2	0	1	0	0	0	0	0	0	0	0	3	0
CO2		3	2	0	1	0	0	0	0	0	0	0	0	3	0
CO3		3	2	0	1	2	0	0	0	0	0	0	0	3	0
CO4		3	2	0	1	2	0	0	0	0	0	0	0	3	0
CO5		3	2	0	1	0	0	0	0	0	0	0	0	3	0
CO6		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (10)**

**Moment Distribution Method:** Principles of the method; Application of the method to analysis of continuous beams and portal frames (Single bay, single story with vertical legs only) without and with side sway.



**UNIT II** **[CO:2] (10)Matrix**  
**methods of Structural analysis:** Flexibility, developing flexibility matrix; Analysis of continuous beams and rigid jointed plane frames (Single bay, single storey with vertical legs only) by flexibility method.

**UNIT III** **[CO:3] (10)**  
**Matrix methods of Structural analysis:** stiffness matrix method; Developing slope deflection equations. stiffness matrix relationship between stiffness matrix and flexibility matrix; Analysis of continuous beams and rigid jointed plane frames (Single bay, single storey with vertical legs only) by stiffness matrix method.

**UNIT IV** **[CO: 4] (10)**  
**Plastic analysis of structures:** Introduction, Stress-strain curve, Plastic moment – Plastic section modulus, Shape factor, Load factor, failure mechanisms; upper bound theorem, lower bound theorem and uniqueness theorem. Plastic analysis of continuous beams and portal frames single bay single story.

**LEARNING RESOURCES:**

**TEXT BOOK(s):**

1. Basic structural analysis by CS Reddy, 3rd Edition, Tata McGraw-Hill ,2011.

**REFERENCE(s):**

1. Structural Analysis by Devdas Menon, Narosa Publishinh House, 2008
2. Structural Analysis A Matrix Approach G S Pandit and S P Gupta, Tata Mc Graw – Hill Publishing Co. Ltd., 2008.
3. Structural Analysis-II by S.S. Bhavikatti, 4th Edition, Vikas Publishers, 2018.
4. Intermediate structural analysis by CK Wang, Tata McGraw-Hill, 2010.

**WEB RESOURCES:**

1. <http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Structural%20Mechanic%20II/Course%20Objective.html>.
2. [http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New\\_index1.html](http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New_index1.html)

**CEEL02****ADVANCED ENVIRONMENTAL ENGINEERING****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

Following are the Course Objectives

1. To explain the importance of self-purification of streams and to derive Streeter- Phelps equation and to discuss the effects of various pollutants on receiving streams.
2. To introduce new concepts in biological treatment like nitrogen and phosphorous removal, anaerobic filters, RBC and U-tube aeration systems, their working principles and suitability.
3. To discuss the effects of various meteorological parameters on air pollution, and to explain various equipment for controlling particulate pollution and their suitability.
4. To discuss about automobile pollution & noise pollution and to introduce pollution control methods.
5. To introduce various functional elements of urban solid waste management and methods of solid waste disposal and to introduce hazardous waste management methods.

**COURSE OUTCOMES:**

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

1. Determine the degree of treatment required for wastewater to be disposed into a stream & demonstrate knowledge on advanced wastewater treatment methods
2. Estimate ground level concentration of air pollutants released from a source
3. Select suitable methods for particulate control and noise control
4. Select suitable methods for collection, transport and disposal of municipal solid waste & hazardous waste management

**COURSE ARTICULATION MATRIX**

PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	3	1	0	0	3	2	0	0	0	0	0	2	3
CO2	3	3	1	0	0	3	2	0	0	0	0	0	2	3
CO3	3	2	2	0	0	0	0	0	0	0	0	0	2	0
CO4	2	2	1	0	0	3	2	0	0	0	0	0	2	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****Text Book-1, [CO:1] (12)**

**Stream Sanitation** : Introduction; Self-purification in streams; factors affecting self-purification; Dissolved Oxygen Balance in streams; Streeter-Phelps's Dissolved Oxygen Model; Zones of Self-purification; Degree of treatment; Impact of pollutants on stream waters and usage of stream water with special reference to flora and fauna.

**Advances in waste water treatment:** Nitrogen removal by biological nitrification and denitrification; Phosphate removal from the activated sludge process; Rotating biological contactor Process; U-Tube aeration systems; sequencing batch reactor (SBR); Up flow anaerobic sludge blanket reactor.

**UNIT II****Text Book-3 [CO:2] (12)**

**Sources and Classification of Air Pollution:** Natural and Man-made sources, Stationary and mobile sources; Point, line and area sources, Primary and secondary pollutants; Natural contaminants; Aerosols; Gaseous pollutants.

**Meteorology and Air Pollution:** Atmospheric stability and temperature inversions; Maximum Mixing Depth; Wind direction and speed; Plume behavior; Gaussian Dispersion Model; Plume rise; Design of stack height, Wind rose.

**Effects of Air Pollution:** Global Effects: Global warming; Ozone depletion; Acid rains; Effects of air pollutants on human health; Effects on plants; Economical effects.

**UNIT III****Text Book-3[CO:3] (12)**

**Control of Air Pollution:** Objectives; Types of collection equipment: Settling chamber; inertial separators; Cyclones; Filters; Electrostatic Precipitators; Scrubbers.

**Automobile Pollution Control:** Introduction; vehicular emissions; fuel combustion, automobile emission control

**Noise Pollution:** Introduction; Levels of noise; Noise rating systems; Measurement of noise; Sources of noise and their noise levels; Acceptable noise levels; Effects of noise; Control of noise.

**UNIT IV****Text Book- 2 [CO: 4] (12)**

**Urban Solid Waste Management:** Sources; Quantities and characteristics; Classification; Collection and transportation; Recovery and reuse; Treatment methods such as composting, incineration and pyrolysis, sanitary landfill.

**Hazardous Waste Management:** Definition and sources; Classification; Waste Minimization; Treatment methods: Physical, Chemical, Biological & Thermal Treatment; Solidification and Stabilization; Disposal Methods: Landfill, Underground disposal

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Wastewater Treatment by M.N. Rao and A.K. Datta; Oxford & IBH Publishing Co. Pvt. Ltd., 3<sup>rd</sup> Edition, 2007
2. Environmental Pollution Control Engineering by C.S. Rao, New Age International, 2<sup>nd</sup> Edition, 2006
3. Air Pollution by M.N. Rao and H.V.N. Rao, Tata Mc Graw-Hill, 1<sup>st</sup> Edition, 1993

**REFERENCE(s):**

1. Wastewater Engineering: Treatment, Disposal and Reuse by Metcalf & Eddy, 3<sup>rd</sup> Edition, Mc Graw- Hill, 1991
2. Water Supply and Wastewater Disposal by G.M. Fair et. al., John Wiley & Sons, 3<sup>rd</sup> Edition, 2011
3. Sewage Disposal and Air Pollution Engineering by S.K. Garg; Khanna Publications, 23<sup>rd</sup> Edition, 2010
4. Environmental Engineering by Peavy and Rowe, Tata Mc Graw Hill, 7<sup>th</sup> Edition, 1987

**CEEL03****ENVIRONMENTAL IMPACT ASSESSMENT****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

Following are the course objectives

1. To introduced concept of environmental impact assessment and EIA methodologies
2. To discuss Prediction and Assessment of Environmental Impact.
3. To learn planning for mitigation of adverse impact on environment.
4. Through case studies, learn to present and explain the components and decision making processes involved in environmental assessment.
5. To introduce environmental auditing procedure, relevant legislation and life cycle analysis

**COURSE OUTCOMES:**

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

1. Demonstrate key concepts of environmental impact assessment and methodologies
2. Assess the impact of development activities on land use, water, air and biological environment and identify suitable mitigation methods
3. Assess the impact of development activities on vegetation and wildlife and identify suitable mitigation methods and prepare EIA statements for selected activities
4. Prepare Environmental Audit report and demonstrate knowledge on Life cycle analysis of development activities

**COURSE ARTICULATION MATRIX**

CO \ PO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PSO														
CO1		2	2	0	0	0	0	2	0	0	0	0	2	2	0
CO2		2	0	0	2	0	2	3	0	0	0	0	2	2	0
CO3		2	0	0	2	0	2	3	0	0	0	0	2	2	0
CO4		2	2	0	2	0	2	2	0	0	0	0	2	2	0

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (12)**

**Basic concepts of EIA :** Initial Environmental Examination; Elements of EIA; Factors affecting EIA; Impact evaluation and analysis; Preparation of Environmental Base map; Classification of Environmental parameters.

**EIA Methodologies:** Introduction; criteria for the selection of EIA Methodology; EIA Methods: Ad-hoc methods, Matrix methods, Network method, Environmental media quality index method; Overlay methods; Cost/benefit Analysis.

**UNIT II****[CO:2] (12)**

**Impact of Developmental Activities and Land Use :** Introduction and Methodology for the assessment of soil and ground water; Delineation of study area; Identification of activities; Procurement of relevant soil quality; Impact prediction; Assessment of Impact significance; Identification and Incorporation of mitigation measures.

**EIA in surface water, Air and Biological Environment:** Methodology for the assessment of Impacts on surface water environment; Air pollution sources; Generalized approach for assessment of Air pollution Impact.

### UNIT III

[CO:3] (12)

**Assessment of Impact of Development activities on vegetation and wildlife:** Environmental Impact of Deforestation; Causes and effects of deforestation.

**EIA Case Studies :** Preparation of Environmental Impact Assessment statement for thermal power plants, mining industry; river valley projects etc.

### UNIT IV

[CO:4] (12)

**Environmental Audit and Environmental legislation :** Objectives of Environmental Audit; Types of Environmental Audit; audit protocol; stages of Environmental Audit; On-site activities; Evaluation of Audit data and preparation of Audit report, Post Audit activities, The Environmental Pollution Act, The Water Act; The Air (Prevention and Control of Pollution) Act; Mota Act; Wild life Act.

### Life Cycle Analysis

Introduction, types, importance, stages in LCA-goals and scope, inventory analysis, impact assessment and interpretations, case studies

## LEARNING RESOURCES

### TEXT BOOK(s)

1. Environmental Impact Assessment Methodologies by Y. Anjaneyulu; B.S. Publication, 3<sup>rd</sup> Edition, 2020

### REFERENCE BOOK(s)

1. Environmental Impact Assessment: Theory & Practice by M. Anji Reddy, B.S. Publication, 2016
2. Environmental Impact Assessment by Larry W. Canter, Mc Graw-Hill, 2<sup>nd</sup> Edition, 1996
3. Environmental Science and Engineering by Suresh K. Dhameja, S.K. Kataria & Sons Publications, New Delhi, 2013

**CEEL04****SURFACE HYDROLOGY****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

The course is designed to

1. Introduce hydrologic cycle and its relevance to Civil engineering.
2. Make the students understand physical processes in hydrology and, components of the hydrologic cycle.
3. Appreciate concepts and theory of physical processes and interactions.
4. Learn measurement and estimation of the hydrologic cycle components.
5. Provide an overview and understanding of Unit Hydrograph theory and its analysis.
6. Understand flood frequency analysis, design flood, flood routing.

**COURSE OUTCOMES:**

By the end of the course the students will be able to

1. Analyze precipitation data and prepare IDF and DAD curves.
2. Estimate abstractions from precipitation.
3. Compute runoff by hydrograph analysis.
4. Estimate design flood of the project and understand flood routing process.

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	1	3	0	0	0	0	0	0	0	0	3	0
CO2		3	3	1	3	0	0	0	0	0	0	0	0	3	0
CO3		3	3	1	3	0	0	0	0	0	0	0	0	3	0
CO4		3	3	1	3	0	0	0	0	0	0	0	0	3	0
CO5		0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO6		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I**

[CO:1] (12)

**Introduction:** Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm.

**UNIT II**

[CO:2] (12)

**Abstractions from Precipitation:** Initial abstractions. Evaporation: factors affecting, measurement, reduction Evapotranspiration: factors affecting, measurement, control. Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices

**UNIT III**

[CO:3] (12)

**Runoff:** Catchment characteristics, Factors affecting runoff, components, computation-empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions,

derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph.

**UNIT IV**

[CO:4] (12)

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type-III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management. Flood Routing: Hydrologic routing, channel and reservoir routing- Muskingum and Puls methods of routing.

**LEARNING RESOURCES:**

**TEXT BOOK:**

- 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi

**REFERENCES:**

1. 'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt. Ltd., (2011), New Delhi.
2. 'Engineering Hydrology' by Subramanya, K, Tata Mc Graw-Hill Education Pvt. Ltd, (2013), New Delhi.
3. 'Hydrology' by Raghunath. H.M., New Age International Publishers, (2010).

**CEEL05 DESIGN OF REINFORCED CONCRETE STRUCTURES L T P C Int Ext**  
**3 - - 3 30 70**

(Use Limit state method as per IS456:2000)

**COURSE OBJECTIVES:**

1. To design and detail various RC structures like continuous beam and slab, staircase, flat slabs etc.
2. To design and detail isolated and combined footings.
3. To design and detail cantilever retaining wall.

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Design and detail beams having various end conditions.
2. Design and detail various slab systems and dog legged stair case.
3. Design and detail isolated and combined footings.
4. Design and detail cantilever retaining wall.

**COURSE ARTICULATION MATRIX**

CO \ PO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	0	0	0	0	0	0	0	0	0	2	3
CO2	3	2	1	2	0	0	0	0	0	0	0	0	0	2	3
CO3	3	3	1	2	0	0	0	0	0	0	0	0	0	2	2
CO4	3	2	1	2	0	0	0	0	0	0	0	0	0	2	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I**

**[CO:1] (12)**

Design of simply supported and cantilever beams, Design of continuous beam.

**UNIT II**

**[CO:2] (12)**

Types of staircases, Design of Dog-legged stair case.

Design of continuous one way slabs.

Flat Slabs: Design and detailing of flat slabs by direct design method.

**UNIT III**

**[CO:3] (12)**

**Foundations:** Design and detailing of square and rectangular isolated footing, Combined footing for two columns.

**UNIT IV**

**[CO:4] (12)**

Retaining Walls: Types of retaining walls, Forces on retaining walls; Stability requirements; Design and detailing of cantilever type retaining wall. Design procedure of counterfort retaining wall.

**TEXT BOOK:**

1. Reinforced Concrete (limit state design) by Ashok K. Jain, 7<sup>th</sup> Edition, 2012, Nem Chand & Bros., Roorkee.

**REFERENCE BOOKS:**

1. Reinforced concrete design by Pillai and Menon, 3<sup>rd</sup> Edition, 2017, Tata McGraw-Hill.
2. Reinforced Concrete , Vol.1 by H. J. Shah, 12<sup>th</sup> Edition, 2021, Charotar publishing house Pvt.Ltd.

**WEB RESOURCES:**

<http://nptel.ac.in/courses/105105105/>



**CEEL06      RAILWAY, AIRPORT AND HARBOUR ENGINEERING      L T P C Int Ext**  
**3 - - 3 30 70**

**COURSE OBJECTIVES:****This course will enable students**

1. To understand the role of railways in transportation.
2. To understand various components of railway track and emphasize on various requirements of stations
3. To know airport planning, various obstructions, runway and structural design of airport pavement.
4. To Emphasize on various facilities of a harbor and port

**COURSE OUTCOMES:****By the end of the course, the students will be able to**

1. Identify proper material and component for a railway track
2. State importance of a railway station.
3. Plan various amenities for an airport and design runway
4. Demonstrate knowledge on various features of harbor and port

**COURSE ARTICULATION MATRIX**

CO \ PO	PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1		2	1	0	1	0	0	0	0	0	0	0	0	1
CO2		2	2	2	1	0	3	0	0	0	0	0	1	3	1
CO3		2	2	2	1	0	3	0	0	0	0	0	1	2	1
CO4		2	2	2	1	0	3	0	0	0	0	0	1	2	1
CO5		0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO6		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Slightly correlated: 1;      Moderately correlated: 2;      Substantially correlated: 3

**UNIT 1****Text Book 1 [CO:1] (12)****Railway Engineering:**

Introduction; Role of railways in transportation; Comparison of railway and highway transportation; Development of railway systems with particular reference to India; Classification of railways.

**Railway Track:**

Permanent way; Gauges in Railway track, Railway track cross – sections; Coning of wheels.

**Rails & Rail Joints:**

Functions of rails; Requirements of rails; Types of rails sections; Standard rail sections; Length of rails; Rail failures; Wear on rails. Requirements of an ideal joint; Types of rail joints; Welding of rails.

**Sleepers:**

Functions of sleepers; Requirements of sleepers; Classification of Sleepers – Timber sleepers, Metal sleepers & Concrete sleepers; Comparison of different types of sleepers.

**UNIT 2****Text Book 1 [CO:2] (10)****Fish Plates:**

Fish plates, section of fish plates, failure of fish plates.

**Geometric Design of Track:**

Necessity; Gradients &amp; Gradient Compensation; Elements of horizontal alignment; Super elevation; Cant deficiency and cant excess; Negative Super elevation; Length of Transition Curve.

**Ballast:**

Functions and requirements of ballast; Types of ballast; Renewal of ballast.

**Stations And Yards:**

Site selection for railway station; Requirements of railway station; Classifications; Station yards

**UNIT 3****Text Book 2 [CO:3] (12)****Airport Planning And Design:**

Introduction; Development of air transportation system with particular reference to India; Aeroplane components; Air-craft characteristics.

**Airport planning and layout:**

Selection of site; Apron; Hanger; Typical airport layouts; Airport marking; Airport lighting; Drainage systems.

**Airport Obstruction:**

Zoning laws; Classification of obstructions; Imaginary surfaces; Approach zone; Turning zone.

**Runway Design:**

Runway orientation; Basic runway length; Corrections for elevation; Temperature and gradient

**Specifications for Structural Design of Airport Pavements:**

Design factors methods for flexible and rigid pavements; LCN system of pavement design.

**UNIT 4****Text Book 3 [CO: 3] (12)****Docks And Harbour Engineering:**

Introduction; Types of water transportation; Economics and advantages of water transportation.

**Planning and Design of Port Facilities:**

General layout and design considerations; Pier and wharf structures; Fender systems; Transit sheds and Apron; Container ports; Docks; Dredging; Light Houses

**LEARNING RESOURCES:****TEXT BOOKS:**

1. Railway Engineering by S.C.Saxena and Arora , Dhanpat Rai Publications (p) Ltd.-new Delhi, 2<sup>nd</sup> edition, 2010.
2. Airport Planning and Design by S. K. Khanna & M. G. Arora, 6th Edition, Nemchand & Bros, 6<sup>th</sup> edition, 2017.
3. Harbour, Dock And Tunnel Engineering by Srinivasan, R |& Rangwala, S.C, 2<sup>nd</sup> Edition, Chartor publishing house, 2010.

**REFERENCE BOOKS**

1. Railway Engineering by M.M.Agarwal and Satish Chandra, 2<sup>nd</sup> Edition, Oxford University Press, 2013.
2. Airport Engineering by G.V.Rao; 2<sup>nd</sup> Edition, Tata Mc Graw Hill publishers, 2014.

**WEB REFERENCES**<https://archive.nptel.ac.in/courses/105/107/105107123/>

**CEEL07****WATERSHED MANAGEMENT****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To understand different watershed behaviour
2. To be able to interpret runoff data and quantify erosion by using various modelling methods.
3. To understand land use classification and impact of land use changes on hydrological cycle parameters.

**COURSE OUTCOMES:**

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

1. Understand the concept of watershed and its management.
2. Estimate soil erosion and control measures.
3. Plan and design of rain water harvesting structures.
4. Understand methods of groundwater recharge & Reclamation of saline soils.

**COURSE ARTICULATION MATRIX**

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PSO														
CO1		3	2	0	0	0	0	0	0	0	0	0	0	3	2
CO2		3	3	0	0	0	0	0	0	0	0	0	0	3	2
CO3		3	2	3	0	0	0	0	0	0	0	0	0	3	3
CO4		3	2	0	0	0	0	0	0	0	0	0	0	3	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT – I**

[CO:1] (12)

Introduction- concept of watershed, need for watershed management, concept of sustainable development. Hydrology of small watersheds.

**UNIT – II**

[CO:2] (12)

Principles of soil erosion- causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds, Control of soil erosion, methods of soil conservation – structural and non-structural measures.

**UNIT – III**

[CO:3] (12)

Principles of water harvesting, methods of rainwater harvesting, design of rainwater harvesting structures.

**UNIT – IV**

[CO:4] (12)

Artificial recharge of groundwater in small watersheds, methods of artificial recharge, reclamation of saline soils.

**TEXT BOOK:**

- Murthy, V.V.N. and M.K. Jha Land and Water Management, Kalyani Publishers, 2015

**REFERENCE BOOKS:**

1. Watershed Hydrology by P E Black, Prentice Hall Englewood Cliffs, 1991.
2. Watershed Hydrology by R Suresh, Standard Publishers and Distributors, Delhi, 2007.
3. Watershed Management by Madan Mohan Das and M.D. Saikia, Prentice Hall of India, 2013.
4. Watershed Management Murthy, J. V. S., New Age International Publishers, 1998.

**CEEL08****REMOTE SENSING AND GIS****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To develop the fundamental concepts of GIS and Remote Sensing including the, and nature of geospatial data.
2. To know about electromagnetic Spectrum, types of Remote Sensing and digital image processing.
3. To make the student to understand the various Remote Sensing and GIS data models.
4. To familiarize the students in the GIS based analytical and problem solving techniques for Sustainable planning and management.

**COURSE OUTCOMES:****After successful completion of the course, the students are able to**

1. Demonstrate the concepts of, Electro Magnetic energy and spectrum, and Remote sensing process.
2. Understand the types of Remote Sensing, resolutions and Compute an image visually and digitally with digital image processing techniques.
3. Analyze raster and vector data and modelling in GIS.
4. Understand spatial analysis and applications of RS and GIS in various fields.

**COURSE ARTICULATION MATRIX:**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	0	0	0	0	0	0	0	0	0	3	1
CO2	2	1	2	0	0	0	0	0	0	0	0	0	3	2
CO3	2	2	2	0	1	0	1	0	0	0	0	0	3	2
CO4	2	2	2	0	1	0	1	0	0	0	0	0	3	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[Text Book 1] [CO:1] (12)**

**Remote Sensing** : Introduction to Remote Sensing - Importance of Remote Sensing - Components of remote Sensing - Types of Remote Sensing system - Electromagnetic spectrum - Electromagnetic Energy Interactions with atmosphere - Energy interactions with earth's surface materials - Spectral reflectance curves for water, soil and vegetation – Sun synchronous and Geosynchronous satellites - Advantages and limitations of Remote Sensing - Types of resolutions - Concepts of Nadir and Swath - Applications of Remote Sensing.

**UNIT II****[Text Book 1] [CO:2] (12)**

**Image processing**: Introduction, Elements of Visual Interpretation, Radiometric correction and Geometric correction. **Image enhancement**: Noise/Haze removal, Contrast enhancement: Linear, non-linear, logarithmic and exponential, Gaussian stretch, density slicing. Spatial filtering: low frequency, high frequency, edge enhancement. **Image Classification**: Supervised and unsupervised classification.

**UNIT III****[Text Book 1] [CO:3] (12)**

**Geographic Information System (GIS):** Introduction, Components of GIS; Fundamental operations of GIS. Types of Data Representations: Data input and output; Data editing; Types of data entry – Keyboard entry, Coordinate geometry procedure, manual digitizing and Scanning; Types of GIS – Raster GIS and Vector GIS; Advantages and Disadvantages of Raster and Vector GIS. Spatial Data, Attribute data – linking spatial attribute data. Layer based GIS and Feature based GIS. DBMS in GIS.

**UNIT IV****[Text Book 1] [CO:4] (12)**

**Spatial data Analysis:** Introduction. Vector Overlay Operations: Point-in Polygon, Line-in-Polygon, Polygon-in-Polygon. Raster overlay operations. Arithmetic operator – Conditional expressions – Overlay using decision table – Network analysis – Optimal path finding – Network allocation – Network tracing – Buffer analysis. **Applications of RS and GIS:** Land Use and Land Cover analysis - Land Information System - Flood zoning and mapping – Transportation.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Text Book of Remote Sensing and Geographical Information systems by M.Anji Reddy, 4th Edition, B.S.Publications, 2012.

**REFERENCE BOOK(s):**

1. Text Book of Remote Sensing and Geographical Information systems by Basudeb Bhatta, OxfordUniversity Press,2020.
2. Text Book of Remote Sensing and Geographical Information systems by A M Chandra and S K Ghosh, Narosa Publishing House,2019
3. Advanced Surveying: Total Station, GIS and Remote Sensing Book by N. Madhu, R. Sathikumar, and Satheesh Gopi , Pearson Education India, 2006
4. Introduction to Geographic Information Systems by Kang- tsung Chang, McGraw-Hill, 2003
5. Basics of Remote sensing & GIS by S.Kumar, laxmi publications, 2016.

**WEB RESOURCES:**

1. [https://en.wikipedia.org/wiki/Indian\\_Institute\\_of\\_Remote\\_Sensing](https://en.wikipedia.org/wiki/Indian_Institute_of_Remote_Sensing)
2. <http://nptel.ac.in/downloads/105108077/>
3. <http://nptel.ac.in/courses/105102015/28>

**CEEL09****IRRIGATION STRUCTURES****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To study various types of dams and design of gravity dam.
2. To understand the failures, criteria for safe design of earth dams and design of stilling basins of spillways.
3. To study silt theories and design of irrigation canals.
4. To understand various seepage theories for design of weirs & barrages and description of various canal structures.

**COURSE OUTCOMES:**

By the end of the course the students will be able to:

1. Design gravity and earth dams
2. Select suitable type of spillway and energy dissipation work
3. Design irrigation canals and suggest suitable remedial measures of water logging.
4. Design impervious floor of diversion head works using seepage theories and identify suitable types of canal regulation works.

**COURSE ARTICULATION MATRIX**

CO \ PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	3	1	0	0	0	0	0	0	0	0	0	3
CO2	3	3	1	0	0	0	0	0	0	0	0	0	3	2
CO3	3	3	1	0	0	0	0	0	0	0	0	0	3	1
CO4	3	3	1	0	0	0	0	0	0	0	0	0	3	2
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO6	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I [CO:1] (12)**

Dams in General: Introduction; Classification; Gravity dams, Arch dams, Buttress dams, Steel dams, Timber dams, Earth dams and rock fill dams; Physical factors governing selection of type of dam and selection of site for a dam.

Gravity Dams: Introduction; Forces acting on a gravity dam; Combination of loading for design; Modes of failure and criteria for stability requirements; Stability analysis; Elementary profile of a gravity dam; Practical profile of a gravity dam; Limiting height of a gravity dam; High and low gravity dams; Design of gravity dams—single step method; Galleries; Joints; Keys and Water seals; Stability analysis of non—overflow section of gravity dam.

**UNIT II [CO:2] (12)**

Earth Dams: Introduction; Types of earth dams; Causes of failure of earth dams; Criteria for safe design of earth dams; Section of an earth dam; Seepage control measures.

Spillways: Introduction; Types of spillways; Energy dissipation below spillways for relative positions of jump height curve and tail water curve; Stilling basins; Indian standards on criteria for design of hydraulic jump type stilling basins with horizontal and sloping aprons.

**UNIT III**

[CO:3] (12)

Irrigation Channels – Silt Theories and Design Procedure: Classification; Canal alignment; Inundation canals; Cross–section of an irrigation channel; Balancing depth; Borrow pit; Spoil bank; Land width; Silt theories–Kennedy’s theory, Kennedy’s method of channel design; Drawbacks in Kennedy’s theory; Lacey’s regime theory; Lacey’s theory applied to channel design; Defects in Lacey’s theory; Comparison of Kennedy’s and Lacey’s theory. Water Logging and Canal Lining: Water logging; Effects of water logging; Causes of water logging; Remedial measures; Saline and alkaline soils and their reclamation; Losses in canal; Lining of irrigation channels – necessity, advantages and disadvantages; Types of lining; Design of lined canal.

**UNIT IV**

[CO:4] (12)

Diversion Head Works: Component parts of a Diversion Head work; Weirs and barrages-Types of weirs; Causes of failure of weirs and their remedies; Design of weirs on permeable foundations – Bligh’s creep theory, Silt control at head works. Canal regulation works: Types of outlets; Non–modular outlets; Semi-module outlets; Rigid modules; Canal falls; Necessity and location of falls; Development of falls; Types of falls; Canal regulators; Off-take alignment; Head regulators and cross-regulators; Canal escape (Designs not included). Cross Drainage Works: Introduction; Types of cross - drainage works; Selection of suitable type of cross - drainage work; Classification of Aqueducts and Syphon Aqueducts.

**LEARNING RESOURCES:****TEXT BOOK:**

- Irrigation and water power Engineering by B.C. Punmia and Pande B.B. Lal; 17 th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2021.

**REFERENCE BOOK(s):**

1. Irrigation Engineering and Hydraulic Structure by S. K. Garg; Khanna Publishers, Delhi, 2011.
2. Irrigation, Water Resources and Waterpower Engineering by P.N. Modi, 7th Edition, Standard BookHouse, 2008.
3. Irrigation, Waterpower and Water Resources Engineering by K R Arora, Standard Publishers, 2010.

**CEEL10****PRE-STRESSED CONCRETE****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To understand pre-stressing of concrete and various pre-stressing systems.
2. To analyse and design pre-stressed concrete beams.

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Understand pre-stressing of concrete and various pre-stressing systems.
2. Analyse pre-stressed concrete beams.
3. Design pre-stressed concrete beams.
4. Analyse and design end block.

**COURSE ARTICULATION MATRIX**

PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	0	0	3	2	0	0	0	0	0	3	2
CO2	3	3	3	0	0	3	2	0	0	0	0	0	3	2
CO3	3	3	3	0	0	3	2	0	0	0	0	0	3	2
CO4	3	3	3	0	0	3	2	0	0	0	0	0	3	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****[CO:1, 2] (12)**

**Introduction:** Basic concepts of prestressing; Historical development; Need for High strength steel and high strength concrete; Advantages of prestressed concrete.

Materials for Prestressed Concrete: High strength concrete; High tensile steel.

Prestressing Systems: Tensioning devices; Hoyer's long line system of pretensioning; Post tensioning systems; detailed study of Freyssinet system, Lee-McCall System and Gifford – Udall system. **(CO:1)**

**Analysis of Prestress and Bending Stresses:** Basic assumptions; Analysis of prestress; Resultant stresses at a section; Pressure (Thrust) line and internal resisting couple; Concept of Load balancing; Stresses in tendons; Cracking moment. **(CO:2)**

**UNIT II****[CO:2] (12)**

**Losses of Prestress:** Nature of losses of prestress; Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.

**Deflections of Prestressed Concrete Members:** Importance of control of deflections; Factors influencing deflections; Short term deflections of uncracked members.



**UNIT III****[CO:3] (12)**

**Flexural strength of prestressed concrete sections:** Types of flexural failure; Flexural strength of prestressed concrete sections as per IS1343: 2012. Design of sections for flexure as per IS1343: 2012:Introduction; Design loads and strengths; Strength and serviceability limit states; Minimum section modulus; Prestressing force; Limiting zone for the prestressing force; Design of rectangular and I sections for the limit state of collapse in flexure.

**Shear Resistance:** Shear and Principal Stresses, Ultimate shear resistance of prestressed concrete members and design of shear reinforcement as per IS1343:2012.

**UNIT IV****[CO:4] (12)**

**Transfer of Prestress in Pre-Tensioned Members & Flexural Bond Stresses:**

Transmission of prestressing force by bond; Transmission length; Bond stresses; Transverse tensile stresses; End zone reinforcement; Flexural bond stresses in pre tensioned and post tensioned grouted beams. Anchorage Zone Stresses In Post-Tensioned Members:Stress distribution in end block; Anchorage zone stresses and Anchorage zone Reinforcement as per IS1343: 2012

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Prestressed Concrete by N. Krishna Raju; 5th Edition, Tata Mc Graw - Hill Publishing Company Limited, 2015.

**REFERENCE BOOK(s):**

1. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns, 3<sup>rd</sup> Edition, John Wiley & Sons, 2010.
2. Prestressed Concrete by Pandit & Gupta , CBS Publishers, 1995.
3. Fundamentals of Pre-stressed concrete by NC Sinha and SK Roy, 3rd Edition, S.Chand Publishers, 1985.
4. Prestressed Concrete by N.Raja Gopalan ,2<sup>nd</sup> Edition,Narosa Publishing House, 2008.

**WEB RESOURCES:**

[www.iitm.ac.in](http://www.iitm.ac.in)

**CEEL11****FINITE ELEMENT METHOD****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. Ideate the relation between stress and strain.
2. Understand the concepts in stiffness matrix method.
3. Learn plane stress and plane strain problems.

**COURSE OUTCOMES**

After successful completion of the course, students are able to

1. Illustrate the relation between stress and strain
2. Determine element stiffness matrix and load vector
3. Determine global stiffness matrix and solve governing equations
4. Solve plane stress and plane strain problems

**COURSE ARTICULATION MATRIX**

CO \ PO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PSO														
CO1		3	3	3	0	0	0	0	0	0	0	0	0	3	0
CO2		3	3	3	0	0	0	0	0	0	0	0	0	3	0
CO3		3	3	3	3	2	0	0	0	0	0	0	0	3	0
CO4		3	3	3	3	2	0	0	0	0	0	0	0	3	0

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (12)**

**Basic Principles:** Equilibrium equations; Strain-displacement relations; Linear constitutive relations; Principle virtual work; Principle of stationary potential energy

**UNIT II****[CO:2] (12)**

**Element Properties:** Different types of elements; Displacement models; Relation between nodal degrees of freedom and generalized coordinates; Convergence requirements; Compatibility requirement; Geometric invariance; Natural coordinate systems; Shape functions; Element strains and stresses; Element stiffness matrix; Element nodal load vector  
Isoparametric elements – Definition, Two-dimensional isoparametric elements – Jacobian transformation, Numerical integration

**UNIT III****[CO:3] (12)**

**Direct Stiffness method and Solution Technique :** Assemblage of elements–Obtaining Global stiffness matrix and Global load vector; Governing equilibrium equation for static problems; Storage of Global stiffness matrix in banded and skyline form; Incorporation of boundary conditions; Solution to resulting simultaneous equations by Gauss elimination method.

**UNIT IV**

**[CO:4] (12)**

**Plane-stress and Plane-strain analysis:** Solving plane stress and plane-strain problems using constant strain triangle and four noded isoparametric element.

**LEARNING RESOURCES:**

**TEXT BOOK(s):**

1. Finite element analysis by C.S.Krishnamurthy, Tata-McGraw-Hill, 1994.

**REFERENCE BOOKS**

1. Introduction to finite element method by PN Godbole, IK International, 2013.
2. Finite element analysis by SS Bhavikatti, New Age International, 2010.
3. Matrix and finite element analyses of structures by M.Mukhopadhyay and A.H.Sheikh, Ane Books, 2004.
4. Finite element method in Structural analysis by AS Meghre and KN Kadam, Khanna Publishers, 2014.
5. Concepts and applications of finite element analysis by R.D.Cook et.al., John Wiley and Sons, 1989.

**CEEL12 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To provide a coherent development to the students for the courses in sector of earthquake engineering.
2. To present the foundations of many basic engineering concepts related earthquake Engineering.
3. To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering.
4. To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

**COURSE OUTCOMES:**

After the completion of the course student will be able to

1. Understand causes and theories on earthquake, seismic waves and elements of earthquake.
2. Demonstrate knowledge on measurement of earthquakes and derive fundamental equations in structural dynamics.
3. Evaluate the lateral forces on a building using equivalent static method.
4. Design and Detail the reinforcement for earthquake forces and demonstrate knowledge on liquefaction.

**COURSE ARTICULATION MATRIX**

PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	0	0	0	0	0	1	0	1	2	1
CO2	2	2	1	1	0	0	0	0	0	1	0	2	2	1
CO3	2	2	1	1	0	0	0	0	0	1	0	2	2	2
CO4	3	2	1	1	0	0	0	0	0	2	0	1	1	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I****[CO:1](12)**

**Engineering Seismology:** Basic terminology, causes and effects of earthquake, composition of Earth, origin of earthquakes, classification of earthquakes, propagation of seismic waves.

**Introduction to structural dynamics :** Theory of vibrations; Degrees of freedom; Spring action and damping; Free vibration of undamped system having single degree of freedom; Free vibration of viscous damped system having single degree of freedom; Forced vibration of a viscous damped single degree freedom system subjected to harmonic excitation; Earthquake excitation (Base excitation) of a single degree freedom system.

**UNIT II****[CO: 2](12)**

**Elements of Earthquake Ground motion:** Strong Motion characteristics of Earthquakes Earthquake size - Intensity and magnitude; Seismic Zoning-Introduction; Response spectrum (elastic); Local site effect (Effect of type of soil).

**Seismo-resistant building architecture:** Introduction; Building configuration- Problems and solutions; Building characteristics - Mode shape and fundamental period, non-structural elements, Foundations; Quality of construction and materials - quality of concrete, construction joints.

**UNIT III****[CO:3](12)**

**Computation of seismic forces on the structure:** Principal steps involved in the earthquake resistant design of RCC structures as per IS 1893(part-I)-2016.Calculation of lateral force due to earthquake using equivalent static method.

**UNIT IV****[CO:4](12)**

**Design and detailing of RCC buildings:**Ductility in reinforced concrete structures, ductile detailing of flexural member and column (As per IS13920-1993).

**Elements of Geotechnical Earthquake Engineering:** Liquefaction - Definition and types, Effect of liquefaction on built environment, Evaluation of liquefaction susceptibility, Liquefaction hazard mitigation ; Seismic slope stability - Introduction, Pseudo-static analysis, Sliding block methods.

**LEARNING RESOURCES:****TEXT BOOK(s) :**

1. Earthquake Resistant Design of Structures by Pankaj Agarwal, and Manish Shrikhande, PHI Publications.
2. S. K. Duggal; Earthquake Resistance Design of Structures; Oxford University Press, New Delhi.
3. Geotechnical Engineering by S.K.Gulhati& Manoj Datta, Tata McGraw-Hill, 2010

**REFERENCE BOOK(s):**

1. Elements of Earthquake Engineering by Jai Krishna, A.R.Chandrasekaran and Brijesh Chandra,Second Edition, South Asian Publishers, 1994.
2. Dynamics of Structures by A.K.Chopra, 3rd Edition, Person Education, 2007.

**WEB RESOURCES**

<https://nptel.ac.in/courses/105101004>

**CEEL13****DESIGN OF STEEL STRUCTURES****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To design gantry girder and welded plate girder
2. To design various types connections
3. To design roof trusses
4. To design light gauge sections and composite beams

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Design gantry girder and welded plate girder
2. Design bolted and welded connections
3. Design structural steel components of roof truss
4. Design light gauge steel sections and composite construction

**COURSE ARTICULATION MATRIX**

PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	2	0	0	0	0	0	0	0	0	2
CO2	3	3	3	0	2	0	0	0	0	0	0	0	0	2
CO3	3	3	3	0	2	0	0	0	0	0	0	0	0	2
CO4	3	3	3	0	2	0	0	0	0	0	0	0	0	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT – I****[CO:1] (13)**

**Gantry girder:** Introduction; Loads on gantry girder; Web buckling and Crippling; Deflection, Check; Design of gantry girder

**Welded Plate girder:** Introduction; Behavior of transversely stiffened plate girder panels in shear ; Design methods for transversely stiffened web panels; Design of end panels; Other design specifications ; Design of stiffeners ; Design of welded plate girder

**UNIT – II****[CO2] (12)**

**Connections :** Introduction; Bracket connections using welding/bolting; Simple beam end connections-Web connections using welding/bolting, Seat-angle connection using welding/bolting, Stiffened seat angle connection using welding/bolting; End plate connection, Fin-plate connection; Moment resistant beam end connection- Extended end plate connection; Splicing of beams /girders using bolts.

**UNIT – III** **[CO:3] (12)**

**Roof Trusses** : Components of a trussed roof; Types of trusses; Dead, Live and wind loads on trussed roof; Design of tubular purlins ; Design of members of a roof truss using tubes; Design of connections using welding.

**UNIT –IV** **[CO:4] (13)**

**Light-gauge steel sections**: Introduction; Types of sections; Design of light gauge sections; Design of axially loaded columns; Design of beams which do not buckle laterally.

**Composite Construction**: Introduction; Composite beam; Method of construction; Limit states of collapse; Limit states of serviceability – Deflection

**TEXT BOOK(s):**

- Design of steel structures by K.S.Sai Ram, Pearson Education, 2020.

**REFERENCE BOOK(s):**

1. Design of steel structures by N.Subramanian, Oxford University Press, 2016.
2. Limit state design of steel structures by M.R.Shiyekar, PHI Learning, 2017.
3. Limit state design of steel structures by S.K.Duggal, McGraw-Hill,2017.

**WEB REFERENCES:**

<http://nptel.iitm.ac.in>

**CEEL14****GROUND IMPROVEMENT TECHNIQUES****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES****This course will enable students to**

1. Know the necessity of ground improvement
2. Study modification of granular and cohesive soils
3. Study modification of problematic soils by Geotextiles, Dewatering, and Grouting.
4. Study ground modification by various stabilization methods

**Course Outcomes****By the end of the course, the students will be able to**

1. Understand the various ground improvement techniques available
2. Suggest a suitable method for In-situ densification of cohesive soils and design reinforced earth.
3. Modify problematic soils by Geotextiles, Dewatering, and Grouting
4. Suggest ground modification by various stabilization methods

**COURSE ARTICULATION MATRIX**

PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	0	0	0	0	0	0	0	0	0	2	2
CO2	3	2	1	0	0	0	0	0	0	0	0	0	2	2
CO3	3	2	1	0	0	0	0	0	0	0	0	0	2	2
CO4	2	2	1	0	0	0	0	0	0	0	0	0	2	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (13)**

**Introduction:** Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique; objectives of improving soil.

**In-situ densification methods in granular soils:** Introduction, Vibration at the ground surface, impact at the ground surface, vibration at depth, impact at depth.

**UNIT II****[CO:2] (12)**

**In-situ densification methods in cohesive soils:** Introduction, preloading, sand drains, sand wicks, band drains, stone and lime columns.

**Reinforced earth:** Principles, components of reinforced earth, governing design of reinforced earth walls, design principles of reinforced earth walls.



**UNIT III****[CO:3] (12)**

**Geotextiles:** Introduction, types of geotextiles, functions and their applications, tests for geotextiles, geogrids and its functions.

**Dewatering:** methods of dewatering and pressure relief, well point systems, deep well drainage, vacuum dewatering, electro osmosis, capacity of pumps and pumps design, installation and operation of dewatering systems – single line, two line, flow to a single well, multiple well systems.

**Grouting:** Introduction; Kinds of grout- Cementitious grouts and Chemical grouts; Grouting methods, Intrusion grouting, Permeation grouting, compaction grouting and jet grouting.

**UNIT IV****[CO:4] (11)**

**Mechanical Stabilization** -Soil aggregate mixtures, properties and proportioning techniques, soft aggregate stabilization, compaction, field compaction control;

**Cement Stabilization**-Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques.

**Lime and Bituminous Stabilization**-Type of admixtures, mechanism, factors affecting, design of mixtures, construction methods.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Engineering Principles of ground modification by MR Hausmann, McGraw-Hill, 1<sup>st</sup> edition, January, 1990.

**REFERENCE BOOK(s):**

1. Ground improvement Techniques, P.Purushothama Raju, Laxmi Publications, 2<sup>nd</sup> Edition, January, 2016
2. Designing with Geosynthetics by Robert M. Koerner, 5th Edition, Prentice Hall, 2005.
3. Construction and Geotechnical methods in Foundation Engineering by R.M.Koerner, McGraw-Hill, 1<sup>st</sup> edition 1984.
4. Current Practices in Geotechnical Engineering Vol.-I, Alam Singh and Joshi, International Book Traders, 1985.

**WEB REFERENCES:**

[www.iitm.ac.in](http://www.iitm.ac.in)

**CEEL15 REPAIR AND REHABILITATION OF STRUCTURES****LT P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To learn various distress and damages to concrete and masonry structures
2. To understand the importance of maintenance of structures
3. To study the various types and properties of repair materials
4. To assess the damage to structures using various tests
5. To learn the importance and methods of substrate preparation
6. To learn various repair techniques of damaged structures, corroded structures

**COURSE OUTCOMES:**

After the completion of the course student will be able to

1. Demonstrate knowledge on various distress and damages to concrete and masonry structures.
2. Assess various types and properties of repair materials.
3. Assess damage to structures and understand various strengthening techniques.
4. Apply various retrofitting techniques used for seismic retrofitting of buildings.

**COURSE ARTICULATION MATRIX**

PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO														
CO1	3	3	2	2	3	0	0	0	0	0	3	0	3	2
CO2	3	3	2	3	3	0	0	0	0	0	3	0	3	2
CO3	3	3	2	3	3	0	0	0	0	0	3	0	3	2
CO4	3	3	2	3	3	3	0	0	0	0	3	0	3	2
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO6	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****Text Book - T1 [CO:1] (13)**

**Introduction:** Need for repair and rehabilitation of structures, Road map to repair of structures. Deterioration of concrete structures: Degradation of reinforced concrete structures; Major causes and signs of deterioration; Durability and permeability aspect of concrete; Deterioration of concrete structures; Cracking-Types, causes and characteristics.

**UNIT II****Text Book - T1 [CO:2] (12)**

**Evaluation of concrete structures:** Preliminary investigation-Scope and methodology of preliminary investigation, rapid visual investigation; Output of preliminary investigation-Damage classification based on preliminary investigation, reporting of findings of preliminary investigation; Detailed investigation-Scope and methodology of detailed investigation; In-situ and laboratory testing of concrete structures-Non destructive tests for strength estimation of

concrete, Semi-destructive tests for strength evaluation of concrete, Tests to assess the corrosion potential of concrete, Chemical tests of concrete; Concrete repair materials:Repair methodology- Options, performance requirements of repair systems, factors of selecting repair methods, causes of damage, extent of damage, selection of repair material and repair methods, preparation of the old concrete for repair, application of the repair material and curing method. Materials for repair:Cement based repair methods, Polymer modified repair materials, Resin based products, Micro-concrete, Composites.

### UNIT III

#### Text Book - T1 [CO:3] (12)

**Repair techniques:**Repairs using mortars, Dry pack and epoxy bonded dry pack, Pre-placed aggregate concrete, Gunite or Shotcrete, replacement of concrete, grouting, polymer impregnation, resin injection, routing and sealing, stitching, surface patching, overlays and surface coatings, autogenous healing, gravity filling, drilling and plugging.Strengthening of structures:Design philosophy of strengthening-General procedure for strengthening of structures; Strengthening techniques-Section enlargement, composite construction, post tensioning, stress reduction, strengthening by reinforcement; Strengthening of beams-Flexural strengthening of beams, shear strengthening of beams; Strengthening of slabs; strengthening of columns; strengthening of footings.

### UNIT IV

#### Text Book – T2 [CO:4] (13)

Seismic Retrofitting of reinforced concrete buildings:Introduction, Considerations in retrofitting of structures, Source of weakness in RC frame buildings- Structure damage due to discontinuous load path, Structural damage due to lack of deformation, Quality of workmanship and materials, Classification of retrofitting techniques, Retrofitting strategies for RC buildings, Structural level (global) retrofit methods, Member level (local) retrofit methods.

### LEARNING RESOURCES:

#### TEXT BOOK(s):

1. Repair and Rehabilitation of concrete structures by Poonam I.Modi, Chirag N.Patel, PHI, 2016.
2. Earthquake resistant design of structures by Pankaj agarwal, Manish shrikande, PHI, 2006.

#### REFERENCE BOOK(s):

1. Maintenance repair & rehabilitation of minor works of buildings by P.C.Varghese, PHI, 2014.
2. Rehabilitation of concrete structures by Dr.B.Vidivelli, Standard Publishers Distributors, 2015.
3. Failures and repair of concrete structures by S.Champion, John Wiley and Sons, 1961.
4. Diagnosis and treatment of structures in distress by R.N.Raikar Published by R & D Centre ofStructural Designers and Consultants Pvt.Ltd, Mumbai.
5. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.
6. Handbook on seismic retrofit of buildings, A. Chakrabartiet.al.,Narosa Publishing House, 2010.

**CEEL16****BRIDGE ENGINEERING****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To explain various investigations to be conducted before constructing a bridge
2. To introduce various types of RC bridges and IRC loadings
3. To design slab culvert and T-beam bridge
4. To design substructure for bridges
5. To explain various types of bearings and design of elastomeric bearing
6. To explain various types of foundations and design of well foundation

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Demonstrate knowledge on various investigations to be conducted before constructing a bridge
2. Understand various types of RC bridges and IRC loadings
3. Design slab culvert and T-beam bridge
4. Design substructures like piers and abutments
5. Understand various types of bearings and able to design elastomeric bearing
6. Demonstrate knowledge on types foundations used for bridges and design well foundation

**COURSE ARTICULATION MATRIX**

PO, PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	0	0	3	3	0	0	0	0	0	3	2
CO2	2	2	2	0	0	3	3	0	0	0	0	0	3	2
CO3	3	3	3	0	0	3	2	0	0	0	0	0	3	2
CO4	3	3	3	0	0	3	2	0	0	0	0	0	3	2
CO5	3	3	3	0	0	3	2	0	0	0	0	0	3	2
CO6	3	3	3	0	0	3	2	0	0	0	0	0	3	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1,2] (12)**

**Introduction & Investigation For Bridges:** Components of a Bridge; Classification; Standard Specifications; Need for Investigation; Selection of Bridge Site; Preliminary Data to be Collected; Preliminary Drawings; Determination of Design Discharge; Economical Span; Location of Piers and Abutments; Vertical clearance above HFL; Scour depth; Traffic Projection; Choice of Bridge type; Importance of Proper Investigation. **(CO1)**

Concrete Bridges: Various types of bridges; I. R. C. Specifications for road bridges. **(CO2)**

**UNIT II**

**[CO:3] (12)**

**Culverts** : Design of R. C. slab Culvert.

**T – Beam Bridge:** Pigeaud's method for computation of slab moments; Courbon's method for computation of moments in girders; Design of simply supported T–beam bridge.

**UNIT III**

**[CO:4] (12)**

**Sub Structure for Bridges:** Pier and abutment caps; Materials for piers and abutments; Design of pier; Design of abutment; Backfill behind abutment; Approach slab.

**UNIT IV**

**[CO:5,6] (12)**

**Bearings for Bridges:** Importance of bearings; Bearings for slab bridges; Bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing. **(CO5)**

**Foundations for Bridges:** Scour at abutments and piers; Grip length; Types of foundations; Design of well foundation. **(CO6)**

**LEARNING RESOURCES**

**TEXT BOOK(s):**

1. Essentials of Bridge Engineering by Dr. Johnson Victor; 6<sup>th</sup> Edition, Oxford & IBH Publishing Company Pvt. Ltd., 2019.

**REFERENCE BOOK(s):**

1. Design Of Bridges, 5<sup>th</sup> Edition by Raju N. K. Oxford and IBH Publishing Company Pvt. Ltd, (2019).
2. Bridge Engineering by S Ponnuswamy, 2<sup>nd</sup> edition, Mc Graw Hill Education, 2009
3. Design of bridge structures by Jagadeesh and Jayaram, 2<sup>nd</sup> Edition, PHI Learning, 2009.

**WEB REFERNCES**

[www.iitm.ac.in](http://www.iitm.ac.in)

**CESL1****SURVEYING****LTPCIntExt****Skill Oriented Course- I****2-- 2100 -****Semester III [Second Year]****COURSE OBJECTIVES:**

1. To study the basic measurement in surveying methods like chain surveying, compass surveying and etc.
2. To study the basics of leveling and to determine the relative positions of the existing features on the ground.
3. To study the basics of theodolite survey in elevation and angular measurements.
4. To learn the basics of Total station and to determine the angular, elevation, area, volume and relative positions on the field.
5. To study the basics of GPS and various DGPS methods to determine accurate coordinate of real world.

**COURSE OUTCOMES:****By the end of the course the students will be able to:**

1. Determine the relative positions of a point on the existing ground by conducting the survey.
2. Determine the reduced levels and calculate area and volume of the tract.
3. Determine the relative positions of a point, levels of existing ground, area and volume by using total station.
4. Locate the coordinate of the boundaries using GPS and DGPS instruments.

**COURSE ARTICULATION MATRIX:**

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	3	2	0	0	0	3	2	2	0	3	3
CO2	3	3	2	3	3	0	0	0	3	2	2	0	3	3
CO3	3	3	2	3	3	0	0	0	3	2	2	0	3	3
CO4	3	3	2	3	3	0	0	0	3	2	2	0	3	3

**UNIT I****Text Book-1,2[CO:1](15)**

**Surveying & Measurements:** Definitions; Classification; Principles of Surveying; Basic measurements in surveying; Traditional surveying Instruments used for different measurements (Only theory; Chain, Tape, and Compass).

**Simple Levelling:** Basic definitions; Bench Marks – Temporary Adjustments; Different methods of levelling; Types of Levels and its equipments, Booking and reducing levels; Classification of direct differential levelling methods - Fly levelling, check levelling, Profile levelling and Cross sectioning, Reciprocal levelling and Precise levelling; Contouring; Contour interval; Characteristics of contours; Uses of contour maps.

**UNIT II****Text Book-1,2[CO:2](15)**

**Theodolite Surveying:** Types of Theodolites; Vernier Theodolite - Essential Parts; Basic definitions; Fundamental lines and desired relations; Temporary adjustments; Field operations - Measurement of horizontal angles (Repetition & Reiteration), vertical angles, direct angles, deflection angles, bearings.

**UNIT III****Text Book-3[CO:3](15)**

**Total Station:** Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station

**UNIT IV****Text Book-3[CO:4](15)**

**GPS Surveying :** Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Hand Held and Geodetic receivers – GPS and DGPS Positioning Types- Absolute Positioning, Differential positioning Methods-Static & Rapid static, Kinematic-Real time kinematic Survey.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Surveying Volume I & II by Dr. K. R. Arora, 11th Edition, Standard Book House, 2012.
2. Surveying Volume I & II by SK Duggal, 4th Edition, McGraw Hill Education (India) Private Limited, 2013.
3. Advanced surveying: Total station, GPS, GIS and Remote Sensing by Satheesh Gopi, R.Sathikumar, N.Madhu, 2<sup>nd</sup> Edition, Pearson Education, 2017.

**REFERENCE BOOK(s):**

1. Surveying Volume I & II by B.C. Punmia, Laxmi Publications, 2005.
2. Surveying and Levelling by N.N Basak, McGraw Hill Education (India) Private Limited, 2014.

**WEB RESOURCES:**

1. <http://nptel.ac.in/courses/105107121/>
2. <https://nptel.ac.in/courses/105/107/105107062/>
3. <https://nptel.ac.in/courses/105/104/105104100/>
4. <https://nptel.ac.in/courses/105/107/105107122/>
5. <https://nptel.ac.in/courses/105/104/105104101/>

**CESL2**  
Skill Oriented Course- III

**BUILDING PLANNING AND DRAWING**  
**Semester IV [Second Year]**

**L T P C Int Ext**  
**1 - 2 2 100 -**

**Course Objectives**

1. Identify the factors affecting building planning.
2. Study various aspects of a building.
3. Identify Stipulated rules, regulations and laws framed by the Government.
4. Drawing various buildings as per government norms.

**Course Outcomes**

After successful completion of the course, students are able to

1. Summarize the fundamentals of building drawing.
2. Detail principles of building planning.
3. Explore building bye laws framed by the government.
4. Plan various buildings as per the government norms.

**COURSE ARTICULATION MATRIX**

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	PSO														
CO1	3	2	3	0	0	2	0	0	0	0	0	0	0	3	3
CO2	3	2	3	0	0	2	0	0	0	0	0	0	0	3	3
CO3	3	0	3	0	0	3	0	0	0	0	0	0	0	3	3
CO4	3	0	3	0	3	3	0	0	0	0	0	0	0	3	3

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT I**

**Text Book-1 [CO:1] (8)**

**FUNDAMENTALS OF BUILDING DRAWING**

Introduction to building drawing, Preparation of drawings, Interpretation of drawings, Building plans approval procedure as per NBC 2005, Classification of buildings, Site selection for residential buildings.

**CLIMATE AND ITS INFLUENCE ON BUILDING PLANNING**

Introduction, Elements of climate, Climatic zones of india, Earth and its motion, Directions and their characteristics, orientation of building, Factors affecting orientation, optimum orientation

**UNIT II**

**Text Book-1 [CO:2] (8)**

**PRINCIPLES OF PLANNING OF BUILDINGS**

Aspect, Prospect, Privacy, Internal privacy, External privacy, Furniture requirement, Drawing room, Dining table and dining chairs, Bed room, Kitchen, Roominess, Grouping, Circulation, Sanitation, Lighting, Ventilation, Cleanliness, Flexibility, Elegance, Economy, Practical considerations.

**UNIT III**

**Text Book-1 [CO:3] (8)**

**BUILDING BYE-LAWS**



Introduction, Building bye-laws, Objectives of building bye-laws, Principles underlying building bye laws, Minimum plot sizes and building frontage , Open spaces, Minimum standard, imensions of building elements , Provisions for lighting and ventilation, Provisions for safety from, fire and explosions , Provisions for means of access, Provisions for drainage and sanitation, Provisions for safety of works against hazards or accidents.

Requirements for off street parking, Requirements for green belt and landscaping, Special requirements for low income housing, Sizes of structural elements, Applicability of the bye-laws.

#### **UNIT IV**

#### **Text Book-1 [CO:4] (20)**

Drawing of various buildings using AutoCAD software: A two BHK residential building, A three BHK residential building, An office building, Two storeyed duplex residential building, Plan of a secondary school, Primary health centre, Post office.

#### **LEARNING RESOURCES**

##### **Text book**

1. Building Planning and Drawing by Dr. N. Kumara Swamy, A. Kameswara Rao, Charotar Publishing House Pvt. Ltd., 2019.

##### **Reference book**

1. Building Planning and Drawing by M.V. Chitawadagi S.S. Bhavikatti, 2019.  
2. Building Planning and Drawing, M N Gangarde , S P Deshpande, Nirali Prakashan.

**CESL3**  
**Skill Oriented Course- III**

**GIS Lab**

**L T P C Int Ext**  
**1 - 2 3 100 -**

**Semester V [Third Year]**

**COURSE OBJECTIVES:**

1. To familiarize the students in basic concepts of GIS and GIS software
2. To know about various map projection system and registration process
3. To make the student to generate various map by using spatial and attribute data.
4. To familiarize the students to design a typical map with suitable map elements.

**COURSE OUTCOMES:**

**After successful completion of the course, the students are able to**

1. Demonstrate the basic concepts of GIS and GIS software.
2. Understand the Projection Systems and map registration process.
3. Generate various map by using spatial and attribute data.
4. Compile and design a typical map with suitable map elements.

**COURSE ARTICULATION MATRIX:**

CO \ PC	PSC	PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2	1	1	2	1	0	0	0	0	0	0	0	3	2
CO2		2	2	1	3	3	2	1	0	0	0	0	0	3	2
CO3		2	2	1	3	2	0	1	0	0	0	0	0	3	2
CO4		2	1	1	2	1	0	0	0	0	0	0	0	3	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**Geographical Information System (GIS)**

**[Text Book:1] [CO:1] (4)**

Introduction to GIS – Components of GIS – Data I/P and Data O/P – Spatial and Attribute data – Raster GIS & Vector GIS.

**Lab exercise**

**[Text Book:2] [CO:1] (5)**

1. Demonstration on data Input.
2. Demonstration on onscreen digitization.
3. Demonstration on creating Point, Line and Polygon layers.

**Cartography:**

**[Text Book:1] [CO:2, CO:3] (10)**

Introduction to Cartography - Maps – Uses – Types of maps - Map Projection system and its types – Map coordinate system - Map and Image registration and its types.

**Lab exercises**

**[Text Book:2] [CO2 , CO3] (20)**

4. Demonstration on Geo-referencing of topo sheet.
5. Demonstration on creating thematic maps in GIS software
6. Demonstration on finding a shortest route using trip planning
7. Demonstration on labeling the parcel boundaries with their length
8. Demonstration on labeling the streets with their names
9. Demonstration on creating DEM from satellite images

**Map design and Production:****[Text Book:1] [CO:4] (6)**

Elements of a map – Map design fundamentals – Symbols and conventional signs – color and pattern in symbolization.

**Lab exercises for unit III****[Text Book:2] [CO:4] (3)**

10. Demonstration on map design or layout and map production.

**LEARNING RESOURCES:****TEXT BOOK FOR THEORY:**

1. Text Book of Remote Sensing and Geographical Information systems by M.Anji Reddy, 4th Edition, B.S.Publications, 2012.

**TEXT BOOK FOR LAB EXERCISE:**

2. GIS Tutorial for ArcGIS Desktop 10.8 by Wilpen L.Gorr and Kristen S. Kurland, 7<sup>th</sup> Edition, Environmental Systems Research Institute Inc., U.S, 2020.

**REFERENCE BOOK(s):**

1. Getting to know ArcGIS by Michael Law and Amy Collins, ESRI Press, 4<sup>th</sup> Edition, 2015.
2. Text Book of Remote Sensing and Geographical Information systems by Basudeb Bhatta, Oxford University Press, 2020
3. Text Book of Remote Sensing and Geographical Information systems by A M Chandra and S KGhosh, Narosa Publishing House, 2019
4. Advanced Surveying: Total Station, GIS and Remote Sensing Book by N. Madhu, R. Sathikumar, and Satheesh Gopi, Pearson Education India, 2006
5. Introduction to Geographic Information Systems by Kang- tsung Chang, McGraw-Hill, 2003
6. Basics of Remote sensing & GIS by S.Kumar, laxmi publications, 2016
7. H. Robinson et al, Elements of Cartography, 7th Edition, John Wiley and Sons, 2004.
8. C.P. Lo Albert K.W. Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India Publishers, 2006

**WEB RESOURCES:**

1. [https://en.wikipedia.org/wiki/Indian\\_Institute\\_of\\_Remote\\_Sensing](https://en.wikipedia.org/wiki/Indian_Institute_of_Remote_Sensing)
2. <http://nptel.ac.in/downloads/105108077/>
3. <http://nptel.ac.in/courses/105102015/28>

**CESL4**  
**Skill Oriented Course- IV**

**SOFT SKILLS**  
**Semester VI [Third Year]**

**L T P C Int Ext**  
**1 - 2 2 100 -**

### **COURSE OBJECTIVES**

**Soft Skills course prepares students to**

1. raise awareness of and to develop key competencies to succeed in professional and personal life.
2. to demonstrate their team working abilities; and, that they can emerge as leaders while still maintaining the group objectives.
3. prepare resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity and demonstrate an ability to target the resume to the presenting purpose.
4. develop confidence in relationship to their interviewing skills.

### **COURSE OUTCOMES**

**By the end of the course students will be able to:**

1. develop key competencies to succeed in professional and personal life.
2. understand the key skills and behaviour required to facilitate group discussion
3. produce resume with basic format and inputs to meet the company requirements.
4. identify appropriate verbal and non-verbal communication skills/techniques for an interview including preparedness, professional attire.

### **COURSE ARTICULATION MATRIX CO-PO-PSO**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	-	-	-	-	2
CO2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO4	-	-	-	-	-	-	-	-	1	-	2	-	-	-

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

### **UNIT 1**

**(9)**

#### **Importance of Skills in Professional and Personal life**

- Soft Skills Vs Hard Skills
- Personality Development
- Self-Grooming
- SWOT/ SWOC Analysis
- Goal Setting

### **UNIT II**

#### **Communication Skills**

**(12)**

- Presentation Skills
- Mini presentations
- (GD Lab)
- Group Discussions
- Types of GDs -How to face GD
- Practice Sessions

**UNIT III (6)**

**Resume Writing**

- Email -Etiquette
- Resume Workshop
- Cover Letter
- Effective Resume Writing: Structure and Presentation

**UNIT IV (9)**

**Interview Skills**

- Facing Interviews: Interview Process - Understanding Employer Expectations - Pre-Interview Planning.
- Frequently Asked Questions (FAQs)- Opening Strategies - Answering Strategies  
Mock Interviews.

**Reference Books**

- *Mitra, B. K. (2011). Personality development and soft skills. Oxford University Press.*
- *Technical Communication - Principles and Practice, II Ed, OUP by Meenakshi Raman & Sangeetha Sharma, 2015.*
- *Strategies for Engineering Communication – Susan Stevenson and Steve Whitmore, 2002.*
- *Group Discussion and Interview Skills by Priyadarshi Patnaik, published by Foundation Books.*
- *The Skills of Interviewing: A guide for Managers and Trainers – Leslie Rae*
- *Cambridge English for Job-Hunting by Colm Downes, published by Cambridge University Press.*

**CESL-5 QUANTITY ESTIMATION AND PROJECT MANAGEMENT LAB L T P C Int Ext**

1 - 2 2 100 -

(Skill Oriented-V)

**Semester VII [Fourth Year]****COURSE OBJECTIVES:**

1. Quantity estimation for different civil engineering works.
2. Cost estimation for different civil engineering works.
3. Rate analysis for different items of work.
4. To prepare project management report for different civil engineering projects.

**COURSE OUTCOMES:**

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

1. Estimate quantities required and cost of different civil engineering works.
2. Analyze the rate of different items of work like RCC, Brick work.
3. Analyze a project to schedule, to obtain critical activities and to allocate resources.

**COURSE ARTICULATION MATRIX CO-PO-PSO**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	3	2	0	0	0	3	0	0	3	3
CO2	3	3	3	0	3	2	0	0	0	3	0	0	3	3
CO3	3	3	3	0	3	2	0	0	0	3	0	0	3	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**List of Programs:**

Students are required to write programmes/analyse to solve the following problems using softwares like MS Excel/Road Estimate/Super Rate analysis, MS Project / Primavera etc.

1. Quantity estimation of a single storey residential building (different items).
2. Cost estimation of a single storey residential building.
3. Quantity estimation of a B.T.Road (different items).
4. Cost estimation of a B.T.Road.
5. Quantity estimation of a Canal (different items).
6. Cost estimation of a Canal.
7. Quantity estimation of RCC roof slab and preparing schedule of bars.
8. Quantity estimation of RCC beam and preparing schedule of bars.
9. Quantity estimation of RCC Column with foundation footing and preparing schedule of bars.
10. Quantity estimation of RCC retaining wall and preparing schedule of bars.
11. Determine the labour requirement and preparing the Rate Analysis for different items of work.
  - a) C.C
  - b) R.C.C
  - c) Brick work
  - d) Flooring
12. Preparing the Project management report for a single storey residential building by using the network technique (PERT/CPM).
13. Preparing the Project management report for a B.T.Road by using the network technique (PERT/CPM).
14. Preparing the Project management report for a Canal by using the network technique (PERT/CPM).

**HSEL6****PROJECT MANAGEMENT****L T P C Int Ext****3 - - 3 30 70****SEMESTER VII****COURSE OBJECTIVES:**

1. To introduce the concept of project management including network drawing and monitoring.
2. To know about various equipment related to construction.
3. To introduce the importance of quality and safety in construction projects

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Understand the importance of construction planning.
2. Plan and schedule a project using Network Techniques.
3. Understand about various equipment used in construction projects
4. Manage quality, safety and project economics.

**COURSE ARTICULATION MATRIX**

CO \ PO PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	3	3	2	2	3	0	0	0	0	0	3	0	3
CO2	3	3	2	3	3	0	0	0	0	0	3	0	3	2
CO3	3	3	2	3	3	0	0	0	0	0	3	0	3	2
CO4	3	3	2	3	3	3	0	0	0	0	3	0	3	2

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT - I****[CO:1] (10)**

**Introduction:** Planning and Scheduling: Planning techniques, Bar charts, Limitations of Bar Charts, Mile stone charts. Project Management through Networks: Objectives of network techniques; Events; Activities; Time estimates; Float and Slack; Critical path, near critical path.

**UNIT – II****[CO:2] (10)**

**CPM and PERT:** Introduction, Use in Construction Planning; Difference between CPM and PERT; Probability of completion time for a project.

**Cost Control:** Direct cost; indirect cost; Total project cost; Optimization of cost through networks.

**Resource Management (Manpower):** Introduction; Resource smoothing; Resource leveling.

**UNIT – III****[CO:3] (10)**

**Construction Equipment:** Different types of construction equipment and their use in Construction Industry; Factors affecting the selection of Equipment; Owning and operating the equipment; Equipment maintenance.

**UNIT – IV**

**[CO:4] (10)**

**Quality Control:** Importance of quality; Elements of quality; Quality assurance techniques; Documentation; Total quality management.

**Safety Management:** Importance of safety; Approaches to improve safety in construction industry; Safety benefits to employers, employees and customers.

**Project Economics:** Time value of money; discounted cash flow analysis; Payback period; Return on investment; Benefit cost analysis, re-placement analysis, Inflation.

**LEARNING RESOURCES**

**TEXT BOOKS**

1. Fundamentals of PERT/CPM and Project Management by S. K. Bhattacharjee; Khanna Publishers, 1996.

**REFERENCE BOOKS**

1. PERT & CPM Principles and applications by L. S. Srinath, 3<sup>rd</sup> Edition, Affiliated East West Press.
2. Construction Engineering and Management by Dr. S. Seetharaman, 4<sup>th</sup> Edition, Umesh Publications, 2008.
3. Construction Planning, Equipment & Methods by Peurifoy R. L.; Tata McGraw-Hill, 2008.



**COURSE OBJECTIVES:**

1. To study the basics of linear/angular measurement methods like chain surveying, compass surveying.
2. To determine the relative directions of the existing features on the ground.
3. To study the basics of Theodolite survey in angular measurements.
4. To acquaint with procedures of leveling by dump level & auto level.

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Determine the relative positions of a point on the existing ground by conducting the chain survey.
2. Calculate and minimize the errors in compass survey.
3. Apply Theodolite and Total Station knowledge on various problems.
4. Determine the levels of existing ground with respect a bench mark.

**Course Outcomes Mapping**

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	2		--	3	--	2	--	3	3
CO2	3	3	3	3	3	2		--	3	--	2	--	3	3
CO3	3	3	3	3	3	2		--	3	--	2	--	3	3
CO4	3	3	2	3	3	2		--	3	--	2	--	3	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO1](12)**

Surveying & Measurements: Definitions; Classification; Principles of Surveying; Basic measurements in surveying; Instruments used for different measurements; Units of measurement (linear & Angular); Plan and map; Phases of survey work and Duties of a surveyor. Procedures For distance measurement - Ranging, Chaining/taping a line.

Chain Surveying: Principle of Chain surveying; Basic definitions; Well-Conditioned & Ill-Conditioned triangles; Selection of stations and survey lines; Procedure of Field Work in Chain Surveying; Off-sets; Conventional Symbols; Problems encountered in chaining; Obstacles in chain Surveying.

**UNIT II****[CO2](12)**

Compass Surveying: Angles and Bearings; Instruments used to measure angles and bearings; Designation of Bearings; Fore and Back Bearings; Calculation of Included Angles from Bearings

and Bearings from Included Angles; Prismatic & Surveyor's Compass; Magnetic Dip & Declination; Local Attraction and Corrections.

### **UNIT III**

**[CO3](12)**

Theodolite Surveying: Types of Theodolites; Vernier Theodolite - Essential Parts; Basic definitions; Temporary adjustments; Field operations - Measurement of horizontal angles (Repetition & Reiteration), vertical angles. Total Station: Introduction; components of Total Station; Types of Prisms and targets used in total station; various advantages of Total Stations.

### **UNIT IV**

**[CO4](12)**

Simple Leveling: Basic definitions; Curvature and Refraction; Different methods of leveling; Levels - Dumpy level, Tilting level, Auto level; Leveling staff; Level field book; Booking and reducing levels; Classification of direct differential leveling methods - Fly leveling, Check leveling, Profile leveling and Cross sectioning, Reciprocal leveling and Precise leveling; Sources of errors & Difficulties in leveling.

### **LEARNING RESOURCES:**

#### **TEXT BOOKS:**

1. Surveying Vol. I & II by Dr. K. R. Arora, 11th Edition, Standard Book House, 2012.

#### **REFERENCE BOOKS :**

1. Surveying Vol. I & II by S K Duggal, 4th Edition, McGraw Hill Education (India) Private Limited, 2013.
2. Surveying Vol. I&II by B.C. Punmia, Laxmi Publications, 2005.
3. Surveying and Levelling by N.N Basak, McGraw Hill Education (India) Private Limited, 2014.
4. Plane Surveying by AM Chandra, 2nd Edition, New Age International (P) Ltd., 2006.

#### **WEB REFERENCES:**

1. <http://nptel.ac.in/courses/105104101/>
2. <http://nptel.ac.in/courses/105107121/>
3. <http://nptel.ac.in/courses/105107122/>

**Course Objectives:**

1. To teach the basics involved in selection of good quality building materials for construction.
2. To impart the knowledge of plastics and paints.
3. To demonstrate brick masonry works including types of bonds, specifications of plastering and acoustics of building.
4. To provide knowledge about various building components and their specifications, types of form work and rehabilitation work of building.

**Course Outcomes:**

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

1. Classify various building materials.
2. Acquire the knowledge about plastics, paints, distempers and water proofing materials.
3. Summarize specifications of masonry, plastering, stairs, lifts and acoustics of building.
4. Explore building components, scaffolding, shoring, underpinning and formwork.

**Course Outcomes Mapping**

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	2	--	--	--	--	--	--	3	--
CO2	3	2	--	--	--	2	--	--	--	--	--	--	3	--
CO3	3	2	--	--	--	2	--	--	--	--	--	--	3	--
CO4	3	2	--	--	--	2	--	--	--	--	--	--	3	--

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****Text Book-1 [CO:1] (12)**

**Clay bricks:** Brick clay, Preparation of bricks, Types of bricks, Dimensions of bricks, Weight of bricks, Storing of bricks, Brick substitutes, Classification of bricks, Tests for bricks.

**Timber:** Classification of trees, Structure of wood, seasoning and con-version of timber, Market forms of timber, Defects of timber, Treatment of timber, Classification of timber.

**Glass:** Manufacture and Classification, Uses of glass, testing for quality

**UNIT II****Text Book-1 [CO:2] (12)**

**Plastics:** Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics.

**Paints:** Types of paints, Composition of paints, Considerations in choosing paints, Paints commonly used in buildings. Damp Proofing and water proofing materials and uses, white washing and distemping.

**UNIT III****Text Book-2 [CO:3] (12)**

**Brick Masonry:** Terms used in brickwork, Mortars to be used, bonding of bricks, Method of laying bricks. Plastering: Plastering method, Specifications for plastering with cement mortar.

**Stairs and lifts:** Terminology used in stairs, Types of stairs, Recommendations for RCC stair case, lifts

**Acoustics:** Basic theory, Reverberation and echoes, Sound isolation, Acoustical materials, Recommendations for different types of buildings

#### **UNIT IV**

**Text Book-2 [CO:4] (12)**

**Building Components:** Lintels, arches, vaults, Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Prefabricated roofs.

**Shoring, Underpinning, Scaffolding and Formwork:** Shoring, Types of shores; Underpinning - Pit method, Pile method; Scaffolding -Types of scaffolding; Formwork-requirements of formwork, formwork for columns, beams, slabs

#### **LEARNING RESOURCES:**

##### **TEXT BOOK(s):**

1. Engineering Materials by Rangwala, Charotar Publications, Fortieth Edition: 2013.
3. Building construction by Rangwala, Charotar Publications ,33rd Edition:2017.

##### **REFERENCE BOOK(s):**

1. Building Materials by P.C. Verghese, 1st Edition, PHI, 2009.
2. Building construction by P.C. Verghese, 1st Edition, PHI, 2009.
3. Building material by S K Duggal – New Age International Publishers; Second Edition
4. Building construction by BC Punmia et al., 10th Edition, Laxmi Publications, 2008.

**WEB RESOURCES:** [www.nptel.iitm.ac.in](http://www.nptel.iitm.ac.in)

**CDOL1****PYTHON FOR DATA SCIENCE****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To introduce the fundamentals of Python Programming language.
2. To teach students processing of files, mutable and immutable data types.
3. Impart knowledge of NumPy and Pandas.

**COURSE OUTCOMES:**

After completion of the course, the students will be able to

1. Understand the fundamentals of Python programming language.
2. Create user defined functions to solve problems.
3. Manipulate the data structures lists, tuples and dictionaries.
4. Use NumPy and Pandas in solving problems.

**COURSE ARTICULATION MATRIX:**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	1	1	0	3	3	0	0	2	0	0	1	1
CO2	1	1	1	0	0	3	3	0	1	1	0	0	1	1
CO3	1	0	1	0	0	3	3	0	0	1	0	0	1	1
CO4	2	0	1	1	0	3	3	0	0	1	0	0	1	1

**UNIT I****TEXT BOOK-1, [CO:1] (12)**

**Basics of Python Programming:** Python Character set, Token, Python Core Data Type, The print() function, Assigning value to a variable, Multiple assignments, Writing simple programs in Python, the input() Function, Python inbuilt Functions: the ord and chr functions.

**Operators and Expressions:** Introduction, Operators and Expressions, Arithmetic operators, Operator precedence and Associativity, Changing Precedence and Associativity, Bit Wise operator, The compound Assignment operator.

**Decision making statements:** Introduction, Boolean operators, Decision making statements, Conditional Expressions.

**Loop Control Statements:** The while, range, for, Nested Loops, The break statement, The continue statement.

**UNIT II****TEXT BOOK-1, [CO: 2] (10)**

**Functions:** Introduction, Syntax and Basics of a Function, Use of a Function, parameters with Arguments in a Function, The local and Global scope of a variable, The return Statement, Recursive Functions.

**Strings and Files:** Introduction, the str class, Basic Inbuilt Python functions for String, the index[ ] Operator, Traversing a String, Immutable strings, String operators, String operations; **Files:** Need for File handling ,Text input and output, The seek() Function, Binary Files, Accessing and manipulating Files and Directories in a Disk.

### UNIT III

**TEXT BOOK-1, [CO:3] (12)**

**Lists:** Creating lists, Accessing the Elements of a List, Negative List indices, List slicing, Python inbuilt functions for Lists, List operator, List comprehensions, List methods, List and strings, splitting a string in List, Passing List to a function, returning List from a function

**Dictionaries and Tuples:** Need for Dictionaries, Basics of Dictionaries, creating a Dictionary, Adding and Replacing Values, retrieving values, Formatting Dictionaries, Deleting Items, Comparing Two Dictionaries, The Methods of Dictionary Class, Traversing Dictionaries, Nested Dictionaries, Simple Programs in Dictionaries, and Polynomials as Dictionaries; **Tuples:** Creating Tuple() Function, inbuilt function for Tuples, Indexing and Slicing Operations in Tuples, passing Arguments and Variable length Arguments in Tuples, Lists to Tuple, Traverse Tuples from a List, The zip() Function, inverse zip Function.

### UNIT IV

**TEXT BOOK-2, [CO4] (11)**

**NumPy:** The NumPy ndarray: A Multidimensional Array object; universal functions: Fast element-wise array functions; Array oriented Programming with Arrays, file i/o with arrays;

**Pandas:** Pandas Data structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Handling Missing Data, Hierarchical Indexing.

### Learning Resources:

#### Text Book:

1. Programming and Problem Solving with Python-Ashok Namdev Kamthane and Amit Ashok Kamthane , Tata McGraw Hill,2018
2. Python for Data Analysis,2<sup>nd</sup> Edition by Wes Mckinney Publisher(s):O'Reilly Media,Inc.,2017

#### Reference Books:

1. Beginning Python from novice to professional by Magnus Lie Hedland, 2<sup>nd</sup>Edition,2005
2. Programming in Python3–A complete introduction to the Python Language by Mark Summerfield, Pearson,2008
3. Learning Python by Mark Lutz, 5<sup>th</sup>Edition,O'Reilly,2013
4. Programming Python by Mark Lutz, 4<sup>th</sup>Edition,O'Reilly,2010

#### Web Resources:

<https://nptel.ac.in/courses/106106145>

[www.w3schools.com](http://www.w3schools.com)

<https://www.tutorialsteacher.com/python>

**JOEL11****GEOSPATIAL TECHNOLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Int</b>	<b>Ext</b>
<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>30</b>	<b>70</b>

**COURSE OBJECTIVES:**

1. To develop the fundamental concepts of GIS and Remote sensing including the, and nature of geospatial data.
2. To know about GIS and important terminologies in GIS.
3. To make the student to understand cartography and current trends in Geospatial technology.
4. To familiarize the students in the GIS based analytical and problem solving techniques for various applications.

**COURSE OUTCOMES:**

**After successful completion of the course, the students are able to**

1. Demonstrate the concepts of Remote Sensing and Image processing techniques.
2. Demonstrate the concepts of Cartography and GIS.
3. Understand the concepts of various trends in geospatial technology.
4. Understand geospatial applications in various fields.

**COURSE ARTICULATION MATRIX:**

PO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	0	2	0	1	0	0	0	0	0	3	1
CO2	2	2	2	0	3	0	1	0	0	0	0	0	3	2
CO3	2	2	2	0	2	0	1	0	0	0	0	0	2	1
CO4	2	2	2	1	2	2	2	0	0	0	0	0	3	1

**UNIT I****[Text Book 1] [CO1] (12)**

**Remote Sensing:** Introduction to Remote Sensing - Remote Sensing data acquisition – Types of Remote sensing - Microwave and Thermal Remote Sensing - Aerial Photography - Types of aerial photography – Stages involved in aerial photography - Aerial photo and its interpretation - Types of resolutions - Advantages and benefits of Remote Sensing. **Image processing:** Introduction - Elements of Visual Interpretation of satellite data.

**UNIT II****[Text Book 1] [CO2] (12)**

**Geographic Information System (GIS):** Introduction - Components of GIS - Geospatial database generation and organization - Types of GIS: Raster GIS and Vector GIS - Advantages and Disadvantages of Raster and Vector GIS - Spatial and attribute data - Linking spatial and attribute data - GIS Spatial data analysis: Overlay, Buffer and Network analysis. **Cartography:** Introduction - Map projection - Map coordinate system.

**UNIT III****[Text Book 1] [CO3] (12)**

**Trends in Geospatial Technology:** GPS Introduction – Types of GPS – NAVIC – Advantage and Limitation of GPS – Applications of GPS technology. UAV and its applications – LiDAR and its applications – Google Earth and its applications – Hyper spectral sensor - Artificial Intelligence and GIS. Data Base Management System (DBMS) in GIS - Web based GIS – Mobile GIS - Enterprise GIS - 3-D visualization and fly through model – Open GIS.

**UNIT IV****[Text Book 1] [CO4] (12)**

**Geospatial Applications:** GIS in Location based and business application – GIS in Water resource application - GIS in Disaster mitigation and management – GIS in transportation – GIS in city and infrastructure development – Health GIS – GIS in agriculture – GIS in security and defense studies – GIS in utility development.

**LEARNING RESOURCES:****TEXT BOOK(s):**

1. Text Book of Remote Sensing and Geographical Information systems by M.Anji Reddy, 4th Edition, B.S.Publications, 2012.

**REFERENCE BOOK(s):**

1. Text Book of Remote Sensing and Geographical Information systems by A M Chandra and S K Ghosh, Narosa Publishing House, 2019
2. Text Book of Remote Sensing and Geographical Information systems by Basudeb Bhatta, Oxford University Press, 2020
3. Advanced Surveying: Total Station, GIS and Remote Sensing Book by N. Madhu, R. Sathikumar, and Satheesh Gopi, Pearson Education India, 2006
4. Introduction to Geographic Information Systems by Kang-tsung Chang, McGraw-Hill, 2003
5. Basics of Remote sensing & GIS by S.Kumar, laxmi publications, 2016

**WEB RESOURCES:**

1. [https://en.wikipedia.org/wiki/Indian\\_Institute\\_of\\_Remote\\_Sensing](https://en.wikipedia.org/wiki/Indian_Institute_of_Remote_Sensing)
2. <http://nptel.ac.in/downloads/105108077/>
3. <http://nptel.ac.in/courses/105102015/28>



## Semester IV [Second Year]

**Course Objectives**

1. Identify the factors affecting building planning.
2. Study various aspects of a building.
3. Identify stipulated rules, regulations and laws framed by the Government.
4. Drawing various buildings as per government norms.

**Course Outcomes**

After successful completion of the course, students are able to

- 1 Summarize the fundamentals of building drawing.
- 2 Detail principles of building planning.
- 3 Explore building bye laws framed by the government.
- 4 Plan various buildings as per the government norms.

**Course Outcomes Mapping**

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	--	--	2	--	--	--	--	--	--	3	3
CO2	3	2	3	--	--	2	--	--	--	--	--	--	3	3
CO3	3		3	--	--	3	--	--	--	--	--	--	3	3
CO4	3		3	--	3	3	--	--	--	--	--	--	3	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO:1] (8)****FUNDAMENTALS OF BUILDING DRAWING**

Introduction to building drawing, Preparation of drawings, Interpretation of drawings, Building plans approval procedure as per NBC 2005, Classification of buildings, Site selection for residential buildings.

**CLIMATE AND ITS INFLUENCE ON BUILDING PLANNING**

Introduction, Elements of climate, Climatic zones of india, Earth and its motion, Directions and their characteristics, orientation of building, Factors affecting orientation, optimum orientation.

**UNIT II****[CO:2] (8)****PRINCIPLES OF PLANNING OF BUILDINGS**

Aspect, Prospect, Privacy, Internal privacy, External privacy, Furniture requirement, Drawing room, Dining table and dining chairs, Bed room, Kitchen, Roominess, Grouping, Circulation, Sanitation, Lighting, Ventilation, Cleanliness, Flexibility, Elegance, Economy, Practical considerations.

**UNIT III****[CO:3] (8)****BUILDING BYE-LAWS**

Introduction, Building bye-laws, Objectives of building bye-laws, Principles underlying building bye laws, Minimum plot sizes and building frontage, Open spaces, Minimum standard, imensions of building elements, Provisions for lighting and ventilation, Provisions for safety from, fire and explosions, Provisions for means

of access, Provisions for drainage and sanitation, Provisions for safety of works against hazards or accidents.

Requirements for off street parking, Requirements for green belt and landscaping, Special requirements for low income housing, Sizes of structural elements, Applicability of the bye-laws.

#### **UNIT IV**

**[CO:4] (20)**

Drawing of various buildings using AutoCAD software: A two BHK residential building, A three BHK residential building, An office building, Two storeyed duplex residential building, Plan of a secondary school, Primary health centre, Post office.

#### **LEARNING RESOURCES**

##### **Text book**

1. Building Planning and Drawing by Dr. N. Kumara Swamy, A. Kameswara Rao, Charotar Publishing House Pvt. Ltd., 2019.

##### **Reference book**

1. Building Planning and Drawing by M.V. Chitawadagi S.S. Bhavikatti, Dream tech press, 2019.
2. Building Planning and Drawing, M N Gangarde , S P Deshpande, 3<sup>rd</sup> Edition, Nirali Prakashan, 2022.

**JOEL13****QUANTITY ESTIMATION**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Int</b>	<b>Ext</b>
<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>30</b>	<b>70</b>

**COURSE OBJECTIVES:**

1. To estimate the quantities and cost of different works
2. To analyse the unit rate of different items of work.
3. To understand the organization of various engineering departments.

**COURSE OUTCOMES:**

**After successful completion of the course, the students are able to**

1. Estimate the quantities and cost of different items of work required for residential buildings and R.C.C structures.
2. Estimate the quantity and cost of earth work in roads and irrigation canals.
3. Determine the unit rate and specification of different items of work.
4. Understand the organization of various engineering departments.

**COURSE ARTICULATION MATRIX:**

CO \ PO	PO													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	0	0	0	0	0	0	2	0	2	1
CO2	1	2	0	1	0	0	0	0	0	0	2	0	2	2
CO3	0	1	0	0	0	0	0	0	0	0	0	0	2	2
CO4	0	0	0	0	0	0	0	0	2	0	2	0	2	1

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I [CO:1] (12)**

Procedure of Estimating: Methods of estimating; Main items of work; Deduction for openings; Degree of accuracy; Units of measurement. Methods of building estimates: Individual wall method; Centre line method; Arch masonry calculation; Estimate of steps. Estimate of Buildings: Estimate of residential building; Estimate of a building from line plan.

**UNIT II [CO:2] (12)**

Estimate of RCC works: Standard hooks and cranks; Estimate of RCC slab; RCC beam; and RCC column with foundation. Road Estimating: Estimate of earthwork; Estimate of pitching of slopes; Estimate of earthwork of road from longitudinal sections; Estimate of earthwork in hill roads. Canal estimate: Earthwork in canals—different cases; Estimate of earthwork in irrigation channels.

**UNIT III [CO:3] (12)**

Specifications: Purpose and method of writing specifications; General specifications. Detailed Specifications for Brick work; R.C.C; Plastering; Mosaic Flooring; R.R.Stone Masonry. Analysis of Rates: Task or out – turn work; Labour and materials required for different works; Rates of materials and labour; Preparing analysis of rates for the following items of work: i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing.

**UNIT IV [CO:4] (12)**

PWD Accounts and Procedure of Works: Organization of Engineering department; Work charged establishment; Contract; Tender; Tender notice; Tender Schedule; Earnest money; Security money; Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area; Carpet area; Approximate Estimate; Plinth area estimate; Revised Estimate; Supplementary estimate.

**LEARNING RESOURCES**

**TEXT BOOK(s):**

1. Estimating & Costing in Civil Engineering by B.N. Dutta; 28<sup>th</sup> Edition, CBS Publishers & Distributors Private Limited, 2020.

**REFERENCE BOOK(s):**

1. Practical information for Quantity Surveyors, Contract Managers, Architects Engineers & Builders by P.T. Joglekhar, Marathi Prakasan Publishers, 2017.
2. Estimating, costing and specification in Civil Engineering by M.Chakraborti, Chakraborti publishers, 2006.

**JOEL23****VALUATION OF PROPERTY****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVES:**

1. To understand the definition of property and it's valuation.
2. To learn methods of valuation.
3. To learn the applications of valuation.
4. To understand the appraisal methodology.

**COURSE OUTCOMES:**

After successful completion of the course, students are able to

1. Understand the definition of property and it's valuation.
2. Categorize the methods of valuation.
3. Explore the applications of valuation.
4. Appraise the property on various bases.

**COURSE ARTICULATION MATRIX CO-PO-PSO**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	2	2	3	-	2	2	-	3	-
CO2	3	3	-	-	-	2	2	3	-	2	2	-	3	-
CO3	3	3	-	-	-	2	2	3	-	2	2	-	3	-
CO4	3	3	-	-	-	2	2	3	-	2	2	-	3	-

Slightly correlated: 1;

Moderately correlated: 2;

Substantially correlated: 3

**UNIT-I****[CO:1] (10)**

**Property Valuation:** Introduction, The need for valuations, Types of property to be valued, Bases of value, Determinants of value, Property-specific factors, Market-related factors, Valuation procedures, Terms of engagement, Inspections and investigations, Valuation report, Measurement, Inspection checklist.

**Valuation Mathematics:** Introduction, The time value of money, Single period investments, Multi-period investments, Yields and rates of return.

**UNIT-II****[CO:2] (10)**

**Valuation Methods:** Comparison Method, Investment Method, Profits Method, Replacement Cost Method, Residual Method.

**UNIT-III****[CO:3] (10)****Valuation Applications**

Lease Pricing: Lease incentives, Rent-free periods, Capital contributions, Premiums and reverse premiums, Alternative lease arrangements, Stepped rents, Turnover rents, Short leases and leases with break options, Valuations at rent review, lease renewal and lease end, Rent reviews, Surrender and renewal of leases, Compensation for disturbance and improvements.

Valuations for Financial Statements and for Secured Lending Purposes, Valuations for Taxation Purposes, Valuations for Compulsory Purchase and Compensation, Specialist Valuations, Investment Valuations.

#### **UNIT-IV**

##### **Appraisal**

**[CO:4] (10)**

**Investment Appraisal:** Introduction, Appraisal information and assumptions, Rent and rental growth, Target rate of return, Holding period, Exit value, Appraisal methodology, Payback method, Yield, DCF methods of investment appraisal, Risk analysis in property investment appraisal, Financing property investment.

**Development Appraisal:** Introduction, Conventional residual profit appraisal, Profit as a percentage of cost, Development yield, Criticisms.

#### **LEARNING RESOURCES**

##### **TEXT BOOK(s):**

1. Property Valuation by Peter Wyatt, Second Edition, A John Wiley & Sons, Ltd., Publication, 2013.

##### **REFERENCE BOOK(s):**

1. Valuation of real properties by Datta, S. Eastern Law House, New Delhi, 2004.
2. Introducing Property Valuation, Michael Blackledge, Routledge publishers, ISBN 0-203-87617-2, 2009.
3. Valuation of real properties by Rangwala. S, Charotar Publishing House Anand, New Delhi, 2003.
4. Property valuation methodology by Dominique Fischer, Black swan press, ISBN 1740672151, 2002.

**CEH41                      GROUNDWATER DEVELOPMENT AND MANAGEMENT                      L T P C Int Ext**  
**3 - - 3 30 70**

**COURSE OBJECTIVES:**

Following are the course objectives

1. To introduce terms connected to groundwater and basic concepts of movement of water.
2. To impart knowledge on steady radial flow of wells.
3. To explore various techniques of surface and subsurface investigations of groundwater.
4. To introduce the concepts of saline water intrusion.

**COURSE OUTCOMES:**

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

1. Explain origin, occurrence and movement of groundwater.
2. Analyse steady and un-steady radial flow into a well.
3. Apply surface & sub-surface exploration methods and selection of suitable method of artificial recharge.
4. Analyse sea water intrusion problems.

**COURSE ARTICULATION MATRIX CO-PO-PSO**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	3
CO4	2	3	2	-	-	-	-	-	-	-	-	-	3	2

Slightly correlated: 1;      Moderately correlated: 2;      Substantially correlated: 3

**UNIT I****[CO:1] (12)**

**Introduction:** Groundwater Occurrence, Groundwater hydrologic cycle, origin of groundwater, rock properties effecting groundwater, vertical distribution of groundwater, zone of aeration and zone of saturation, geologic formation as aquifers, types of aquifers, porosity, specific yield and specific retention. Groundwater Movement: Permeability, Darcy's law, storage coefficient, transmissivity, differential equation governing groundwater flow in three dimensions derivation, Groundwater flow contours and their applications.

**UNIT II****[CO:2] (12)**

**Steady Radial Flow:** Steady flow towards a well in confined and unconfined aquifers – Dupit's and Theim's equations, Assumptions, Formation constants, yield of an open well and well tests.

**Unsteady Radial Flow:** Unsteady flow towards a well – Non equilibrium equations – Theis solution – Jacob and Chow's simplifications, Leaky aquifers.

**UNIT III**

**[CO:3] (12)**

**Surface and Subsurface Investigation:** Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging.

**Artificial Recharge of Groundwater:** Concept of artificial recharge – recharge methods, relative merits.

**UNIT IV**

**[CO:4] (12)**

**Saline Water Intrusion in aquifer:** Occurrence of saline water intrusions, Ghyben-Herzberg relation, Shape of interface, control of seawater intrusion.

**LEARNING RESOURCES**

**TEXT BOOK(s)**

1. Groundwater by H.M. Raghunath, New Age International, 2008.
2. Groundwater Hydrology by David Keith Todd, John Wiley & Sons, 1980

**REFERENCE BOOK(s)**

1. Fundamentals of Groundwater by Franklin W. Schwartz and Hubao Zhang, Wiley India Pvt.Ltd.,2012.
2. Groundwater System Planning & Management by R. Willis & W.W.G. Yeh, Printice Hall,1987.



**CEH42****EXPERIMENTAL STRESS ANALYSIS****L T P C Int Ext****4 - - 3 30 70****COURSE OBJECTIVES:**

Following are the course objectives

1. Identify various strain gauges.
2. Learn methods to measure strain.
3. Understand the concepts of photo elasticity.
4. Understand the concepts of modal analysis.

**COURSE OUTCOMES:**

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

1. Describe strain gauges.
2. Measure strain using electrical resistance strain gauges.
3. Determine stresses using photoelasticity.
4. Describe modal analysis of structures.

**COURSE ARTICULATION MATRIX CO-PO-PSO**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	1
CO2	3	3	2	3	-	-	-	-	-	-	-	-	3	1
CO3	3	3	2	3	-	-	-	-	-	-	-	-	3	1
CO4	3	2	2	3	-	-	-	-	-	-	-	-	3	1

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****Text Book-1 [CO:1] (12)**

**Introduction to Strain Measurements:** Experimental determination of strain; Properties of strain gage systems; Types of strain gages.

**UNIT II****Text Book-1 [CO:2] (12)**

**Strain Measurement using Electrical Resistance Strain Gages:** Introduction; Strain sensitivity in metallic alloys; Gage construction; Strain gage adhesives and moulding methods; Gage sensitivities and gauge factor; The Wheatstone bridge; Wheatstone bridge sensitivity; Temperature compensation ; Static recording and data logging – Manual strain indicators, Automatic data acquisition systems, PC based data acquisition systems; Strain analysis methods –Three element rectangular rosette.

**UNIT III****Text Book-1 [CO:3] (12)**

Stress analysis using Photoelasticity Wave theory of light; Refraction of light; The Polariscopes – Plane polarisers, wave plates; Plane polariscopes; Circular polariscopes; Diffused light polariscopes; The stress optic law for two-dimensional plane-stress bodies; Two-dimensional photoelastic

stress analysis – Isochromatic fringe patterns, Isoclinic fringe patterns, Calibration methods, Principal stress separation methods, Scaling model-to-prototype stresses; Materials for two dimensional photo elasticity.

#### **UNIT IV**

**Text Book-2 [CO:4] (12)**

**Model analysis of Structures:** Introduction – Objectives of structural model studies, Some basic definitions, Types of similitude , Classification of model studies, Model materials, Size effects; Principles of similitude – Dimensional analysis, Buckingham  $\pi$  Theorem, Variables in structural behaviour; Requirements of similitude; Direct approach

#### **LEARNING RESOURCES**

##### **TEXT BOOK(s)**

1. Experimental Stress Analysis by Dally and Riley, McGraw-Hill, 1991.
2. Model analysis of Structures by T.P.Ganesan, Universities Press, 2000.

##### **REFERENCE BOOK(s)**

1. Experimental stress analysis by Sadhu Singh, Khanna Publishers, 2014.

**CEH43****GEOSPATIAL TECHNOLOGY APPLICATIONS****L T P C Int Ext****3 - - 3 30 70****COURSE OBJECTIVE:**

1. To enable the students to understand and apply remote sensing and GIS techniques in various fields of water resource management.
2. To permit the students to understand and apply remote sensing and GIS techniques in various fields of Disaster and calamities.
3. To allow the students to understand and apply remote sensing and GIS techniques in various fields of facility management.
4. To allow the students to understand and apply remote sensing and GIS techniques in various fields of environmental, agriculture and soil.

**COURSE OUTCOMES:**

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

1. Analyze water resource management studies by using RS and GIS tools.
2. Develop the knowledge on disaster and analysis the disaster zones by RS and GIS tools.
3. Discover their knowledge on facility management by using Remote Sensing and GIS.
4. Improve the evaluation of land capability for better land use planning and analyze crops and soils by using Remote Sensing and GIS tools.

**Mapping of COs with POs and PSOs**

Course Outcomes	Bloom' s Level	Program Outcomes												Program Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	4	3	3	3	2	3	2	2	-	1	-	-	2	3	2
<b>CO2</b>	6	3	2	3	2	3	3	3	1	1	-	-	2	3	2
<b>CO3</b>	3	3	3	3	2	3	3	3	-	1	-	-	2	3	2
<b>CO4</b>	6	3	3	3	2	3	3	3	-	1	-	-	2	3	2

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[Text Book 1] [CO1] (12)**

**WATER RESOURCES:** Introduction – Importance – Ground water prospect zones mapping, groundwater potential assessment and groundwater information system - Water quality monitoring – Groundwater development and management. Basin, surface runoff, slope analysis, application of DEM in water resources, flood mapping. Watershed management - Artificial recharge zone identification – use of DEM in recharge.

**UNIT II****[Text Book 1] [CO2] (12)**

**DISASTER MANAGEMENT:** Important terms and definitions – Vulnerability – Hazard – Risk Assessment. Types of disaster Natural and manmade: Cyclone, flood, land slide, land subsidence, fire and earthquake - Issues and concern for various causes of disasters - Preparedness, Management and mitigation measures for various disaster. Rehabilitation programs.

**UNIT III****[Text Book 1] [CO3] (12)**

**AGRICULTURE:** Significance of agriculture – Growth and development - Problems – Types of agriculture - Spectral Characteristics of Crop - Site-Suitability analysis for agriculture – Agriculture information system – Land holdings – Irrigation, land use, land reforms - Use of RS and GIS in precision farming – Relevance to Indian agriculture.

**UNIT IV****[Text Book 1] [CO4] (12)**

**URBAN AND RURAL DEVELOPMENT:** Introduction – Concepts - Urban problems: Pollution, slum, housing and social well being – Urban Planning - Infrastructure demand analysis – Utility management – Solid waste management –case studies. Concepts of rural development – Use of RS and GIS for rural development – Use of RS and GIS for socio economic information analysis. Application of RS and GIS in rural problem solving situation – Village information system and planning – Case study

**LEARNING RESOURCES****TEXT BOOKS:**

1. Text Book of Remote Sensing and Geographical Information systems by Basudeb Bhatta, Oxford University Press, 2020.

**REFERENCE BOOKS:**

1. Text Book of Remote Sensing and Geographical Information systems by M.Anji Reddy, 4th Edition, B.S.Publications, 2012.
2. Introduction to Geographic Information Systems by Kang- tsung Chang, McGraw-Hill, 2003.
3. Basics of Remote sensing & GIS by S.Kumar, laxmi publications, 2016.
4. Text Book of Remote Sensing and Geographical Information systems by A M Chandra and S K Ghosh, Narosa Publishing House, 2019
5. Advanced Surveying: Total Station, GIS and Remote Sensing Book by N.Madhu, R. Sathikumar, and Satheesh Gopi, Pearson Education India, 2006.

**WEB REFERENCES:**

1. [https://en.wikipedia.org/wiki/Indian\\_Institute\\_of\\_Remote\\_Sensing](https://en.wikipedia.org/wiki/Indian_Institute_of_Remote_Sensing)
2. <http://notel.ac.in/downloads/105108077/>
3. <http://nptel.ac.in/courses/105102015/28>

**CEH44 GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES** L T P C Int Ext  
3 - - 3 30 70

**COURSE OBJECTIVES:**

Following are the course objectives

1. To know the various types of geosynthetics, their functions and applications.
2. Understand the history and mechanism of reinforced soil
3. To enable the design of Reinforced Earth Retaining Walls, Reinforced Soil Beds, Reinforced Pavements

**COURSE OUTCOMES:**

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

1. Know about various types of geosynthetics and their functions
2. Understand the history and mechanism of reinforced soil
3. Design of Reinforced Earth Retaining Walls and Reinforced Soil embankments,
4. Design of Reinforced Soil Beds, and Reinforced pavements

**COURSE ARTICULATION MATRIX CO-PO-PSO**

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	2	3
CO2	3	2	2	1	-	-	-	-	-	-	-	-	2	3
CO3	3	2	-	1	-	-	-	-	-	-	-	-	2	3
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	3

Slightly correlated: 1; Moderately correlated: 2; Substantially correlated: 3

**UNIT I****[CO: 1] (12)****Geosynthetics:**

Types, Functions, Tests on Geosynthetics, Durability aspects, Applications

**UNIT II****[CO: 2] (10)****Reinforced Earth:**

Mechanism of reinforced soil, factors affecting behaviour and performance, soil - reinforcement interactions, Design of spacing and layout, Materials and material properties.

**UNIT III****[CO: 3] (12)**

**Reinforced Earth Retaining Walls:** Introduction, Stability Mechanisms, Design of Reinforced Earth Retaining Wall, Advantages over conventional Retaining Walls;

**Reinforced Embankments:**

Introduction, Design of Reinforced Embankment, Foundation mattress below the embankment, Design of Reinforced Mattress.

**UNIT IV**

**[CO: 4] (11)**

**Reinforced Soil Beds:** Introduction, Factors affecting the Behaviour of Reinforced Soil Beds, Analysis and Design.

**Reinforced Pavements:** Benefits of placing reinforcement in flexible pavement layers, design of reinforced pavements by Giroud and Noiray approach and modified CBR Method.

**LEARNING RESOURCES:**

**TEXT BOOK(s):**

1. An Introduction to Soil Reinforcement and Geosynthetics by G.L. Siva Kumar Babu, University Press.

**REFERENCE BOOK(s):**

1. Designing with Geosynthetics by Robert M Koerner.
2. Advances in Geosynthetics by G. Venkatapparao, Sai Master Geoenvironmental Services Pvt. Ltd. Publications.