Annexure - C

S.A.ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Veeraraghavapuram, Thiruverkadu post, Chennai-600077

Curriculum and Syllabi

Bachelor of Engineering
Civil Engineering

Regulation – 2020A
Choice Based Credit System (CBCS)

B.E CIVIL ENGINEERING
REGULATION 2020A

VISION OF THE DEPARTMENT

To provide a wholesome knowledge and skills among civil engineering students for complete contribution to fulfill the changing industrial and research requirements, multi-disciplinary collaboration and to become the acknowledged leader with professional commitment and integrity.

MISSION OF THE DEPARTMENT

1. To provide a platform of inspirational features for creating leadership and innovativeness in students technical advancements.
2. To impart essential skills to the student and enhance their employable strengths and entrepreneurial capabilities.
3. To educate the student in solving problems related to interdisciplinary fields.
4. To nurture emerging skills with societal interests to act professionally and ethically.
5. To extend engineering expertise through creative projects and research driven for promoting consultancy in a sustainable environmental friendly system.
6. To use updated Engineering technology and appropriate pedagogical methodologies and techniques for modeling, analyzing and designing solutions for complex challenges.

Program Educational Objectives (PEO)

1. Our graduates will have fundamental technical knowledge in their domain and contribute to the development of various disciplines of civil engineering such as Structural Engineering, Construction management, Environmental Engineering for wholesome education.
2. Our graduates will apply the fundamentals of Science (Mathematics, Physics and Chemistry) in Engineering and capable of teaming with multi-disciplinary professionals to analyze, design and execute projects in the field for the solution of emerging technical problems.
3. Our graduates will exhibit effective communication, leadership, problem solving, and decision making skills by understanding contemporary issues and contribute to overall personality and career development.

4. Our graduates will be proficient in academics and eligible for further specializations in their core of interest, and involve in research and development for futuristic approaches.
5. Our graduates shall ensure sustainable development through consistent learning capabilities and social consciousness.

PROGRAMME SPECIFIC OBJECTIVES (PSOs):

1. To provide graduates with sound fundamental knowledge to design solutions for complex Civil Engineering problems
2. To bring about an effective teaching – learning techniques, for student's contribution for sustainable infrastructure development.
3. To provide a suitable academic environment for the students with a strong ethical attitude and societal responsibility.
4. To prepare graduates as a part of a successful Organization or as Entrepreneurs with evolving trends and technologies.

PROGRAMME OUTCOMES (POs)

1. Graduates will demonstrate high level of fundamental knowledge in mathematics, science, Engineering fundamentals.
2. Graduates will demonstrate the ability to design, solve, and analyze complex problems in Civil Engineering.
3. Graduates will have the ability to design components or processes that meet the specified needs with appropriate consideration for the public health and safety.
4. Graduates will have the ability to identify, formulate and design experimental analysis to provide valid conclusions related to environmental problems.
5. Graduates will demonstrate an understanding of their professional and ethical responsibilities.
6. Graduates will be able to create appropriate techniques, resources with modern engineering tools such as CAD, FEM and GIS including pre decision making aspects and modeling for complex Civil Engineering activities with an understanding of the limitations.
7. Graduates will have the confidence to apply engineering solutions in view of current societal, national and global scenarios.

8. Graduates will be capable of demonstrating the knowledge of need for sustainable development with environmental friendliness.
9. Graduates will be broadly educated and equipped to have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.
10. Graduates will be familiar with modern engineering software tools and equipment to analyze Civil engineering problems.
11. Graduates will possess right attitude to become leader in diverse teams to manage civil Engineering projects and also functioning in multidisciplinary environments.
12. Graduates will be able to prepare themselves to engage in independent and updated knowledge gaining in the broadest context of technological changes.

CHOICE BASED CREDIT SYSTEM
I - VIII SEMESTER CURRICULA

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	HS1101A	Technical English	HS	3	0	0	3
2	MA1101A	Calculus And Its Applications	BS	3	1	0	4
3	PH1101A	Applied Physics	BS	3	0	0	3
4	CY1101A	Engineering Chemistry	BS	3	0	0	3
5	CS1101A	Problem Solving and Python Programming	ES	3	0	0	3
6	ME1101A	Engineering Graphics	ES	2	0	2	3
PRACTICAL							
7	BS1101A	Physics and Chemistry Laboratory	BS	0	0	4	2
8	CS1102A	Problem Solving and Python Programming Laboratory	ES	0	0	4	2
MANDATORY COURSE							
9	CI1101A	Indian Constitution	MC	2	0	0	0
10	FL0001A	French/Japanese	MC	2	0	0	0
TOTAL				**21**	**1**	**10**	**23**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	HS1201A	English for Communication	HS	3	0	0	3
2	MA1201A	Complex Variables And Transforms	BS	3	1	0	4
3	PH1201A	Materials Science	BS	3	0	0	3
4	EE1201A	Basic Electrical and Electronics Engineering	ES	3	0	0	3
5	CE1201A	Engineering Mechanics	ES	3	1	0	3
PRACTICAL							
6	GE1201A	Engineering Practices Laboratory	ES	0	0	4	2
7	EE1204A	Basic Electrical and Electronics Laboratory	ES	0	0	4	2
MANDATORY COURSE							
8	CY1201A	Environmental Science And Engineering	MC	2	0	0	0
TOTAL				**17**	**2**	**8**	**20**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	MA1302A	Transforms and Partial Differential Equations	BS	3	1	0	4
2	CE1301A	Strength of Materials –I	PC	2	1	0	3
3	CE1302A	Mechanics of Fluids	PC	2	1	0	3
4	CE1303A	Surveying	PC	3	0	0	3
5	CE1304A	Engineering Geology	ES	3	0	0	3
PRACTICAL							
6	CE1305A	Computer Aided Building Drawing	PC	0	0	4	2
7	CE1306A	Surveying Laboratory	PC	0	0	4	2
8	HS1301A	Interpersonal Skills Laboratory	EEC	0	0	2	1
TOTAL				**13**	**3**	**10**	**21**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	MA1402A	Numerical Methods	BS	3	1	0	4
2	CE1401A	Strength of materials–II	PC	2	1	0	3
3	CE1402A	Applied Hydraulic Engineering	PC	2	1	0	3
4	CE1403A	Construction Materials, Techniques and Practices	PC	3	0	0	3
5	HV1401A	Universal Human Values	PC	3	0	0	3
6		Professional Elective - I	PE	3	0	0	3
PRACTICAL							
7	CE1404A	Strength of Materials Laboratory	PC	0	0	4	2
8	CE1405A	Hydraulic Engineering Laboratory	PC	0	0	4	2
9	HS1401A	Employability and Soft Skills Laboratory	EEC	0	0	2	1
TOTAL				**16**	**3**	**10**	**24**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1501A	Design of Reinforced Concrete Elements I	PC	3	1	0	4
2	CE1502A	Structural Analysis – I	PC	2	1	0	3
3	CE1503A	Water Supply Engineering	PC	3	0	0	3
4	CE1504A	Soil Mechanics	PC	3	0	0	3
5		Professional Elective – II	PE	3	0	0	3
6		Open Elective – I	OE	3	0	0	3
		NPTEL (Any one 6^{th} Semester Paper, CBCS)					
PRACTICAL							
7	CE1505A	Soil Mechanics Laboratory	PC	0	0	4	2
8	CE1506A	Concrete and Highway Engineering Laboratory	PC	0	0	4	2
9	CE1507A	Survey Camp (2 Weeks during IV Semester Summer)	EEC	0	0	2	1
TOTAL				**17**	**2**	**10**	**24**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1601A	Design of Reinforced Concrete Elements II	PC	3	1	0	4
2	CE1602A	Structural Analysis – II	PC	2	1	0	3
3	CE1603A	Wastewater Engineering	PC	3	0	0	3
4	CE1604A	Foundation Engineering	PC	3	0	0	3
5	CE1605A	Transportation Engineering – I	PC	3	0	0	3
6		Professional Elective – III	PE	3	0	0	3
PRACTICAL							
7	CE1606A	Structural Design and Detailing Laboratory	PC	0	0	4	2
8	CE1607A	Water and Wastewater Analysis Laboratory	PC	0	0	4	2
TOTAL				**17**	**2**	**8**	**23**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1701A	Estimation Costing and Valuation Engineering	PC	3	0	0	3
2	CE1702A	Design of Steel Structures	PC	3	0	0	3
3	CE1703A	Transportation Engineering – II	PC	3	0	0	3
4	CE1704A	Hydrology and Water Resources Engineering	PC	3	0	0	3
5		Professional Elective – IV	PE	3	0	0	3
6		Open Elective –II	OE	3	0	0	3
PRACTICAL							
5	CE1705A	Creative and Innovative Project (Activity based)	EEC	0	0	4	2
6	CE1706A	Industrial Training (4 Weeks during VI Semester – Summer)	EEC	0	0	4	2
TOTAL				**18**	**0**	**8**	**22**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1		Professional Elective – V	PE	3	0	0	3
2		Professional Elective – VI	PE	3	0	0	3
PRACTICAL							
5	CE1801A	Project Work	EEC	0	0	20	10
TOTAL				**06**	**0**	**20**	**16**

PROFESSIONAL ELECTIVE

ELECTIVE - I

SEMESTER – IV

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1407A	Basics of Remote Sensing and GIS	PE	3	0	0	3
2	CE1408A	Geo-Informatics Application for Civil Engineering	PE	3	0	0	3
3	CE1409A	Disaster Management	PE	3	0	0	3
4	CE1410A	Digital Cadastre	PE	3	0	0	3
5	CE1411A	Advanced Surveying	PE	3	0	0	3

ELECTIVE - II

SEMESTER –V

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1511A	Construction Planning and Scheduling	PE	3	0	0	3
2	CE1512A	Air pollution and Control Engineering	PE	3	0	0	3
3	CE1513A	Concrete Technology	PE	3	0	0	3
4	CE1514A	Intellectual Property Rights	PE	3	0	0	3
5	CE1515A	Form Work Engineering	PE	3	0	0	3

ELECTIVE - III

SEMESTER – VI

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1611A	Urban Planning and Development	PE	3	0	0	3
2	CE1612A	Tall Structures	PE	3	0	0	3
3	CE1613A	Ground Improvement Techniques	PE	3	0	0	3
4	CE1614A	Industrial Structures	PE	3	0	0	3
5	CE1615A	Environmental Impact Assessment	PE	3	0	0	3

ELECTIVE - IV
SEMESTER – VII

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1711A	Prestressed Concrete Structures	PE	3	0	0	3
2	CE1712A	Safety in Construction	PE	3	0	0	3
3	CE1713A	Traffic Engineering Management	PE	3	0	0	3
4	CE1714A	Disaster Management	PE	3	0	0	3
5	CE1715A	Irrigation Engineering and Management	PE	3	0	0	3

ELECTIVE - V
SEMESTER – VIII

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1811A	Electronic Waste Management	PE	3	0	0	3
2	CE1812A	Costal Engineering	PE	3	0	0	3
3	CE1813A	Groundwater Engineering	PE	3	0	0	3
4	CE1814A	Integrated Water Resources Management	PE	3	0	0	3
5	GE1801A	Professional Ethics in Engineering	PE	3	0	0	3

ELECTIVE - VI
SEMESTER – VIII

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	CE1821A	Prefabricated Structures	PE	3	0	0	3
2	CE1822A	Maintenance, Repair and Rehabilitation of Structures	PE	3	0	0	3
3	CE1823A	Structural Dynamics and Earthquake Engineering	PE	3	0	0	3
4	CE1824A	Bridge Engineering	PE	3	0	0	3
5	CE1825A	Sustainable and Lean Construction	PE	3	0	0	3

OPEN ELECTIVE OFFERED BY CIVIL ENGINEERING

OPEN ELECTIVE - I
SEMESTER – V

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	OCE501A	Geographical Information System	OE	3	0	0	3
2	OCE502A	Remote Sensing and GIS Techniques	OE	3	0	0	3
3	OCE503A	Air and Noise Pollution	OE	3	0	0	3
4	OCE504A	Pollution Control and Monitoring	OE	3	0	0	3
5	OCE505A	Environmental and Social Impact Assessment	OE	3	0	0	3

OPEN ELECTIVE - II
SEMESTER – VII

S.No	COURSE CODE	COURSE TITLE	CATE GORY	L	T	P	C
THEORY							
1	OCE701A	Hazardous Waste Management	OE	3	0	0	3
2	OCE702A	Green Building and Technologies	OE	3	0	0	3
3	OCE703A	Testing of Materials	OE	3	0	0	3

SEMESTER I

HS1101A	TECHNICAL ENGLISH	L	T	P	C
		3	0	0	3

PREREQUISITES: Basic Language Proficiency.

OBJECTIVES:

1. Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
2. Nurture their ability in technical writing like to prepare professional job applications and effective reports.
3. Develop their speaking skills by participating in various speaking activities.
4. Strengthen their listening skill to comprehend lectures and talks in their areas of specialization.
5. Improve their ability to explicit their excellence in all modes of technical communication.

UNIT I **9**

Reading- Reading short texts; **Listening**- Listening to different formal / informal conversations; **Writing** Instructions, Jumbled sentences; **Speaking**- Self introduction; **Language development**- Parts of speech, Prepositions; **Vocabulary development**- Word formation- root words from foreign language and their use in English.

UNIT II **9**

Reading-Skimming and Scanning to find specific information; **Listening**- Listening to INK talks; **Writing**Job Application – cover letter, resume writing; **Speaking**- Asking and Giving directions **Language development**- Conjunctions, Types of Nouns; **Vocabulary development**- Prefixes and Suffixes.

UNIT III **9**

Reading- Reading for predicting the contentL; **Listening**- Listening to situational short talks; **Writing**-Types of paragraphs- Descriptive/Analytical/ compare and contrast; **Speaking**- Mini presentations, Expressing greeting and thanks; **Language development**- Adjectives, Numerical Adjectives, Conditional Clauses; **Vocabulary development**- Homophones, Homonyms.

UNIT IV **9**

Reading- Practice in speed reading;**Listening**- Listening to short texts and fill the data **Writing**- Interpretation of Graphics / Information, Note making **Speaking**-Contributing for Group Discussion; **Language development**- Active, Passive, Impersonal passive voice; **Vocabulary development**-Definitions, Nominal Compounds.

UNIT V **9**

Reading- Reading short stories; **Listening**- Listening for note taking; **Writing**- Report writing, E-mail Writing; **Speaking**- Picture descriptions, Speaking in familiar situations; **Language development**- Tenses; **Vocabulary development**- British and American Vocabulary.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The Students will be able to

1. Read technical texts and write area- specific texts effortlessly.
2. Listen and comprehend lectures and talks in their area of specialization successfully.
3. Speak appropriately and effectively in varied formal and informal contexts.
4. Write correctly, clearly and concisely with coherence and cohesion.
5. Prepare job applications and resume in an inspiring manner.

Text Books

1. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.
2. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.

Extensive Reading

1. Khera, Shiv. You can Win, Macmillan, 2000.

Reference

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York:Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
3. Darlene Smith-Worthington, Sue Jefferson, Technical writing for Success, South-Western Cengage Learning,USA-2011
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice.Oxford University Press: New Delhi, 2014
6. Swan Michael, Practical English Usage. Oxford University Press, Eighth impression 2002.

Recommended Websites

1. bbc.co.uk/1learning English
2. oxfordonlineenglish.com/
3. cambridgeenglish.org
4. inktalks.com/talks/
5. manageyourwriting.com

MA1101A	**CALCULUS AND ITS APPLICATIONS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

1. To understand the concepts of limits, continuity, differentiation and use it to find maxima and minima of functions of one variable.

2. To make the student acquire sound knowledge of techniques in solving ordinary differential
   equations of first and second order that model in various engineering problems.
3. To familiarize the student with functions of several variables that is needed in many branches of engineering.
4. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS 9+3

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules – Maxima and Minima of functions of one variable.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER WITH APPLICATIONS 9+3

Basic concepts- Separable differential equations - Exact differential equations - Integrating factors -Linear differential equations - Bernoulli's equation - Geometric Applications- Orthogonal trajectories -Physical Applications - Simple electronic circuits-Newton law of cooling-Heat flow-Rate of decay of mradioactive materials-Chemical reaction and solutions.

UNIT III DIFFERENTIAL EQUATIONS 9+3

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients - Method of undetermined coefficients.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V MULTIPLE INTEGRALS 9+3

Double integrals – Change of order of integration – Double integrals in polar co-ordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL PERIODS:60

OUTCOMES:

1. After completing this course, students should demonstrate competency in the following skills
2. Use both the limit definition and rules of differentiation to differentiate functions. apply differentiation to solve maxima and minima problems.
3. The subject helps the students to develop the fundamentals and basic concepts in ODE
4. Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.

TEXTBOOKS:

1. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, Inc., 2016.

REFERENCE BOOKS:

1. Bali,N.P.,Goyal,M.,Watkins,C.,Advanced Engineering Mathematics,Laxmi Publications Pvt. Limited, 2007.
2. Boyce,W.E.,and DiPrima,R.C.,Elementary Differential Equationsand Boundary Value Problems, Wiley India, 2012.
3. O'Neil. P. V., "Advanced Engineering Mathematics", 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
4. T.Veerarajan , Engineering Mathematics , Mc Grawhill Publications , New Delhi 2017.

PH1101A	**APPLIED PHYSICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity- plasticity – Different Types of Stress and Strain- concept of stress-strain diagram and its application - three types of modulus of elasticity- Poisson's Ratio – Bending of beams- Expression for bending moment –- young's modulus uniform and Non uniform bending : Theory and Experiment – I Shape girders – **Torsional oscillation Theory and Experiment-** Application of Elastic Materials.

UNIT II APPLIED OPTICS 9

Laser : characteristics of laser - Principle of spontaneous emission and stimulated emission – Laser action – Einstein A & B coefficients - Population inversion - Pumping – Basic requirement of laser – Types oflaser : Nd-YAG and CO2 – Applications : Welding , Drilling & Cutting – Medical field **Fiber optics**: **Introduction**- Principle and propagation of light – Numerical aperture and acceptance angle – classification of optical fibers – **Losses in optical fibers(Qualitative) –** Fiber optics communication system (Block Diagram) – Advantages with fiber optic communication system.

UNIT III THERMAL PHYSICS 9

Modes of heat transfer- thermal conduction, convection and radiation – Specific heat capacity- thermal conductivity- Newton's law of cooling - **Searle's** and Lee's disc methods: theory and experiment - conduction through compound media (series and parallel) – **thermal expansion of solids, liquids and gases** - Applications: heat exchangers, refrigerators and solar water heaters.

UNIT IV WAVE AND PARTICLE PHYSICS 9

Inadequacy of Classical Mechanics - Development of quantum theory- **Planck's Black body radiation and Distribution Laws(Qualitative) – Compton Effect (Derivation)** - De Broglie wavelength – properties of matter waves – Experimental Verification (G.P Thomson experiment) – Heisenberg's uncertainty principle - Schrodinger's wave equation – time dependent – time independent wave equations – physical significance of Wave function – applications: particle in a one dimensional potential box.

UNIT V CRYSTALOGRAPHY 9

Single crystalline, polycrystalline and amorphous materials Lattice - unit cell- Crystal systems- Bravais lattices- Lattice planes- Miller indices- Interplanar- d- Spacing in cubic Lattice- calculation of number of atoms per unit cell – atomic radius – packing factor for SC, BCC, FCC and HCP structures- **Crystal Defects – types.**

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course,

1. The students will gain knowledge on the basics of properties of matter and its applications
2. Use the concepts of waves and optical devices and their applications in Laser and fiber optics
3. The students will understand the properties of thermal materials and its applications
4. The students will get knowledge on advanced physics concepts of quantum theory and its application in one dimensional box.
5. The students will understand the different types of crystals structures and different crystal growth techniques.

TEXT BOOKS :

1. Gupta S.L. and Sanjeev Gupta, Modern Engineering Physics , Dhanpat Rai Publishers, 2015.
2. R. K. Gaur and S.C. Gupta, Engineering Physics, Dhanpat Rai Publication (P) Ltd, New Delhi, 2014.
3. Bhattacharya, D.K. and Poonam, T. Engineering Physics, Oxford University Press, 2015.

REFERENCES :

1. Kittel ,Introduction to Solid State Physics 8th Edition , Wiley Eastern Ltd,2004.
2. Halliday, D., Resnick, R. and Walker, J. Principles of Physics. Wiley, 2015.
3. Tipler, P.A. and Mosca, G. Physics for Scientists and Engineers with Modern Physics, W.H.Freeman, 2007.
4. Einstein coefficient calculation,https://youtu.be/TvfiZHXUtXg (Video lecture)
5. Lattice structures, https://youtu.be/Rm-i1c7zr6Q (Video lecture)

CY1101A	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
2. To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
3. It enables the students to gain information about Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells
4. It deals with the information about the types of fuels, calorific value calculations and manufacture of solid, liquid and gaseous fuels.
5. To impart knowledge about the nanomaterials synthesis, properties and applications

UNIT I WATER TREATMENT AND TECHNOLOGY 9

Introduction – characteristics, Water quality parameters -hardness– types, Determination-EDTA method, Alkalinity ,boiler feed water requirements-boiler troubles – scale & sludge - Caustic Embrittlement, boiler explosion -softening of hard water - external treatment process - demineralization and zeolite, internal treatment - boiler compounds (phosphate, calgon, carbonate and colloidal conditioning methods) – desalination of brackish water –reverse osmosis.

UNIT II PHASE RULE AND ALLOYS 9

Phase rule: Introduction, definition of terms with examples, One Component System- water system,Sulphur,CO2 system, Thermal Analysis and cooling curves, Reduced phase rule - Two Component Systems- classification – lead-silver system-problems. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying,Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel.

UNIT III ENERGY SOURCES AND STORAGE DEVICES 9

Energy – Types – Non-renewable energy - Nuclear energy -renewable energy - solar energy conversion - solar cells. Introduction to Electrochemistry, Nernst Equation-Electrochemical cells – reversible and irreversible cells –Cell construction and representation - Batteries -types of batteries – characteristics – construction and working of primary battery (dry cell) - secondary battery (lithium-ion-battery) – fuel cells (H2-O2).

UNIT IV FUELS AND COMBUSTION 9

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- Coal- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) – petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number – diesel oil- cetane number – natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- ignition temperature- explosive range – flue gas analysis (ORSAT Method).

UNIT V NANOCHEMISTRY 9

Basics - distinction between nanoparticles and bulk materials; size-dependent properties., nano cluster, nano rod, nanotube(CNT)-Types of CNT and nanowire. Synthesis: precipitation, thermolysis, chemical vapour deposition, Properties, Characterisation and applications.

TOTAL: 45 PERIODS

OUTCOMES:

1. The knowledge gained on water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.
2. With the help of phase rule, they could understand the various phase diagrams and able to predict the low melting alloys.
3. Students can get knowledge about various fuels and its applications based on its calorific value.
4. It provides the students to understand about conventional and non-conventional energy sources and its applications
5. Students gain an insight about the recent trends in nano materials.

TEXT BOOKS

1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010.

REFERENCES

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

CS1101A PROBLEM SOLVING AND PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures –- lists, tuples, dictionaries.
6. To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudocode, flow chart, programming language), algorithmic problem solving, simple strategies

for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional(if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES & TURTLE 9

Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file- **Case study: Simple Graphics using Turtle**: Draw a Random Pattern of Circle, Square and Rectangle; Draw a Pattern of Straight Lines, **Plotting Graphs in Python**: Menu Driven Program to Create Mathematical 3D Objects.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

1. Develop algorithmic solutions to simple computational problems
2. Read, write, execute by hand simple Python programs.
3. Structure simple Python programs for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, and dictionaries.
6. Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 http://greenteapress.com/wp/thinkpython/)

2. Reema Thareja, Problem Solving and Programming with python, 2nd edition, Oxford University press, 2019.

3. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,, 2015.

ME1101A	**ENGINEERING GRAPHICS**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

OBJECTIVES:

1. To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 1

Importance of graphics in engineering applications –Use of drafting instruments – BIS conventions and specifications – Size and layout of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND ORTHOGRAPHIC PROJECTIONS 6+6

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse,parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization principles – Layout of views- Orthographic projection of multiple views(Free Hand Sketching) from pictorial views of objects-Principal planes-Projection of points-Demo using CAD software for above topics.

UNIT II PROJECTION OF POINTS STRAIGHT LINES AND PLANE SURFACES 6+6

Orthographic projections-principles-Principal planes-First angle projection-Projection of pointsProjection of straight lines (only First angle projections) inclined to one of the principal planes - Determination of true lengths and true inclinations - Projection of planes (polygonal and circular surfaces) inclined to one of the principal planes - Demo using CAD software for above topics.

UNIT III PROJECTION OF SOLIDS 6+6

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method-Demo using CAD software for above topics.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENTOF SURFACES 6+6

Sectioning of above solids in simple vertical position - the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones-Demo using CAD software for above topics.

UNITV ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+6

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions –Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method-Demo using CAD software for above topics.

TOTAL: 61 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

1. Familiarize with the fundamentals and standards of Engineering graphics
2. Perform freehand sketching of basic geometrical constructions and multiple views of objects.
3. Project orthographic projections of lines and plane surfaces.
4. Draw projections of solids and development of surfaces.
5. Visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

1. NatrajanK.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition,2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore,2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi,2005.

5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, NewDelhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition,2009.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation –Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

- There will be five questions, each of either-or type covering all units of the syllabus.
- All questions will carry equal marks of 20 each making a total of 100.
- The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3size.
- The examination will be conducted in appropriate sessions on the same day

BS1101A	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

PHYSICS LABORATORY

OBJECTIVE:

To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
   (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
4. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
5. Determination of wavelength of mercury spectrum – spectrometer grating
6. Determination of band gap of a semiconductor
7. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:

• Upon completion of the course, the students will be able to apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY

OBJECTIVES:

To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

LIST OF EXPERIMENTS (**Any seven experiments to be conducted)**

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of TDS of water sample.
5. Determination of strength of acids in a mixture of acids using conductivity meter.
6. Estimation of iron content of the given solution using potentiometer.
7. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

CS1102A	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

OBJECTIVES:

1. To study python programs with conditionals and loops
2. To use functions for python structured programs.
3. Use strings for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. To read and write data from and to files in python.

LIST OF EXPERIMENTS:

1. Write a program to display the largest number among three numbers.
2. Write a program to display the Fibonacci series by using looping constructs.
3. Write a function to compute the GCD of two numbers.
4. Explore String Functions
5. With the help of strings, array or list, display a simple calendar in python program without using the calendar module.
6. With the help of list perform Linear search and Binary search.
7. Write a program to perform Selection sort, Insertion sort, Merge sort

8. Create a text file using python file I/O. Read the content of the file and change themfrom lower to upper case characters.
9. Programs that take command line arguments (word count)
10. Find the most frequent words in a text read from a file
11. Simulate bouncing ball using Pygame

TOTAL: 60 PERIODS

COURSE OUTCOMES:

1. Design simple programs using conditionals and loops.
2. Write functions to solve mathematical problems
3. Use strings for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Identify to read and write data from and to files in python.

CI1101A	INDIAN CONSTITUTION	L	T	P	C
		2	0	0	0

Prerequisites: Basic law.

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution.

The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

COURSE CONTENT

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India

3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the
9. President of India
10. Amendment of the Constitutional Powers and Procedure
11. The historical perspectives of the constitutional amendments in India
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Scheme of the Fundamental Right to Equality
15. Scheme of the Fundamental Right to certain Freedom under Article 19
16. Scope of the Right to Life and Personal Liberty under Article 21

SEMESTER II

		L	T	P	C
HS1201A	**ENGLISH FOR COMMUNICATION**	**4**	**0**	**0**	**3**

OBJECTIVES

The Course enables the second semester Engineering and Technology students to

1. Improve their language ability to improve the four basic skills of communication (LSRW).
2. Enhance the skills and methods to enrich their reading and comprehending ability.
3. Strengthen their skills to listen to the lectures and talks related to their fields of studies.
4. Foster their ability to write effectively in all contexts.
5. Cultivate their oral presentation skills through technical presentations and contribution in group discussions.

UNIT I **9**

Reading- Reading for detailed comparison **Listening**- Listening to interviews **Writing**Developing hints, summarizing **Speaking**- Talk about future plans, arrangements intensions **Language development**- Sentence structures **Vocabulary development-** Synonyms, Antonyms, Adverbs

UNIT II **9**

Reading-Extended reading **Listening**- Listening to telephonic conversations **Writing** Formal Letter Writing - Letters for bona fide certificate - to the principal for permission for in plant training, industrial visit, paper presentations, inter college events, Letter to the Editor, Recommendations **Speaking**- Formal conversation **Language development**-Use of Punctuation, Modal verbs **Vocabulary development-** One word substitutes, Common Phrasal verbs

UNIT III **9**

Reading- Identify topic sentences by reading a short story **Listening**- Listening to TED talks **Writing**- Process/product description **Speaking**- Formal Conversations **Language development**- Relative Clauses, Concord, Error correction **Vocabulary development**Idioms & Phrases, Minimal pairs

UNIT IV **9**

Reading- Reading newspaper articles **Listening**- Listening to inspirational speeches **Writing**- Essays, Checklist **Speaking**- Technical Presentations **Language development**Degrees of Comparison **Vocabulary development**- Articles, Cause and Effect Expressions

UNIT V **9**

Reading- Close reading **Listening**- Listening for summarizing **Writing**- Dialogue conversations **Speaking**- Movie/ Book Review **Language development**- Wh Questions, Yes/ no Questions **Vocabulary development**- Foreign Expressions and its applications, Reference words

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Read for comprehending and responding in general and professional settings.
2. Demonstrate the communication skills (LSRW) in academic, professional and social Environment.
3. Participate effectively in formal and informal conversations and express findings and opinions with proper language ability.
4. Comprehend conversations and short talks delivered in English.
5. Use the language effectively to write with clarity and accuracy in general and technical contexts.

Extensive Reading:

1. Kalam, Abdul Dr.A.P.J. - The Wings of Fire, Universities press: 1999

Reference:

1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
4. Dutt P. Kiranmai and RajeevanGeeta. Basic Communication Skills, Foundation Books: 2013
5. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges.CengageLearning ,USA: 2007.

Recommended websites:

1. TED.com

2. learningenglish.voanews.com
3. islcollective.com
4. examenglish.com
5. englishclass101.com

MA1201A COMPLEX VARIABLES AND TRANSFORMS

L	T	P	C
3	1	0	4

OBJECTIVES

1. Understand the concept of Divergence and curl and use it in evaluating Line, Surface and Volume integrals
2. Understand C-R equations and use it in the construction of Analytic Functions.
3. Understand the methods of Complex Integration using Cauchy's Integral Formula and Cauchy Residue theorem, finding Taylor's and Laurent's Series expansions.
4. Find the Laplace Transforms of standard Functions and to find the Inverse Laplace Transform of a function and use it in solving Differential Equations.
5. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems

UNIT I VECTOR CALCULUS 9+3

Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral – Area of a curved surface – Volume integral – Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals-simple applications involving cubes and rectangular parallelopipeds.

UNIT II ANALYTIC FUNCTIONS 9+3

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions ($w = 1/z, w = z^2, w = e^z, w = \sinh z, w = \cosh z$) – Bilinear transformation.

UNIT III COMPLEX INTEGRATION 9+3

Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

UNIT IV LAPLACE TRANSFORMS 9+3

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+3

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL: 60 PERIODS

OUTCOMES

On successful completion of this course, the student will be able to

1. Solve problems using divergence and curl and evaluate line, Surface and Volume integrals.
2. Solve problems in Analytic functions and construction of analytic functions using CR Equations.
3. Evaluate problems using Cauchy's integral formula and Cauchy residue theorem and find Taylor's and Laurent's series expansion of a given function.
4. Obtain the Laplace Transforms of standard functions.
5. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXTBOOKS

1. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, Inc., 2016.

REFERENCE BOOKS

1. Bali,N.P.,Goyal,M.,Watkins,C.,Advanced Engineering Mathematics,Laxmi Publications Pvt. Limited, 2007.
2. Boyce,W.E.,andDiPrima,R.C.,ElementaryDifferentialEquationsandBoundary Value Problems, Wiley India, 2012.
3. O'Neil. P. V. "Advanced Engineering Mathematics", 7th Edition, Cengage Learning India
   Pvt., Ltd, New Delhi, 2011.
4. T. Veerarajan, Engineering Mathematics, Tata Mcgraw Hill publications co. ltd, New Delhi.2017.

PH1201A MATERIAL SCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states –carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination –Elemental and Compound Semiconductors – **N-type and P-type semiconductor (Qualitative)** – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism –Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials –Ferrites and its applications. **Electro static Discharge (ESD)-** Superconductivity: properties – Type I and Type II superconductors–BCS theory of superconductivity (Qualitative) - High Tc superconductors – Electrical, medical, magnetic and computer application of superconductors.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientation and space charge polarization – frequency and temperature dependence of polarisation – **Clausius mosotti relation -** dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer).

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses - melt spinning process, applications - shape memory alloys: Ni-Ti alloy, applications – nanomaterials: preparation (bottom up and top down approaches), properties and applications- Bio materials – introduction- properties of bio materials-examples- medical applications- Ophthalmology- bio sensors- characteristics.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course,

1. The students will gain knowledge of conducting materials and variation of its properties with temperature.
2. Acquire knowledge on basics of semiconductor physics and its applications in various devices.
3. Get knowledge on magnetic and superconducting materials properties and their various applications.
4. The students will understand the basics of dielectric materials, properties and applications of dielectric materials.
5. The students will get knowledge about new engineering materials and its applications in social applications.

TEXT BOOKS:

1. S.Mohan, Principles of Materials Science, MJP Publishers, 2018.
2. Jasprit Singh, Semiconductor Devices, Basic Principles, Wiley 2012.
3. Umesh K Mishra and Jasprit Singh, Semiconductor Device Physics and Design‖, Springer, 2008.

REFERENCES:

1. Wahab, M.A. Solid State Physics: Structure and Properties of Materials‖, Narosa Publishing House, 2009.
2. William D.Callister Jr, David G. Rethwisch, Materials Science and Engineering, An Introduction, Wiley India (P) Ltd., 8th Edition, 2009.
3. Pillai S.O., Solid State Physics, New Age International (P) Ltd., Publishers, 2009. Semiconductor Introduction, https://youtu.be/k6ZxP9Yr02E (Video lecture)
4. Superconductivity, https://youtu.be/D-9M3GWOBrw (Video lecture)

EE1201A	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To explain the basic Quantities and different componentsused in Electrical circuits
2. To explain the operations of electrical machines.
3. To explain the working principles of measuring instruments, transducers and calibrationfor instruments.
4. To explain the fundamentals of Electronics
5. To impart knowledge of communication.

UNIT I FUNDAMENTALS OF ELECTRICALCIRCUITS 9

Basic Electrical Quantities , Circuit components ,Fundamental laws of electric circuits– Steady State Solution of DC Circuits- Nodal analysis and Mesh analysis-Introduction of AC Circuits-Sinusoidal Steady State Analysis, Power and Power Factor-Current and Voltage equations for Three Phase Balanced Circuits.

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of Operation and Basic Equations of DC Generator, DCMotor, Single Phase Transformer and Single phase induction Motor.

UNIT III MEASURING INSTRUMENTS AND TRANSDUCERS 9

Introduction to Measuring instruments –Operating principles of PMMC, Voltmeter,Ammeter,and Dynamometer type Wattmeter & Energy Meter, Introduction to transducers –Stain Gauge, LVDT and RTD-Principles of Calibration.

UNIT IV ELECTRONICS 9

Introductionto Analog electronics–Characteristics of PN Junction Diode and Zener Diode - Half Wave &Full Wave Rectifiers.Bipolar Junction Transistor and its Characteristics. Introduction to Digital electronics:Number systems -Boolean algebra theorems–Logic GatesAdder-Multiplexer and Demultiplexer Basics of sequentialCircuits– Flip-Flops – Shift Registers-4 bit Ripple Counter – R-2R ladder type D/A and Successive approximation type A/D Conversion.

UNIT V FUNDAMENTALS OF COMMUNICATION SYSTEMS 9

Introduction – Elements of Communication Systems–Principles of Amplitude and Frequency Modulations. Basic of digital Communication –ASK,PSK and FSK- Communication Systems:

Radio, Antenna, TV, ISDN, Microwave, Satellite and Optical Fibre (Block Diagram Approach only) and Comparison of 2G,3G and 4G in mobile communications.

TOTAL: 45 PERIODS

OUTCOMES:

Ability to

1. Understand electric circuits and fundamental analysis of circuits.
2. Understand working principles of electrical machines
3. Choose appropriate instruments for electrical measurement and transducers for a specific application.
4. Understand the concepts of Analog electronics and Digital electronics.
5. Understand and Gain knowledge of types communication systems

TEXT BOOKS:

1. D.P.Kothari and I.J. Nagarath –"Basic Electrical & Electronics Engineering", c.Grawhill publications, 1st Edition, 2014. (All Units)
2. Mehta V K, "Principles of Electronics", S.Chand& Company Ltd, 1994.
3. Gary S. Rogers, " An Introduction to Wireless Technology", Pearson Education, 2008

REFERENCE BOOKS:

1. Vincent Del Toro, Electrical Engineering Fundamentals, Prentice Hall, 2006.
2. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi,2007
3. V.K.Mehta&Rohit Mehta, Principles of Electrical Engineering, S.Chand publications, 2nd Edition, 2003.
4. Simon Haykin, ―Communication Systems‖, 4th Edition, Wiley, 2014.

CE1201A	**ENGINEERING MECHANICS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I STATICS OF PARTICLES 9+6

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES 9+6

Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III ROPERTIES OF SURFACES AND SOLIDS 9+6

Centroids and centre of mass – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 9+6

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND RIGID BODY DYNAMICS 9+6

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 75 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

1. illustrate the vectorial and scalar representation of forces and moments
2. analyse the rigid body in equilibrium
3. evaluate the properties of surfaces and solids
4. calculate dynamic forces exerted in rigid body
5. determine the friction and the effects by the laws of friction

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education2010.
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley &Sons,1993.

GE1201A ENGINEERING PRACTICES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE 13

Buildings:

1. Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, Unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – .pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 18

Welding:

1) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2) Gas welding practice

Basic Machining:

1) Simple Turning and Taper turning
2) Drilling Practice

Sheet Metal Work:

1) Forming & Bending:
2) Model making – Trays and funnels.
3) Different type of joints.

Machine assembly practice:

1) Study of centrifugal pump
2) Study of air conditioner

Demonstration on:

1) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
2) Foundry operations like mould preparation for gear and step cone pulley.
3) Fitting – Exercises – Preparation of square fitting and V – fitting models.

GROUP -B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 13

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE 16

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL : 60 PERIODS

OUTCOMES:

On successful completion of this course, the student will be able to

1. Fabricate carpentry components and pipe connections including plumbing works.
2. Use welding equipment to join the structures.
3. Carry out the basic machining operations
4. Make the models using sheet metal works
5. Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundry and fittings
6. Carry out basic home electrical works and appliances
7. Measure the electrical quantities
8. Elaborate on the components, gates, soldering practices.

EE1204A	BASIC ELECTRICAL AND ELECTRONICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

1. To train the students in performing various tests on electrical drives and sensors
2. To enable the students to understand the behavior of semiconductor device based on experimentation.
3. To learn the characterizing of circuit behavior with digital ICs.

LIST OF EXPERIMENTS: (Minimum of 10 Experiments to be carried out)

1. Verification of KVL and KCL Laws
2. Measurement of three phase power
3. Load test on separately excited DC generator
4. Load test on Single phase Transformer
5. Load test on Induction motor
6. Load test on DC shunt motor.
7. Characteristics of LVDT
8. Calibration of Ammeter and Voltmeter
9. RTD and Thermistor
10. Characteristics of PN Diode and Zener Diode
11. CE Characteristics of NPN Transistor
12. Application of Diode-Half Wave Rectifier and Full Wave Rectifier
13. Verification of Half Adder and Flip-Flops,

TOTAL : 60 PERIODS

CY1201A	**ENVIRONMENTAL SCIENCE AND ENGINEERING**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

COURSE OBJECTIVES

1. To understand nature and the facts about the environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of major ecosystem – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid

wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water – Mineral resources: environmental effects of extracting and using mineral resources, case studies – Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – 12 Principles of Green chemistry, role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act –- central and state pollution control boards.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health.

TOTAL: 45 PERIODS

OUTCOMES

1. Students will be able to understand the functions of ecosystems and appreciate the bio diversity.
2. Students will be able to know the measures to control environmental pollution.
3. Students will be able to understand the usage as well as the effects of over exploitation of natural resources.
4. Students will have knowledge about finding technological, economic and political solutions to environmental problems with various Environmental Protection Act in mind.
5. Students will be able to understand the interrelationship between population explosion and the environment and also role of IT in environment and human health.
6. Students will be able to understand that Environmental problems can only be solved by Public participation in all aspects and cannot be solved by mere laws.

TEXT BOOKS

1. Environmental Science and Engineering by Anubha Kaushik and C.P.Kaushik-New Age International Publishers. New Delhi, 2017.

REFERENCES

1. Benny Joseph , Environmental Studies, Tata McGraw-Hill Publishing Company, Ltd., New
   Delhi, 2006.
2. Dr.B.S.Chauhan,. Environmental Studies , University Science Press, New Delhi, 2011.

MA1302A	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES:

1. To introduce the basic concepts of PDE for solving standard partial differential equations.
2. To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
3. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4. To acquaint the student with Fourier transform techniques used in wide variety of situations.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS-I **12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation –Integral surface passing through a curve-surface orthogonal to a system of surface-Non linear partial differential equation –Charpit's method-special methods of solution applicable to certain standard forms- Jacobi's Method

UNIT II PARTIAL DIFFERENTIAL EQUATIONS-II **12**

Homogenous Linear partial differential equations of second and higher order with constant coefficients –Non homogeneous Linear partial differential equations of second and higher order with constant coefficients- Partial differential equation reducible to equation with constant coefficients-partial differential equation of order two with variable coefficients

UNIT III FOURIER SERIES **12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.-

UNIT V FOURIER TRANSFORMS **12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

TOTAL : 60 PERIODS

OUTCOMES :

Upon successful completion of the course, students should be able to:

1. Understand how to solve the given standard partial differential equations.
2. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
3. Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES :

1. Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
4. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

CE1301A	STRENGTH OF MATERIALS I	L	T	P	C
		2	1	0	3

OBJECTIVES:

1. To learn the fundamental concepts of Stress, Strain and deformation of solids
2. To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
3. To understand the effect of torsion on shafts and springs.
4. To analyze plane and space trusses.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLID 9

Simple Stresses and strains – Elastic constants - Relationship between elastic constants – Stress Strain Diagram – Ultimate Stress – Yield Stress – Deformation of axially loaded member -

Composite Bars - Thermal Stresses – State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress - Mohr's circle method.

UNIT II SHEAR AND BENDING IN BEAMS 9

Types of loads, supports, beams – concept of shearing force and bending moment - Relationship between intensity of load, Shear Force and Bending moment - Shear Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force - Flitched Beams - Leaf Springs.

UNIT III DEFLECTION OF BEAMS 9

Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - Conjugate beam method for computation of slope and deflection of determinant beams.

UNIT IV TORSION 9

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel – Design of buffer springs.

UNIT V ANALYSIS OF TRUSSES 9

Determinate and indeterminate trusses - Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient – Analysis of Space trusses by tension coefficient method.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Understand the concepts of stress and strain, principal stresses and principal planes.
2. Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
3. Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
4. Apply basic equation of torsion in design of circular shafts and helical springs.
5. Analyze the pin jointed plane and space trusses

TEXTBOOKS:

1. Rajput.R.K. “Strength of Materials”, S.Chand and Co, New Delhi, 2015.
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, Laxmi publications. New Delhi, 2015
3. Rattan. S. S, “Strength of Materials”, Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bansal. R.K. “Strength of Materials”, Laxmi Publications Pvt. Ltd., New Delhi, 2010

REFERENCES:

1. Timoshenko.S.B. and Gere.J.M, "Mechanics of Materials", Van Nos Reinbhold, New Delhi 1999.
2. Vazirani.V.N and Ratwani.M.M, "Analysis of Structures", Vol I Khanna Publishers, New Delhi, 1995.
3. Junnarkar.S.B. and Shah.H.J, "Mechanics of Structures", Vol I, Charotar Publishing House,New Delhi 2016.
4. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016
5. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, Hyderabad, 2010.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

CE1302A	MECHANICS OF FLUIDS	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To study the mechanics of fluid motion.
- To establish fundamental knowledge of basic fluid mechanics and address specific topics relevant to simple applications involving fluids
- To familiarize students with the relevance of fluid dynamics to many engineering systems

UNIT I INTRODUCTION 9

Fluids and continuum, Physical properties of fluids, density, specific weight, vapour pressure, Newton's law of viscosity. Ideal and real fluids, Newtonian and non-Newtonian fluids.Fluid Statics- Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, measurement of pressure.

UNIT II KINEMATICS & DYNAMICS OF FLUID FLOW 9

Kinematics : Eulerian and Lagrangian approaches, classification of fluid flow, 1-D, 2-D and 3-D flow, types of flows, types of lines, velocity and acceleration in fluid, circulation and vorticity, stream function and potential function, Laplace equation, equipotential lines flow nets, uses and limitations. Equations of fluid dynamics: Differential equations of mass, energy and momentum (Euler's equation), Navier-Stokes equations (without proof) in rectangular and cylindrical co-ordinates, Bernoulli's equation and its applications: Venturi and Orifice meters, Notches and Weirs.

UNIT III PIPE FLOW 9

Viscous flow: Reynolds experiment to classify laminar and turbulent flows, significance of Reynolds number, critical Reynolds number, shear stress and velocity distribution in a pipe, law of fluid friction, head loss due to friction, Hagen Poiseuille equation. Turbulent flow: Darcy-Weisbach equation, Chezy's equation Moody's chart, Major and minor energy losses, hydraulic gradient and total energy line, flow through long pipes, pipes in series, pipes in parallel, equivalent pipe, siphon, transmission of power through pipes, efficiency of transmission, Water hammer, Cavitation.

UNIT IV CONCEPT OF BOUNDARY LAYER 9

Growth of boundary layer over a flat plate and definition of boundary layer thickness, displacement thickness, momentum thickness and energy thickness, laminar and turbulent boundary layers, laminar sub layer, velocity profile, Von- Karman momentum integral equations for the boundary layers, calculation of drag, separation of boundary and methods of control.

UNIT V DIMENSIONAL ANALYSIS AND HYDRAULIC SIMILITUDE 9

Dimensional analysis, Buckingham's theorem, important dimensional numbers and their significance, geometric, Kinematic and dynamic similarity, model studies. Froude, Reynold, Weber, Cauchy and Mach laws- Applications and limitations of model testing, simple problems only.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course students will be able to

- Calculate pressure variations in accelerating fluids using Euler's and Bernoulli's equations
- become conversant with the concepts of flow measurements and flow through pipes
- Apply the momentum and energy equations to fluid flow problems.
- Evaluate head loss in pipes and conduits.
- Use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity.

TEXT BOOKS:

1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
2. Jain.A.K.., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
3. Subramanya.K " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
4. Rajput.R.K. "Fluid Mechanics", S.Chand and Co, New Delhi, 2008.

REFERENCES:

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.
2. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
3. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.
4. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2013.

CE1303A	SURVEYING	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
2. To learn the various methods of plane and geodetic surveying to solve the real world Civil *e*ngineering problems.
3. To introduce the concepts of Control Surveying The student is also exposed to the Modern Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Definition- Classifications - Basic principles-Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Obstacles - Traversing – Plotting – – Areas enclosed by straight line irregular figures- Compass – Basic principles - Types - Bearing - Systems and conversions- Sources of errors - Local attraction - Magnetic declination-Dip- Traversing - Plotting - Adjustment of closing error – applications - Plane table and its accessories - Merits and demerits - Radiation - Intersection - Resection – Traversing- sources of errors – applications.

UNIT II LEVELLING AND ITS APPLICATIONS 9

Level line - Horizontal line - Datum - Bench marks -Levels and staves - temporary and permanent adjustments – Methods of leveling - Fly leveling - Check leveling - Procedure in leveling - Booking -Reduction - Curvature and refraction - Reciprocal leveling – Sources of Errors in leveling- Precise leveling - Types of instruments - Adjustments - Field procedure – Longitudinal and Cross-section-Plotting - Contouring - Methods - Characteristics and uses of contours – Plotting – Methods of interpolating contours – Computations of cross sectional areas and volumes - Contour gradient – Uses of contour plan and map.

UNIT III THEODOLITE AND CONTROL SURVEYING 9

Theodolite – Types – Description – Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometer – Stadia Constants – Analytic Lens -Tangential and Stadia Tacheometry surveying – Horizontal and vertical control – Methods – specifications – triangulation- baseline – instruments and accessories – corrections – satellite stations – reduction to centre- trigonometrical leveling – single and reciprocal observations – traversing.

UNIT IV SURVEY ADJUSTMENTAND ROUTE SURVEYING 9

Errors Sources- precautions and corrections – classification of errors – true and most probable values – weighed observations – method of equal shifts –principle of least squares – normal equation – correlates- level nets- adjustment of simple triangulation networks. Route Surveying - Reconnaissance - Route surveys for highways, railways and waterways - Simple curves – Compound and reverse curves - Setting out Methods – Transition curves - Functions and requirements - Setting out by offsets and angles - Vertical curves - Sight distances.

UNIT V ADVANCED TOPICS IN SURVEYING 9

Total Station : Advantages – Fundamental quantities measured – Parts and accessories – working principle – On board calculations – Field procedure – Errors and Good practices in using Total Station GPS Surveying : Different segments – space, control and user segments – satellite configuration – signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability – Task of control segment – Hand Held and Geodetic receivers – data processing – Traversing and triangulation.hydrographic surveying – Tides - MSL - Sounding methods - Three-point problem - Strength of fix – fundamentals of Astronomical Surveying, Photogrammetry and Remote Sensing.

TOTAL 45 PERIODS

OUTCOMES:

On completion of this course students shall be able to

1. Understand the basics of conventional surveying instruments.
2. Understand the methods of Leveling and setting Levels with different instruments prepare LS & CS, contour maps and carryout surveying works related to land and civil engineering projects.
3. Understand Measuring of Horizontal angle and vertical angle using different instruments.
4. Understand the elimination of various errors in observations and setting out works.
5. Understand the Concept and principle of modern surveying equipments.

TEXTBOOKS :

1. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I, II & III Lakshmi Publications Pvt Ltd, New Delhi, 2005
2. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014
3. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 9th Edition, McGraw Hill, 2017.
4. Kanetkar.T.P and Kulkarni.S.V, Surveying and Levelling, Parts 1 & 2, Pune VidyarthiGrihaPrakashan, Pune, 2008
5. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993

REFERENCES :

1. Arora K.R.,"Surveying Vol I & II", Standard Book house, 10th Edition 2008
2. Alfred Leick, “GPS satellite surveying”, John Wiley & Sons Inc., 3rd Edition, 2004.
3. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
4. SatheeshGopi, rasathishkumar, N. madhu, “Advanced Surveying, Total Station GPS and Remote Sensing” Pearson education, 2007
5. Guocheng Xu, “GPS Theory , Algorithms and Applications”, Springer – Berlin, 2003.

CE1304A	ENGINEERING GEOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end of this course the students will be able to understand the importance ofgeological knowledge such as earth, earthquake, volcanism and to apply this knowledge inprojects such as dams, tunnels, bridges, roads, airport and harbor.

UNIT I PHYSICAL GEOLOGY 9

Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes– Seismic zones in India.

UNIT II MINEROLOGY 9

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT III PETROLOGY 9

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS 9

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V APPLICATION OF GEOLOGICAL INVESTIGATIONS 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings - Hydrogeological investigations and mining - Coastal protection structures. Investigation of Landslides, causes and mitigation.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing this course

1. Will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.
2. Will get basics knowledge on properties of minerals.
3. Gain knowledge about types of rocks, their distribution and uses.
4. Will understand the methods of study on geological structure.
5. Will understand the application of geological investigation in projects such as dams, tunnels, bridges, roads, airport and harbor

TEXT BOOKS:

1. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
2. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
3. Gokhale KVGK, "Principles of Engineering Geology", B.S. Publications, Hyderabad 2011.
4. ChennaKesavulu N. "Textbook of Engineering Geology", Macmillan India Ltd., 2009.
5. Parbin Singh. A "Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2009.

REFERENCES:

1. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
2. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
3. Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.

CE1305A	COMPUTER AIDED BUILDING DRAWING	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To introduce the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

LIST OF EXPERIMENTS

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows)
2. Buildings with load bearing walls
3. Buildings with sloping roof
4. R.C.C. framed structures.
5. Industrial buildings – North light roof structures

TOT AL: 60 PERIODS

OUTCOMES:

1. The students will be able to draft the plan, elevation and sectional views of the buildings, industrial structures, and framed buildings using computer softwares.

TEXTBOOKS:

1. Sikka V .B., A Course in Civil Engineering Drawing, 4thEdition, S.K.Kataria and Sons,2015.

2. George Omura, Mastering in Autocad 2005 and Autocad LT 2005– BPB Publications, 2008

REFERENCES:

1. Chuck Eastman, Paul T eicholz, Rafael Sacks, Kathleen Liston, BIM Handbook:A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors, John Wiley and Sons. Inc.2011.

2. Marimuthu V .M., Murugesan R. and Padmini S., Civil Engineering Drawing-I, PratheebaPublishers, 2008.

3. Shah.M.G., Kale. C.M. and Patki.S.Y ., Building Drawing with an Integrated Approach to Built Environment, T ata McGraw Hill Publishers Limited, 2007.

4. Verma.B.P ., Civil Engineering Drawing and House Planning, Khanna Publishers, 2010.

CE1306A	SURVEYING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE :

At the end of the course the student will possess knowledge about Survey field techniques.

LIST OF EXPERIMENTS:

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset

Compass Survey

2. Compass Traversing – Measuring Bearings & arriving included angles

Levelling - Study of levels and levelling staff

3. Fly levelling using Dumpy level &Tilting level
4. Check leveling

Theodolite - Study of Theodolite

5. Measurements of horizontal angles by reiteration and repetition and vertical angles
6. Determination of elevation of an object using single plane method, double plane method when base is accessible / inaccessible.

Tacheometry – Tangential system – Stadia system

7. Determination of Tacheometric Constants
8. Heights and distances by stadia Tacheometry
9. Heights and distances by Tangential Tacheometry
10. Heights and distances by subtence bar method

Setting out works

11. Foundation marking using tapes single Room and Double Room
12. Setting out of simple curve

Total Station & GPS

13. Study of Total Station, Measuring Horizontal and vertical angles
14. Traverse using Total station and Area of Traverse
15. Study of GPS.

TOTAL: 60 PERIODS

OUTCOME:

1. Students completing this course would have acquired practical knowledge on handlingbasic survey instruments including Theodolite, Tacheometry, Total Station and

GPS andhave adequate knowledge to carryout Triangulation surveying includinggeneral field marking for various engineering projects and Location of site etc.

REFERENCES :

1. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
2. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004.
3. Guocheng Xu, "GPS Theory , Algorithms and Applications", Springer – Berlin, 2003.

SEMESTER IV

CE1401A	**STRENGTH OF MATERIALS II**	**L**	**T**	**P**	**C**
		2	**1**	**0**	**3**

OBJECTIVES:

1. To know the method of finding slope and deflection of beams and trusses using energy theorems.
2. To know the concept of analyzing indeterminate beams**.**
3. To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

UNIT I ENERGY PRINCIPLES 9

Strain energy and strain energy density – strain energy due to axial load (gradual, sudden and impact loadings) , shear, flexure and torsion – Castigliano's theorems – Maxwell's reciprocal theorem - Principle of virtual work – unit load method - Application of energy theorems for computing deflections in determinate beams , plane frames and plane trusses – lack of fit and temperature effects - Williot Mohr's Diagram.

UNIT II INDETERMINATE BEAMS 9

Concept of Analysis - Propped cantilever and fixed beams - fixed end moments and reactions – sinking and rotation of supports - Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT III COLUMNS AND CYLINDERS 9

Euler's column theory – critical load for prismatic columns with different end conditions – Effective length – limitations - Rankine-Gordon formula - Eccentrically loaded columns – middle third rule - core of a section – Thin cylindrical and spherical shells – stresses and change in dimensions - Thick cylinders – Compound cylinders – shrinking on stresses.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9

Stress tensor at a point – Stress invariants - Determination of principal stresses and principal planes - Volumetric strain. Theories of failure: Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Total Strain energy theory – Maximum distortion energy theory – Application problems.

UNIT V ADVANCED TOPICS **9**

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre - curved beams – Winkler Bach formula – stresses in hooks.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.
2. Analyze propped cantilever, fixed beams and continuous beams using theorem of three moment equation for external loadings and support settlements.
3. find the load carrying capacity of columns and stresses induced in columns and cylinders
4. Determine principal stresses and planes for an element in three dimensional state of stress and study various theories of failure
5. Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and find the stresses in curved beams.

TEXTBOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand& company Ltd., New Delhi, 2015.
2. Rattan.S.S, "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series,Tata McGraw Hill Publishing company, 2007.
3. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016
4. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2012
5. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain,"Theory of Structures" (SMTS) Vol - II, Laxmi Publishing Pvt Ltd, New Delhi 2017.
6. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016

CE1402A APPLIED HYDRAULIC ENGINEERING

L	T	P	C
2	1	0	3

OBJECTIVE:

To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

UNIT I UNIFORM FLOW **9**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Velocity distribution in open channel - Steady uniform flow:

Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow .

UNIT II GRADUALLY VARIED FLOW 9

Dynamic equations of gradually varied flows – Types of flow profiles - Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation.

UNIT III RAPIDLY VARIED FLOW 9

Application of the momentum equation for RVF- Hydraulic jumps - Types - Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)

UNIT IV TURBINES 9

Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine - Specific speed – Characteristic Curves of Turbines Draft tube and cavitation.

UNIT V PUMPS 9

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump -NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip – Indicator diagrams and its variations – Air vessels - Savings in work done.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of this course the students will be able to

1. Apply their knowledge of fluid mechanics in addressing problems in open channels.
2. Able to identify a effective section for flow in different cross sections.
3. To solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
4. Understand the principles, working and application of turbines.
5. Understand the principles, working and application of pumps.

TEXTBOOKS:

1. Subramanya.K ,"Flow in open channels", Tata McGraw Hill, New Delhi, 2000.
2. Modi P.N and Seth.S.M "Hydraulics and Fluid Mechanics including Hydraulic Machines",Standard Book House New Delhi, 2009.

REFERENCES:

1. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
2. Hanif Chaudhry.M., "Open Channel Flow", Second Edition, Springer, 2007
3. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi,2008.
4. Jain.A.K., " Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.

5. Subramanya.K., " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
6. Chandramouli P.N.,"Applied Hydraulic Engineering", Yes Dee Publishing Pvt. Ltd., 2017.

CE1403A	CONSTRUCTION MATERIALS, TECHNIQUES AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To introduce students to various construction materials, techniques and practices commonly used in civil engineering construction.

UNIT I STONES - BRICKS - CONCRETE BLOCKS - LIME 9

Stone as building material - criteria for selection - Tests on stones - Bricks – Classification Manufacturing of clay bricks - Tests on bricks - Compressive strength - Water Absorption Efflorescence - Bricks for special use - Lime - Preparation of lime mortar - Concrete hollow blocks Lightweight concrete blocks.

UNIT II CEMENT - AGGREGATES 9

Cement - Ingredients - Manufacturing process - Types and grades - Properties of cement and Cement mortar - Tests on Cement - Fineness - Soundness, Consistency - Setting time – Coarse Aggregate -Crushing strength - Impact strength - Flakiness Index - Elongation Index – Abrasion resistance - Grading – Fine aggregate - grading – Bulking.

UNIT III CONCRETE 9

Concrete - Ingredients - Hydration - Batching plants – RMC - Properties of fresh concrete - Slump , Flow and Compaction factor - Properties of Hardened concrete - Compressive, Tensile and Shear strength -Modulus of rupture tests – Non-destructive testing.

UNIT IV CONSTRUCTION TECHNIQUES 9

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism – floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials – responsible sourcing - Eco Building (Green Building) -Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Meaning - Building automation - Energy efficient buildings for various zones.

UNIT V CONSTRUCTION PRACTICES 9

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – Building foundations – basements – slip forms – scaffoldings – Fabrication and erection of steel trusses – roof finishes – acoustic and fire protection.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Identify the good quality of brick for construction.

2. Understand material properties of cement and aggregates.
3. Design the concrete mixes for different exposure conditions
4. know the different construction techniques and structural systems
5. Understand various techniques and practices on masonry construction, flooring, and roofing.

TEXTBOOKS:

1. Varghese.P.C, Building Construction,Second Edition PHI Learning ltd., 2016.
2. Shetty.M.S., Concrete Technology (Theory and Practice), S Chand and company limited 2015.

REFERENCES:

1. Arora S.P and Bindra S.P Building construction , Dhanpat Rai and sons,1997.
2. Punmia ,B.C Building construction , Laxmi publication (p)ltd..,2008.
3. Neville A.M Properties of concrete , fourth edition ,Pearson education ltd.2012.
4. Peurifoy R.L., Schexnayder,C.J., Shapira A., Schmitt.R., Construction Planning Equipment and Methods, Tata mcgraw-hill,2011.

HV1401A	**UNIVERSAL HUMAN VALUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

UNIT I INTRODUCTION 9

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING 9

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as

an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY 9

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE 9

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT V UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 9

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society

4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

TEXT BOOKS:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

REFERENCES:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

CE1404A	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

To expose the students the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS

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

9. Deflection test on carriage spring
10. Test on Cement

TOTAL: 60 PERIODS

OUTCOME

1. The students will have the required knowledge in the area of testing of materials and components of structural elements experimentally.

REFERENCES

1. IS1786-2008 (Fourth Revision, Reaffirmed 2013), 'High strength deformed bars and wires for concrete reinforcement – Specification', 2008.

CE1405A	HYDRAULIC ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS

A. Flow Measurement

1. Calibration of Rotometer
2. Flow through Venturimeter / Orifice meter
3. Flow through variable duct area - Bernoulli's Experiment
4. Flow through Orifice, Mouthpiece and Notches

B. Losses in Pipes

5. Determination of friction coefficient in pipes
6. Determination of loss coefficients for pipe fittings

C. Pumps

7.Characteristics of Centrifugal pumps
8. Characteristics of Gear pump
9. Characteristics of Submersible pump
10. Characteristics of Reciprocating pump

D. Turbines

11. Characteristics of Pelton wheel turbine
12. Characteristics of Francis turbine
13. Characteristics of Kaplan turbine

E. Determination of Metacentric height

14. Determination of Metacentric height of floating bodies (Demonstration)

TOTAL: 60 PERIODS

OUTCOMES:

1. The students will be able to measure flow in pipes and determine frictional losses.
2. The students will be able to develop characteristics of pumps and turbines.

REFERENCES:

1. Sarbjit Singh." Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2009.

2. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
3. Modi P .N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
4. Subramanya.K. "Flow in open channels", Tata McGraw Hill Publishing. Company, 2001.

SEMESTER V

CE1501A DESIGN OF REINFORCED CONCRETE ELEMENTS - I

L	T	P	C
3	1	0	4

OBJECTIVE:

To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.

UNIT I INTRODUCTION OFCONCRETE STRUCTURAL DESIGN 9

Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC - Advantages of Limit State Method over other methods - Properties of Concrete and Reinforcing Steel - Design of Singly and Doubly reinforced by working stress method

UNIT II DESIGN OF SLABS AND BEAMS USING LIMIT STATE METHOD 9

Design of cantilever, one way simply supported and continuous slabs -Two-way slab- Design of simply supported and continuous slabs- Design of singly and doubly reinforced rectangular and flanged beams

UNIT III LIMIT STATE DESIGN 9

Behaviour of RC members in bond and Anchorage - Design requirements as per current code Behaviour of RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.

UNIT IV DESIGN OF COLUMNS 9

Types of columns –Axially Loaded columns – Design of short Rectangular Square and circular columns– Design of Slender columns- Design for Uniaxial and Biaxial bending using interaction Curves

UNIT V DESIGN OF FOOTING 9

Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded square, rectangular pad and sloped footings – Design of Combined Rectangular footing for two columns only.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Understand the various design methodologies for the design of RC elements.
2. Know the analysis and design of slabs and beams by limit state method

3. Design the beams for shear, bond and torsion by limit state method.
4. Design columns for axial, uniaxial and biaxial eccentric loadings.
5. Design of footing by limit state method.
6. Understand and design various members using Limit state method

TEXT BOOKS:

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.
2. Unnikrishna Pillai, Devdas Menon "Reinforced Concrete Design", McGraw Hill Education,3rd Edition 2017.

REFERENCES:

1. Subramanian,N., "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.
2. Krishnaraju.N "Design of Reinforced Concrete Structures", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Ramachandra, "Limit state Design of Concrete Structures", Standard Book House, New Delhi.
4. Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.

CE1502A	**STRUCTURAL ANALYSIS - I**	**L**	**T**	**P**	**C**
		2	**1**	**0**	**3**

OBJECTIVES:

1. To introduce the students to basic theory and concepts of classical methods of structural analysis
2. Learn about the method of analysis of beam and frame by slope deflection method.
3. Know the significance of carry over moments and distribution factors with moment distribution method.
4. Know the characteristics of flexibility method for frames and beams.
5. Learn about the stiffness method for frames and beams.

UNIT I STRAIN ENERGY METHOD 9

Determination of Static and Kinematic Indeterminacies – Analysis of continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy).

UNIT II SLOPE DEFLECTION METHOD 9

Slope deflection equations – Equilibrium conditions – Analysis of continuous beams and rigid frames – Rigid frames with inclined members – Support settlements- symmetric frames with symmetric and skew-symmetric loadings.

UNIT III MOMENT DISTRIBUTION METHOD 9

Stiffness and carry over factors – Distribution and carryover of moments – Analysis of continuous Beams- Plane rigid frames with and without sway – Support settlement – symmetric frames with symmetric and skew-symmetric loadings.

UNIT IV FLEXIBLITY METHOD 9

Primary structures – Compatibility conditions – Formation flexibility matrices – Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT V STIFFNESS METHOD 9

Restrained structure –Formation of stiffness matrices – equilibrium condition – Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Analyse continuous beams, pin-jointed indeterminate plane frames and rigid plane frames by strain energy method
2. Analyse the continuous beams and rigid frames by slope defection method.
3. Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
4. Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
5. Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXTBOOKS:

1. Bhavikatti, S.S, Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt.Ltd.,NewDelhi-4, 2014.
2. Vazrani.V.N and Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.

REFERENCES:

1. Punmia. B.C, Ashok Kumar Jain &Arun Kumar Jain, Theory of structures, LaxmiPublications, New Delhi, 2004.
2. William Weaver, Jrand James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Delhi,1995
3. Hibbeler, R.C.,Structural Analysis, VII Edition, Prentice Hall, 2012.
4. Reddy.C.S, "Basic Structural Analysis",Tata McGraw Hill Publishing Company,2005.
5. Rajasekaran. S, & G. Sankarasubramanian., "Computational Structural Mechanics", PHI Learning Pvt. Ltd, 2015
6. Negi L.S.andJangidR.S.,Structural Analysis, Tata McGraw Hill Publishing Co.Ltd.2004.
7. Vazrani.V.NAndRatwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.
8. PanditG.S.andGuptaS.P.,Structural Analysis–AMatrix Approach, Tata McGraw Hill Publishing Company Ltd.,2006
9. https://nptel.ac.in/content/storage2/courses/downloads_new/LectureNotes/105101085/105101085.zip
10. https://nptel.ac.in/courses/105/101/105101085/

CE1503A WATER SUPPLY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To identify the sources and quantity of surface and ground water bodies and their demand for the public.
2. To study the quality of water and their treatment techniques.
3. To understand the principles and design aspects of distribution system.

UNIT I SOURCES OF WATER 9

Necessity, planning and objectives of public water supply system, design period, population forecasting, water demand and quantity– sources of water and their characteristics, surface and groundwater – impounding reservoir– source water quality – characterization – significance – drinking water quality standards.

UNIT II CONVEYANCE OF WATER 9

Intake structures – types, functions – pipes and conduits for water – hydraulics of flow in pipes – transmission main design – pipe materials – laying, jointing and testing of pipes – appurtenances – types and capacity of pumps – selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives – unit operations and processes – principles, functions, and design – screens- plain sedimentation – sedimentation with coagulation, flash mixers, clarifloccuator – pulsator clarifier – tube settlers – filtration, sand filters – disinfection – operation and maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 9

Principles and functions of aeration, iron and manganese removal, water softening – desalination – demineralization – defluoridation – adsorption – membrane systems– recent advances – MBR process

UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9

Requirements of water distribution – components – layouts of distribution network – distribution reservoirs – functions – network design – analysis of pipe networks – appurtenances – leak detection. Design aspects of water supply in buildings – house water connections – pipe fittings – water piping systems in buildings

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. An insight into the structure of public water supply systems and knowledge in water quality criteria and standards.
2. The knowledge in hydraulics of flow in pipes and design of water transmission main.
3. The knowledge in various unit operations and processes and ability to design the various functional units in water treatment.
4. The knowledge in advancements in the water treatment techniques.
5. The ability to analyse and design a complex pipe networks.

6. The ability to design and evaluate water supply project alternatives on basis of chosen criteria.

TEXTBOOKS:

1. Garg S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications Pvt Ltd, New Delhi, 2014.

REFERENCES:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.
3. Modi P.N, Water Supply Engineering, Vol-I Standard Book House, New Delhi, 2010.

CE1504A	SOIL MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
2. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.
3. To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

History – formation and types of soil – composition - Index properties – description – techniques - Classification – BIS – US – phase relationship – Compaction – theory – laboratory and field technology – field Compaction method – factors influencing compaction.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– – Permeability – Darcy's law – Determination of Permeability – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems Sheet pile and weir.

UNIT III STRESS DISTRIBUTION AND CONSOLIDATION 9

Stress distribution in homogeneous and isotropic medium – Boussinesq of theory – (Point load, Line load and udl) Use of Newmark's influence chart –Components of settlement – Immediate and consolidation settlement – Factors influencing settlement –Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. – $\sqrt{t}$ and log t methods. e- log p relationship consolidation settlement N-C clays – O.C clays – Computation.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Factors influences shear strength of soil.

UNIT V SLOPE STABILITY 9

Infinite slopes and finite slopes — Friction circle method –Swedish Slip Circle Method- Use of stability number –Guidelines for location of critical slope surface in cohesive and c - soil – Slope protection measures.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Classify the soil and assess the engineering properties, based on index properties.
2. Understand the stress concepts in soils
3. Understand and identify the settlement in soils.
4. Determine the shear strength of soil
5. Analyze both finite and infinite slopes.
6. Understand the suitability of soil for the various site conditions and requirements.

TEXTBOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBSPublishers Distribution Ltd., New Delhi. 2014
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers andDistributors, New Delhi, 7th Edition, 2017(Reprint).
3. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics" New Age International Publication, 3rd Edition, 2016.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi,6th Edition, 2017.

REFERENCES:

1. McCarthy,D.F., "Essentials of Soil Mechanics and Foundations: Basic Geotechnics" Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of IndiaPvt. Ltd. New Delhi, 2010.
3. Braja M Das, "Principles of Geotechnical Engineering", Cengage Learning IndiaPrivateLimited, 8th Edition, 2014.
4. Palanikumar.M., "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private LimitedDelhi, 2013.
5. Craig.R.F., "Soil Mechanics", E & FN Spon, London and New York, 2012.

CE1505A	SOIL MECHANICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

1. DETERMINATION OF INDEX PROPERTIES **20**

a. Specific gravity of soil solids
b. Grain size distribution – Sieve analysis
c. Grain size distribution - Hydrometer analysis
d. Determination of Atterberg Limits

2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS **12**

a. Field density Test (Sand replacement method and core cutter method)
b. Determination of moisture – density relationship using standard Proctor compaction test.
c. Determination of relative density

3. DETERMINATION OF ENGINEERING PROPERTIES **28**

a. Permeability determination (constant head and falling head methods)
b. Direct shear test in cohesion less soil
c. Unconfined compression test in cohesive soil
d. Laboratory vane shear test in cohesive soil
e. Tri-axial compression test in cohesion less soil (Demonstration only)
f. California Bearing Ratio Test

TOTAL: 60 PERIODS

OUTCOMES:

1. Students are able to conduct tests to determine both the index and engineering properties of soils and to characterize the soil based on their properties.

REFERENCES:

1. "Soil Engineering Laboratory Instruction Manual" published by Engineering College Cooperative Society, Anna University, Chennai, 2010.
2. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized 2008.
3. Saibaba Reddy, E.Ramasastri, K. "Measurement of Engineering Properties of Soils" New age International (P) Limited Publishers, New Delhi, 2002.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.

CE1506A	CONCRETE AND HIGHWAY ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

I. TESTS ON CEMENT **15**

1. Fineness test
2. Normal Consistency

3. Initial and Final Setting time
4. Specific Gravity on Cement

II. TESTS ON CONCRETE **15**

1. Slump cone test
2. Compaction factor
3. Compressive strength - Cube & Cylinder
4. Flexure test

III. TESTS ON AGGREGATES **15**

1. Specific Gravity test
2. Gradation of Aggregate
3. Crushing Strength
4. Abrasion Value
5. Impact Value
6. Water Absorption
7. Flakiness and Elongation Index

IV. TESTS ON BITUMEN **15**

1. Penetration
2. Softening Point
3. Ductility
4. Viscosity
5. Specific Gravity test
6. Bituminous Mix Design by Marshall Method

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course

1. Students will have the required knowledge in the area of testing of construction materials and components of construction elements experimentally
2. Student knows the techniques to characterize various pavement materials through relevant tests.

REFERENCES:

1. M.L.Gambir, "Concrete Manual", Danpat Rai and sons, New Delhi
2. Shetty M.S, "Concrete Technology", S. Chand & Co. Ltd, New Delhi.
3. L R Kadiyali, "Highway Engineering ", Khanna Publishers, New Delhi
4. IS 516:1959 Methods of Tests for Strength of Concrete (Eighteenth revision)
5. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual ", Nem Chand Bros, Roorkee
6. IS 2386(Part 1 to Part 4):1963 Methods of test for aggregates for concrete
7. IS 4031(Part 1 to Part 5):1988 Methods of physical tests for hydraulic cement
8. IS 383– 1970 Indian Standard specification for coarse and fine aggregates from natural sources for Concrete.
9. IS 1201 to 1220 (1978): Methods for Testing Tar and Bituminous Materials

CE1507A	SURVEY CAMP	L	T	P	C
	(During IV semester Summer Vacation 2 weeks)	0	0	0	2

OBJECTIVE:

The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members in a group will carry out each exercise in survey camp. The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Traverse - using Total station
2. Contouring
   (i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line.
   (ii). Block Level/ By squares of size at least 100 Meter x 100 Meter atleast 20 Meter interval
   (iii). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter atleast L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting the Location
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

SEMESTER VI

CE1601A	DESIGN OF REINFORCED CONCRETE ELEMENTS - II	L	T	P	C
		3	1	0	4

OBJECTIVE:

To give an exposure to the design of continuous beams, slabs, stair cases, walls and brick masonry structures and to introduce yield line theory.

UNIT I RETAINING WALLS **9**

Design of Cantilever and Counterfort Retaining walls.

UNIT II WATER TANKS **9**

Water Tanks resting on ground, Elevated Circular, underground Rectangular Tanks.

UNIT III SELECTED TOPICS **9**

Design of doglegged staircase – Design of flat slabs – Interior and Exterior

UNIT IV ROAD BRIDGES **9**

Design of Box culvert – Design of deck slab bridge subjected to class AA tracked loading

UNIT V BRICK MASONRY **9**

Introduction, Classification of walls, Lateral supports and stability, effective height of wall and columns, effective length of walls, design loads, load dispersion, permissible stresses, design of axially and eccentrically loaded brick wall.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Design and draw reinforced concrete Cantilever and Counterfort Retaining Walls
2. Design and draw RCC water tank as per code provisions
3. Design and draw RCC dog legged stair case and Bridge structures
4. Design and draw circular and triangular structures based on yield line theory
5. Understand and design various brick masonry structures
6. Understand and design various large structures designed using working stress method

TEXT BOOKS:

1. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012.
2. Punmia B.C, Ashok Kumar Jain, ArunK.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.

REFERENCES:

1. Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.
2. Dayaratnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH Publishing House, 1997

CE1602A	STRUCTURAL ANALYSIS - II	L	T	P	C
		2	1	0	3

OBJECTIVE:

To learn the method of drawing influence lines for beams and plane trusses and to analyse the arches, suspension bridges and space trusses.

UNIT I INFLUENCE LINES FOR DETERMINATE BEAMS 9

Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS 9

Muller Breslau's principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams.

UNIT III ARCHES **9**

Arches - Types of arches – Analysis of three hinged, two hinged and fixed arches – Parabolic and circular arches – Settlement and temperature effects.

UNIT IV CABLES AND SUSPENSION BRIDGES **9**

Equilibrium of cable – length of cable - anchorage of suspension cables – stiffening girders cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

UNIT V PLASTIC ANALYSIS **9**

Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load – Static and kinematic methods – Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Draw influence lines for statically determinate structures and calculate critical stress resultants.
2. Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
3. Analyse of three hinged, two hinged and fixed arches.
4. Analyse the suspension bridges with stiffening girders
5. Understand the concept of Plastic analysis and the method of analyzing beams and rigid frames.

TEXT BOOKS:

1. Bhavikatti,S.S, Structural Analysis,Vol.1 & 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4, 2014.
2. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.

REFERENCES:

1. Negi.L.S and Jangid R.S., Structural Analysis, Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.Ltd.2002.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHIL earning Pvt. Ltd.,2011.
4. Prakash Rao D.S., Structural Analysis, Universities Press,1996.
5. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.
6. https://nptel.ac.in/content/storage2/courses/downloads_new/LectureNotes/105105109/105105109.zip
7. https://nptel.ac.in/courses/105/105/105105109/

CE1603A WASTEWATER ENGINEERING **L T P C**

3 0 0 3

OBJECTIVES:

1. To impart knowledge on characteristics and estimation of sewage.
2. To develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.
3. To understand the methods of sludge disposal.

UNIT I QUANTITY, COLLECTION AND CONVEYANCE OF SEWAGE 9

Objectives of sanitary engineering – systems of sewage disposal – sanitary sewage flow estimation, population equivalent – storm runoff estimation– hydraulics of flow in sanitary sewers – sewer design – sewer materials – sewer joints – sewer appurtenances – laying and testing of sewer lines – sewage pumping – drainage in buildings – systems of plumbing.

UNIT II QUALITY OF SEWAGE AND PRIMARY TREATMENT 9

Characteristics and composition of sewage – unit operations and processes – selection of treatment processes – onsite sanitation – septic tank – grey water harvesting – primary treatment – principles, functions and design of sewage treatment units – screens – grit chamber – primary sedimentation tanks – operation and maintenance aspects.

UNIT III SECONDARY TREATMENT OF SEWAGE 9

Principles and objectives of biological treatment of sewage – selection of treatment methods – principles, functions – activated sludge process – trickling filters– sequencing batch reactor(SBR) – membrane bioreactor(MBR) – UASB – waste stabilization ponds – other treatment methods – advanced wastewater treatment methods.

UNIT IV DISPOSAL OF SEWAGE 9

Standards for sewage disposal – methods – dilution – self-purification of streams – oxygen sag curve – deoxygenation and reaeration – Streeter–Phelps model – land disposal – recycle and reuse of sewage – sewage farming – effluent irrigation– sodium hazards.

UNIT V SLUDGE TREATMENT AND DISPOSAL 9

Objectives – sludge characterization – sludge thickening – design of gravity thickener – sludge digestion – design of sludge digester – biogas recovery – sludge conditioning and dewatering – sludge drying beds – final disposal of sludge.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. An ability to estimate sewage generation and design sewer system.
2. An ability to perform basic design of the unit operations and processes that are used in sewage treatment.
3. The required knowledge in principles of biological treatment of sewage and the selection of treatment methods.
4. The ability to understand the standard methods for disposal of sewage.
5. The knowledge on sludge treatment and disposal.
6. An ability to plan house drainage including onsite wastewater treatment and disposal.

TEXT BOOKS:

1. Garg S.K, Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015.
2. Duggal K.N, "Elements of Environmental Engineering" S. Chand and Co. Ltd, New Delhi, 2014.

REFERENCES:

1. Manual on Sewerage and Sewage Treatment Systems Part A, B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Manual on Storm water drainage systems Part A, CPHEEO, Ministry of housing and urban affairs, Government of India, New Delhi, 2019.
3. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc. Graw -Hill Company, New Delhi, 2010.
4. Syed R. Qasim "Wastewater Treatment Plants", CRC Press, Washington D.C,2010
5. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd., New Delhi, 2006.
6. Punmia B.C, Jain, A.K, and Jain A.K, Environmental Engineering, Vol II, Laxmi Publications, 2010.

CE1604A FOUNDATION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

To provide knowledge on the soil investigation and testing, besides design of shallow, pile foundation based on bearing capacity and settlement. Knowledge on earth pressure is also improved

UNIT I SITE INVESTIGATION AND SOIL EXPLORATION 9

Introduction, need, planning, stages - depth and spacing of soil-exploration methods –samplers, sampling method – In-situ tests – SPT,SCPT, VST, Pressure meter - Data interpretation - Strength parameters - Bore log report.

UNIT II BEARING CAPACITY 9

Types and choice of foundation–Depth of foundation–Types of shear failures – safe bearing capacity – Terzaghi's analysis – Meyerhof's analysis – Skempton's analysis – IS Method – Effect of water table on bearing capacity - Plate load test - Seismic consideration in bearing capacity evaluation – Introduction to methods improving bearing capacity

UNIT III SETTLEMENT AND DESIGN OF FOUNDATION 9

Settlement – Immediate and time dependent settlements – Differential settlement – Causes – Effect – Control – Permissible settlement – BIS code provisions – Contact pressure distribution – Design – Proportioning – Isolated footing, combined footing and strap footing - raft foundation – Types – Floating foundation.

UNIT IV PILE FOUNDATION 9

Necessity – Classification – Load carrying capacity of piles – Static methods – Dynamic formulae – Insitu penetration tests – pile load tests – Negative skin friction –group action in piles – Settlement of pile groups.

UNIT V EARTH PRESSURE THEORIES AND RETAINING WALLS 9

Earth pressure theories: Plastic equilibrium of soil – Earth pressure at rest, Active & passive earth pressure – Rankine's & Coulomb's earth pressure theories, – wedge method of analysis – estimation of earth pressure by graphical construction (Culmann Method).

Retaining wall & sheet pile structures: Proportions of retaining walls, – stability checks, cantilever and anchored sheet piles – free earth and fixed earth method of analysis of anchored bulk heads.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the various methods of soil exploration and field testing
2. Evaluate the Bearing Capacity of soils
3. Estimate the stresses under any system of foundation loads solve practical problems related to consolidation settlement and time rate of settlement
4. Assess the pile and pile group capacity for any kind of soil including group efficiency and negative friction
5. Understand the basic concepts of earth pressure theories and Analyze earth retaining structures for any kind of soil medium.
6. Apply necessary theoretical background for design and construction of foundation systems.

TEXT BOOKS:

1. K. R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers Distributor,Delhi,2010
2. Dr. B. C. Punmia, Ashok kumar Jain and Arunkumar Jain, "Soil Mechanics and Foundation Engineering",Lakshmi Publications (P) Ltd., New Delhi.2017

REFERENCES:

1. Gopal Rajan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers,Third Edition, New Delhi, 2016.
2. Murthy. V.N.S., "Soil Mechanics and Foundation Engineering", Dhanapat Rai Publication, 2018.
3. Teng. W.L., "Foundation Design" Prentice Hall of India Ltd., New Delhi, 1969.
4. C. Venkatramaiah, "Geotechnical Engineering", New Age International (P) Ltd, Publishers,New Delhi,2012

CE1605A	TRANSPORTATION ENGINEERING – I	L	T	P	C
		3	0	0	3

OBJECTIVES:

To give an overview on the fundamentals of traffic stream characteristics, pavement materials and to impart the various process and methods involved in the planning, development, designing of geometric elements, flexible pavements and rigid pavements

UNIT I HIGHWAY DEVELOPMENT AND PLANNING 8

Highway development in India – Necessity for Highway planning – Different road development plans – Classification of Roads – Road Network Patterns – Highway Alignment – Factors affecting alignment – Engineering Surveys.

UNIT II HIGHWAY GEOMETRIC DESIGN 10

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

UNIT III TRAFFIC ENGINEERING 9

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

UNIT IV HIGHWAY MATERIALS 9

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

UNIT V HIGHWAY PAVEMENT DESIGN 9

Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

TOTAL: 45 PERIODS

OUTCOMES:

After the completion of the course, students willbe able to

1. Carry out surveys involved in planning and highway alignment
2. Describe and design of highway geometric elements.
3. Carry out traffic studies and implement traffic regulation and control measures and intersection design.
4. Characterize pavement materials
5. Design flexible and rigid pavements as per IRC
6. Explain basic parameters of traffic, parking studies and its characteristics, road accident analysis.

TEXT BOOKS:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2. Kadiyalai, L.R., “Traffic Engineering and Transport Planning”, Khanna Publishers.

REFERENCES:

1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, “Principles of Highway Engineering and Traffic Analysis”, 4th Edition, John Wiley
2. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.

3. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.
4. IRC: 37-2001 – Guidelines for the Design of flexible Pavements for Highways, IRC, New Delhi, 2012.
5. IRC: 58-2002(Second Revision) – Guidelines for the Design of Rigid Pavements for Highways, IRC, New Delhi, 2002.
6. Partha Chakraborty, "Principles Of Transportation Engineering", PHI Learning

CE1606A STRUCTURAL DESIGN AND DETAILING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVE:

To acquire hands on experience in design and preparation of structural drawings for concrete structures normally encountered in Civil Engineering practice.

LIST OF EXPERIMENTS:

1. RCC one way &Two-way Slab and beam system
2. Rectangular Column and Footing
3. Combined footing with Two columns
4. Dog-legged Stair case
5. Cantilever Retaining wall
6. RCC T beam bridge deck
7. Rectangular Underground Water Tank
8. Elevated circular water Tank
9. Flat Slab
10. Analysis and design of simple Ground floor building

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course

1. The student will be able to analyse and design RCC structures normally encountered.
2. The students will be able to prepare structural detailing drawings for onsite execution.

TEXT BOOKS:

1. Krishnaraju N, Structural Design and Drawing, Universities Press, 2009.
2. Punmia B.C, Ashok Kumar Jain and Arun KumarJain, Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.

REFERENCES:

1. Krishnamurthy D, "Structural Design and Drawing Vol I,II and III" ,CBS Publishers, 2010.
2. Shah V L and Veena Gore, Limit State Design of Steel Structures
3. IS800-2007, Structures Publications, 2009.

4. IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi.
5. IS 875 Part 1 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice-Dead Load, Bureau of Indian Standards, New Delhi.
6. IS 875 Part 2 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice-Imposed Load, Bureau of Indian Standards, New Delhi.
7. IS 875 Part 3 (2003) Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Code of Practice-Wind Load, Bureau of Indian Standards, New Delhi.
8. IS 3370 Part 1 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice–General Requirements, Code of Practice, Bureau of Indian Standards, New Delhi.
9. IS 3370 Part 2 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice-Reinforced Concrete Structures, Code of Practice, Bureau of Indian Standards, New Delhi.
10. IS 3370–Part 4 (2008) Indian Standard Code of Practice for Concrete Structures for The Storage of Liquids-Design Tables, Code of Practice, Bureau of Indian Standards, New Delhi.

CE1607A WATER AND WASTEWATER ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

1. To analyse the physical, chemical and biological characteristics of water and wastewater
2. To quantify the dosage requirement for coagulation process
3. To study the growth of micro-organism and its quantification
4. To quantify the sludge

LIST OF EXPERIMENTS:

1. Determination of pH, turbidity and conductivity
2. Determination of hardness
3. Determination of alkalinity and acidity
4. Determination of chlorides
5. Determination of optimum coagulant dosage
6. Determination of residual chlorine and available chlorine in bleaching powder
7. Determination of suspended, settable, volatile and fixed solids
8. Determination dissolved oxygen and BOD for the given sample
9. Determination of COD for given sample
10. Determination of SVI of biological sludge
11. Determination of MPN index of given water sample

TOTAL: 60 PERIODS

OUTCOMES:

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

1. Analyse the physical, chemical and biological characteristics of the given sample.
2. Quantify the pollutant concentration in water and wastewater.
3. Suggest the type of treatment required and amount of dosage required for the treatment.
4. Examine the residual concentration of disinfectant in water.
5. Evaluate the oxygen demand in water and wastewater.
6. Examine the conditions for the growth of micro-organisms.

SEMESTER VII

CE1701A ESTIMATION, COSTING AND VALUATION ENGINEERING **L T P C**

3 0 0 3

OBJECTIVE:

- To introduce the different types of philosophies related to estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

UNIT I ESTIMATION OF BUILDINGS 9

Purpose – Methods of estimation – Types of estimates –Data required for estimation – Different items of work and units of measurement - Estimation of all items of work for residential buildings- (additional practice in class room using computer softwares)

UNIT II ESTIMATION OF OTHER STRUCTURES AND RATE ANALYSIS 9

Estimation of bituminous and cement concrete roads, septic tank, soak pit, retaining walls – culverts, Schedule of rates – Market rates – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads.

UNIT III SPECIFICATIONS, REPORTS AND TENDERS 9

Specifications – Types of specifications – Preparation of detailed and general specifications - Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices – types – tender procedures, E-tendering-Digital signature certificates- Encrypting -Decrypting.

UNIT IV CONTRACTS 9

Contract – Types of contracts – Formation of contract – Contract conditions – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Contract problems – Arbitration and legal requirements.

UNIT V VALUATION 9

Definitions – Various types of valuations – Valuation methods - Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

7. Estimate the quantities for buildings,
8. Rate Analysis for all Building works, canals, and Roads.

9. Understand types of specifications, principles for report preparation, tender notices types.
10. Gain knowledge on types of contracts
11. Evaluate valuation for building and land.

TEXT BOOKS:

1. B.N Dutta 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006.

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998
3. Arbitration and Conciliation Act, 1996.
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003
6. https://onlinecourses.swayam2.ac.in/nou20_cs11.

CE1702A	DESIGN OF STEEL STRUCTURAL ELEMENTS	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections. Design of structural systems such as roof trusses, gantry girders as per provisions of current code (IS 800 - 2007) of practice for working stress and Limit state Method.

UNIT I INTRODUCTION AND ALLOWABLE STRESS DESIGN 9+6

Structural steel types – Mechanical Properties of structural steel- Indian structural steel products - Steps involved in the Deign Process -Steel Structural systems and their Elements -Type of Loads on Structures and Load combinations- Code of practices, Loading standards and Specifications - Concept of Allowable Stress Method, and Limit State Design Methods for Steel structures-Relative advantages and Limitations-Strengths and Serviceability Limit states. Allowable stresses as per IS 800 section 11 -Concepts of Allowable stress design for bending and Shear –Check for Elastic deflection-Calculation of moment carrying capacity –Design of Laterally supported Solid Hot Rolled section beams-Allowable stress deign of Angle Tension and Compression Members and estimation of axial load carrying capacity.

UNIT II CONNECTIONS IN STEEL STRUCTURES 9+6

Type of Fasteners- Bolts Pins and welds- Types of simple bolted and welded connections Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections for Plates and Angle Members using bearing type bolts –Prying forces and Hanger connection– Design of Slip critical connections with High strength

Friction Grip bolts.-Design of joints for combined shear and Tension- Eccentrically Loaded Bolted Bracket Connections- Welds-symbols and specifications- Effective area of welds-Fillet and but Welded connections-Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections.

UNIT III TENSION MEMBERS 9+6

Tension Members - Types of Tension members and sections –Behaviour of Tension Members modes of failure-Slenderness ratio- Net area – Net effective sections for Plates,Angles and Tee in tension –Concepts of Shear Lag- Design of plate and angle tension members-design of built up tension Members-Connections in tension members – Use of lug angles – Design of tension splice.

UNIT IV COMPRESSION MEMBERS 9+6

Types of compression members and sections–Behaviour and types of failures-Short and slender columns- Current code provisions for compression members- Effective Length, Slenderness ratio –Column formula and column curves- Design of single section and compound Angles-Axially Loaded solid section Columns- Design of Built up Laced and Battened type columns – Design of column bases – Plate and Gusseted bases for Axially loaded columns- Splices for columns.

UNIT V DESIGN OF FLEXURAL MEMBERS 9+6

Types of steel Beam sections- Behaviour of Beams in flexure- Codal Provisions – Classification of cross sections- Flexural Strength and Lateral stability of Beams –Shear Strength-Web Buckling, Crippling and defection of Beams- Design of laterally supported Beams- Design of solid rolled section Beams- Design of Plated beams with cover plates - Design Strength of Laterally unsupported Beams – Design of laterally unsupported rolled section Beams- Purlin in Roof Trusses-Design of Channel and I section Purlins.

TOTAL: 75 PERIODS

OUTCOMES:

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

1. Understand the concepts of various design philosophies
2. Design common bolted and welded connections for steel structures
3. Design tension members and understand the effect of shear lag.
4. Understand the design concept of axially loaded columns and column base connections.
5. Understand specific problems related to the design of laterally restrained and unrestrained steel beams.

TEXTBOOKS:

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013

REFERENCES:

1. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005
2. Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002

3. Sai Ram. K.S. “Design of Steel Structures “ Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2nd Edition, 2015, www.pearsoned.co.in/kssairam
4. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013
5. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800– 2007, IK International Publishing House Pvt. Ltd., 2009
6. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007, Structures Publications, 2009.
7. IS800 :2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
8. SP 6(1) Hand book on structural Steel Section

CE1703A TRANSPORTATION ENGINEERING-II

L	T	P	C
3	0	0	3

OBJECTIVES:

To expose the students to Railway planning, design, construction and maintenance and planning and design principles of Airports and Harbours.

UNIT I RAILWAY PLANNING 9

Significance of Road, Rail, Air and Water transports - Coordination of all modes to achieve sustainability - Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, -Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- - Soil suitability analysis - Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 9

Earthwork – Stabilization of track on poor soil –- Tunneling Methods, drainage and ventilation – -Calculation of Materials required for track laying - Construction and maintenance of tracks – Modern methods of construction & maintenance - Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

UNIT III AIRPORT PLANNING 9

Air transport characteristics-airport classification-airport planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, Typical airport layouts, Parking and circulation area.

UNIT IV AIRPORT DESIGN 9

Runway Design: Orientation, Wind Rose Diagram - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings and lighting.

UNIT V HARBOUR ENGINEERING 9

Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave

action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. The knowledge Plan and Design various civil Engineering aspects of Railways, Airports and Harbour.

TEXTBOOKS:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi, 2003
2. Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi, 2013.
3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
4. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi, 2013

REFERENCES:

1. Rangwala, "Railway Engineering", Charotar Publishing House, 2013.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013. 3. Rangwala, "Harbor Engineering",Charotar Publishing House, 2013

CE1704A	HYDROLOGY AND WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To impart knowledge on hydrological aspects of water availability.
2. To apply the principles of reservoir engineering to estimate the capacity of reservoirs and their useful life.
3. To understand the properties of aquifers and the concepts of rainwater harvesting.

UNIT I PRECIPITATION AND ABSTRACTIONS 9

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges -Spatial analysis of rainfall data using Thiessen and Isohyetal methods- Evaporation- Horton’s equation, pan evaporation measurements - Infiltration- infiltration indices.

UNIT II RUNOFF 9

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical formulas – Strange’s table and Soil Conservation Service(SCS) methods – Stage discharge relationships- flow measurements- Hydrograph – Instantaneous Unit Hydrograph(IUH).

UNIT III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts- Meteorological, hydrological and agricultural droughts- Indian Meteorological Department (IMD) method- Normalized Difference Vegetation Index (NDVI) analysis- Drought Prone Area Programme (DPAP)-Application of Geographical information system (GIS) in flood management.

UNIT IV RESERVOIRS 9

Classification of reservoirs, General principles of design, site selection, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve- case studies.

UNIT V GROUNDWATER AND MANAGEMENT 9

Origin- Classification - properties of aquifers- Dupit's equations – steady and unsteady flow - artificial recharge – Rain Water Harvesting (RWH) in rural and urban areas.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. an understanding of the key drivers on water resources and hydrological processes
2. knowledge in the integrated behaviour of catchments and hydrograph.
3. ability to understand flood estimation and drought management.
4. ability to conduct spatial analysis of rainfall data and design water storage reservoirs
5. an understanding the concept and methods of ground water management.
6. ability to construct and apply a range of hydrological models to surface water and groundwater problems.

TEXTBOOKS:

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
2. S. K. Garg "Hydrology and Water Resources Engineering" Khanna Publishers, 2005.

REFERENCES:

1. Jayarami Reddy.P. "Hydrology", Tata McGraw Hill, 2008
2. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
3. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
4. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.
5. Linsley, R.K. and Franzini, J.B. "Water Resources Engineering", McGraw Hill International Book Company, 1995.

CE1705A	CREATIVE AND INNOVATIVE PROJECT (ACTIVITY BASED-SUBJECT RELATED)	L	T	P	C
		0	0	4	2

OBJECTIVE:

- To use the knowledge acquired in Civil Engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

TOTAL: 60 PERIODS

STRATEGY

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs.

CE1706A	INDUSTRIAL TRAINING	L	T	P	C
	(4 Weeks During VI Semester – Summer)	**0**	**0**	**0**	**2**

OBJECTIVE:

- To train the students in field work so as to have a first-hand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

STRATEGY:

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

OUTCOMES:

At the end of the course the student will be able to understand

1. The intricacies of implementation textbook knowledge into practice
2. The concepts of developments and implementation of new techniques

SEMESTER -VIII

CE1801A	PROJECT	L	T	P	C
		0	**0**	**20**	**10**

OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 300 PERIODS

OUTCOMES:

1. On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

PROFESSIONAL ELECTIVE

SEMESTER- IV

ELECTIVE –I

CE1407A	**BASICS OF REMOTE SENSING AND GIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To acquire knowledge on basic concepts and principles of various components of remote sensing.
- To develop an exposure to GIS and its practical applications in civil engineering.

UNIT I EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL 9

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

UNIT II PLATFORMS AND SENSORS 9

Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and space-borne TIR and microwave sensors.

UNIT III IMAGE INTERPRETATION AND ANALYSIS 9

Types of Data Products – types of image interpretation – basic elements of image interpretation visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised.

UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software's – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT V APPLICATIONS OF REMOTE SENSING AND GIS 9

Advanced applications of GIS – Disaster management, Land use Land cover – Urban planning – Water Resources - Highway alignment studies.

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course the student will be able to

- Identify the basic remote sensing concepts and its characteristics.
- Differentiate various platforms and its corresponding sensors.
- Perform the basic image interpretation process using different tools and keys.
- Analyze raster and vector data and modelling in GIS.
- Apply GIS in advance applications such as land use, disaster management and urban planning.

TEXTBOOKS:

1. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd edition. BS Publications, Hyderabad, 2001.

REFERENCES:

1. Lo.C.P.and A.K.W.Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India Pvt. Ltd., New Delhi, 2002
2. Peter A.Burrough, Rachael A. McDonnell, " Principles of GIS", Oxford University Press, 2000
3. Ian Heywood "An Introduction to GIS", Pearson Education Asia, 2000
4. Lilles and,T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" 5th Edition, John Willey and Sons Asia Pvt. Ltd., New Delhi, 2004.

CE1408A GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To acquire knowledge on various applications of civil engineering and its relevance in geo informatics.

UNIT I LAND RESOURCE MANAGEMENT 6

Total Station and GPS Surveys – Topographic and Bathymetric Surveys – Cadastral Information –Soil and Land Use Surveys - Land Information System (LIS) – Real Estate Information System

UNIT II STRUCTURAL STUDIES 6

Deformation studies of deflection - Dam deformation - structural movement - Pavement yield -shifting sand-bank and shoreline – Landslide Risk Analysis

UNIT III SOIL CONSERVATION AND MANAGEMENT 9

Soil survey interpretation and mapping - impact of agricultural and industrial activity on soil properties - soil erosion - factors influencing soil erosion - soil contamination using Hyper spectral Remote Sensing - mining pollution- EMR responses with contaminated soil - modeling soil characteristics using satellite data - soil degradation assessment using Remote Sensing and GIS -Land reclamation studies

UNIT IV URBAN AND TRANSPORTATION MANAGEMENT 12

Monitoring Urban Growth through Remote Sensing - Geo-demographic Analysis – Property Market Analysis Urban Renewal - traffic analysis - accident analysis - site suitability analysis for transport infrastructure –transportation databases: creation and maintenance - Vehicle routing –Highway maintenance system – Intelligent Transportation System.

UNIT V WATER RESOURCES PLANNING AND MANAGEMENT 12

Location of storage/diversion works – capacity curve generation – sediment yield - modelling of catchments – Delineation of watershed - Watershed modelling for sustainable development -Rainfall – Runoff modelling –LiDAR Mapping for Urban area –Water

quality mapping and monitoring – Flood Risk Zoning - Flood damage assessment – Flood Modelling - Assessment of droughts and mitigation

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students will

- Apply geo informatics based solutions to Land Resource Management.
- Apply geo informatics based solutions to Structural Studies.
- Apply geo informatics based solutions to Soil Conservation and Management.
- Apply geo informatics based solutions to Urban and Transportation Management.
- Apply geo informatics based solutions to Water Resources Planning and Management.

TEXTBOOKS:

1. Basudeb Bhatta, 'Remote Sensing and GIS', Second edition, Oxford University Press 2011.

REFERENCES:

1. Andrew N. Rencz, Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring, John Wiley & Sons Inc, April 2004
2. Rashed, Tarek; Jürgens, Carsten (Eds.), Remote Sensing of Urban and Suburban Areas, Springer, 1st Edition. 2010.
3. Harvey J. Miller, Shih-Lung Shaw, Geographic Information Systems for Transportation –Principles and Applications, Oxford University Press, 2001.
4. Gert A. Schulitz Edwin T. Engman, Remote Sensing in hydrology and Water Management, Springer - verlag Berlin Heidelberg Germany - 2000.
5. Lo.C.P., Albert K.W.Yeung, Concepts and Techniques of Geographic Information Systems, Second edition, PHI Learning Private Limited, Delhi, 2014.

CE1409A	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on various principles involved and to develop an exposure about various mitigation to be adopted during the disasters.

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters –Earthquake, Landslide, Flood, Drought, Fire etc. - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayat Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V APPLICATIONS AND CASE STUDIES AND FIELDWORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students will

- Understand what a disaster is and get to know about the mitigation measures.
- Understand the fundamentals and measurements of disaster management.
- Apply the disaster management practices during various developmental activities.
- Get exposure to various disasters happened across the nation.
- Apply GIS in real time disaster management practices.

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.

3. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
4. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
5. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

CE1410A	DIGITAL CADASTRE	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To acquire knowledge on the cadastral survey methods and to develop an expertise in its applications in generation of Land information system.

UNIT I INTRODUCTION 9

History of cadastral survey - Types of survey - T ax - Real Property – Legal cadastre - Graphical and Numerical Cadastre, Legal Characteristics of Records, Torrens System.

UNIT II CADASTRAL SURVEY METHODS 9

Steps in survey of a village - Instruments used for cadastral survey & mapping - Orthogonal, Polar survey methods - Boundary survey - Rectangulation - Calculation of area of Land- GPS and Total Station in Cadastral survey.

UNIT III PHOTOGRAMMETRIC METHODS 9

Photogrammetry for cadastral surveying and mapping - Ortho photo map – Quality control measures - Organization of cadastral offices – international scenario.

UNIT IV CADASTRAL MAPPING AND LIS 9

Cadastral map reproduction - Map projection for cadastral maps – Conventional symbols -map - reproduction processes - Automated cadastral map, Management of Digital Cadastral. Creation of Land Information System. Integrating LIS – Land administration.

UNIT V MAINTENANCE AND MEASUREMENTS 9

Cadastral survey maintenance - Resurveys - Measurement of sub-division - Measurement of obstructed lines - Survey of urban areas - Control requirement for Urban survey use of Satellite Imagery in boundary fixing.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students will

- Know about the basics and history of cadastral survey.
- Understand the methods of cadastral survey.
- Understand Land Record System and computational procedure for modernization of the same.
- Gain exposure to methods for creation of cadastral database using GIS.
- Apply the cadastral surveying practice in various real world problems.

TEXTBOOKS:

1. Gerhard Larsson, Land Registration and cadastral systems: Tools for Land Information and Management, 1991.

REFERENCES:

1. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007.
2. E. M. Mikhail, J. S. Bethel, J. C. Mc Glone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.
3. James, M. Anderson and Edward N. Mikhail, Introduction to Surveying, McGraw Hill Book Co, 1985.
4. Paul. R Wolf., Bon A. DeWitt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014
5. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

CE1411A	ADVANCED REMOTE SENSING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To acquire knowledge on various advancements in remote sensing such as Hyper spectral, Thermal and Lidar and get exposed to its applications for earth resources.

UNIT I INTRODUCTION TO HYPERSPECTRAL REMOTE SENSING 9

Spectral radiometry - imaging spectrometry- factors affecting the field spectrum – Hyper spectral sensor systems-imaging spectrometry – scattering principles - BDRF and hemispherical reflectance –models; MODTRAN -Sensors and platforms – data characteristics.

UNIT II APPLICATIONS OF HYPERSPECTRAL REMOTE SENSING 9

Application to lithology, mineral exploration – agricultural crop systems – stress detection, plant production, vegetal bio physics and bio chemistry, soil moisture , soil characteristics, degradation status - forestry canopy characters, ecosystem, forest health, biodiversity, Gap dynamics, environmental and resource management.

UNIT III INTRODUCTION TO THERMAL REMOTE SENSING 9

Radiation science basics - Thermal radiation principles, thermal interaction behavior of terrain elements, thermal sensors and specifications – MUST (Medium Scale Surface Temperature Missions) infrared sensors and radiometers - aerial thermal images - Image characters, spatial and radiometry- sources of image degradation –radiometric and geometric errors and correction –interpretation of thermal image.

UNIT IV APPLICATIONSOFTHERMAL REMOTE SENSING 9

Thermal and optical RS for plant biophysics – hydrology, Forestry and Agriculture applications - case studies.

UNIT V INTRODUCTION TO LiDAR 9

LASER RANGING- Types of LiDAR: Range Finder LiDAR, Doppler LiDAR, DIAL – Principles of Laser Ranging: Pulse Laser, Continuous Wave Laser –Space Borne Laser Missions – Geo Science Laser Altimeter System (GLAS), LiDAR In-Space Technology Experiment (LITE), Chandrayan.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students will

- Understand the basic principles of Hyperspectral remote sensing.
- Apply the Hyper spectral remote sensing techniques to real world problems.
- Understand the basic principles of Thermal remote sensing.
- Apply the Thermal remote sensing techniques to real world problems.
- Understand the basic principles of LiDAR.

TEXT BOOKS:

1. Chein I Chang, "Hyperspectral Imaging: Techniques for Spectral Detection and Classification", Kluwer Academic/Plenum Publishers, New York, N.Y., 2003.(ISBN: 0-306-47483-2)
2. Dale A Quattarochi and Jeffrey C Luvall, "Thermal Remote Sensing in Land surface Processes" e-book, 2005 Taylor & Fancis, ISBN 0 203 50217 5.

REFERENCES:

1. John A. Richards and Xiuping Jia, "Remote sensing digital Image Analysis – an introduction" fifth edition, Springer Verlag., 2012 ISBN 978 3 642 30061 5.
2. Marcus Borengasser and William C., Hungate and Russel Watkins, "Hyper spectral Remote sensing: principles and application" CRC, 2008.
3. Jie Shan and Charles K., Topographic laser ranging and scanning : principles and processing, CRC Press, Taylor & Francis Group, 2008.
4. Zhilin Li Qing Zhu, Chris Gold, Christopher Gold, Digital Terrain Modeling: Principles and Methodology, CRC Press, 2004.

SEMESTER V

PROFESSIONAL ELECTIVE – II

		L	T	P	C
CE1511A	**CONSTRUCTION PLANNING AND SCHEDULING**	**3**	**0**	**0**	**3**

OBJECTIVE:

To make the students to learn about planning of construction projects, scheduling procedures and techniques, cost and quality control projects and use of project information as decision making tool.

UNIT I CONSTRUCTION PLANNING 9

Basic concepts in the development of construction plans-choice of Technology and Construction Method-Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 9

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedencies -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations.

UNIT III COST CONTROL MONITORING AND ACCOUNTING 9

The cost control problem-The project Budget-Forecasting for Activity cost control – financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 9

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

TOTAL: 45 PERIODS

OUTCOMES:

1. The student should be able to understand basic concepts of construction planning.
2. The student should be able to schedule the construction activities.
3. The student should be able to Forecast and control the cost in a construction.
4. The student should be able to ensure quality and safety during Construction.
5. The student should be able to Organize information in Centralized database Management systems
6. The student should be able to use the project information as decision making tool.

TEXT BOOKS:

1. Chitkara, K.K. “Construction Project Management Planning”, Scheduling and Control,Tata McGraw Hill Publishing Co., New Delhi, 2005
2. Srinath,L.S., “Pert and CPM Principles and Applications“, Affiliated East West Press, 2001

REFERENCES:

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
2. Moder.J., Phillips. C. and Davis E, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3rd Edition, 1985.
3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.
4. Halpin,D.W., "Financial and Cost Concepts for Construction Management", John Wiley and Sons, New York, 1985.

CE1512A AIR POLLUTION AND CONTROL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

To impart knowledge on the principle and design of control of indoor/ particulate/ gaseous air pollutant and its emerging trends.

UNIT I INTRODUCTION 7

Structure and composition of atmosphere – definitions, scope and scales of air pollution – sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility – ambient air quality and emission standards – ambient and stack sampling and analysis of particulate and gaseous pollutants.

UNIT II METEOROLOGY 6

Effects of meteorology on air pollution - fundamentals, atmospheric stability, inversion, wind profiles and stack plume patterns- atmospheric diffusion theories – dispersion models, plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 11

Factors affecting selection of control equipment – gas particle interaction – working principle, design and performance equations of gravity separators, centrifugal separators fabric filters, particulate scrubbers, electrostatic precipitators – operational considerations.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 11

Factors affecting selection of control equipment – working principle, design and performance equations of absorption, adsorption, condensation, incineration, bio scrubbers, bio filters – process control and monitoring - operational considerations.

UNIT V INDOOR AIR QUALITY MANAGEMENT 10

Sources, types and control of indoor air pollutants, sick building syndrome and building related illness- sources and effects of noise pollution – measurement – standards – control and preventive measures.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management.
2. The knowledge on the fundamental concepts of meteorology and its effect on air pollution.
3. An ability to design stacks and particulate air pollution control devices to meet applicable standards.
4. An ability to select control equipments.
5. An ability to ensure quality, control and preventive measures.
6. An ability to identify, formulate and solve air and noise pollution problems.

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science + science media LLC,2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press, Inc 2017.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
4. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited,2007.
5. C.S.Rao, "Environmental Pollution Control Engineering", New Age International(P) Limited Publishers,2006.

CE1513A	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. Understand and test the materials characteristics in concrete.
2. Learn about the different types of admixtures that are used in Concrete.
3. Know the significance of concrete mix design.
4. Know the characteristics of fresh and hardened concrete.
5. Learn about the importance and application of special concretes.

UNIT I CONCRETE CONSTITUENTS MATERIALS 9

Overview, Cement brought up - Chemical composition– Hydration - Bogue's compound – types of cement. Properties of cement - Tests on cement. Aggregates – classification – source - size – shape – texture. Properties of aggregates and tests – Water - Quality of water for use in concrete.

UNIT II ADMIXTURES 9

Overview –Chemical and mineral admixtures. Chemical Admixtures like Accelerators – Retarders - Plasticizers - Super plasticizers - Water proofers – properties, application – advantages and uses. Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaolin properties, application – advantages and uses.

UNIT III CONCRETE MIX DESIGN 9

Definition - Principles of mix design - Factors choice of mix proportion -Properties of concrete related to Mix Design - Physical properties of materials required for mix design- Nominal and design mix – variables in mix design - Objective of mix design – List of methods of mix design Basic steps - Information required for mix design.

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

FRESH CONCRETE: Workability - Tests for workability of concrete - Segregation and Bleeding - HARDENED CONCRETE: Factors affects strength of concrete, Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength - Flexural strength - Stress-strain curve for concrete - Modulus of elasticity. – Durability of concrete - Sulphate attack – methods to control Acid attack – concrete in sea water Carbonation - Chloride attack – corrosion test.

UNIT V SPECIAL CONCRETES 9

Light weight concretes - foam concrete- self compacting concrete – vacuum concrete - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON - Shotcrete – Polymer concrete - High performance concrete - Geopolymer Concrete.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. The cement aggregates, and water qualities are tested and studied.
2. The impact of admixtures in concrete and how to assess the qualities of new concrete.
3. Create a concrete mix that is both free of admixtures and contains admixtures.
4. Gain knowledge about the qualities of hardened concrete and the importance of concrete durability.
5. Gain knowledge about the characteristics of special concrete.
6. The importance and application of special concretes.

TEXTBOOKS:

1. Shetty, M.S. Concrete Technology, Theory and Practice, S. Chand & Company, New Delhi, 2014.
2. Gambhir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi,2013.

REFERENCES:

1. Bhavikatti.S.S, “Concrete Technology”, I.K. International Publishing House Pvt. Ltd., New Delhi, 2015.
2. A.R. Santhakumar, Concrete Technology, 2009 Edition, Oxford University Press Concrete
3. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
4. Job Thomas, “Concrete Technology”, Cengage Learning India Pvt. Ltd., Delhi.
5. Kumar P Mehta., Paulo J.M. Monterio. “Concrete - Microstructure, Properties and materials”, McGraw Hill Education (India) Private Limited, New Delhi,

CE1514A INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
3	0	0	3

OBJECTIVE:

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

UNIT I INTRODUCTION 9

Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.

UNIT II TRADE MARK 9

Purpose and Function of Trade Marks, Acquisition of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT III LAW OF COPY RIGHTS 9

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents -foundation of patent law, patent searching process, ownership rights and transfer

UNIT IV TRADE SECRETS 9

Trade Secrete Law, Determination of Trade Secrete Status, Liability For Misappropriations of Trade Secrets, Protection For Submission, Trade Secrete Litigation. Unfair Competition: Misappropriation Right of Publicity, False Advertising.

UNIT V NEW DEVELOPMENTS OF INTELLECTUAL PROPERTY 9

New developments in trade mark law- copy right law, patent law, and intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TOTAL: 45 PERIODS

OUTCOMES:

1. Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
2. Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.

3. Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
4. Be familiar with the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.
5. Be able to anticipate and subject to critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.
6. Be able to demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing;

TEXTBOOKS:

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy",McGraw Hill Education, 2011.

CE1515A	**FORM WORK ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVE:

On completion of this course the students will be able to know the detailed planning of formwork, design of forms and erection of form work.

UNIT I INTRODUCTION TO FORM WORK 9

Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples - Overall Planning - Detailed planning - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork.

UNIT II FORMWORK MATERIALS ASSESORIES & PRESSURES 9

Formwork Materials, Accessories and consumables – Application of tools, Reconstituted wood - Steel – Aluminum Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants - Formwork hours - Labour Requirement. Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on

formwork - Examples - Finish - Sheathing boards working stresses - Repetitive member stress Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls

UNIT III FORMWORK DESIGN 9

Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.

UNIT IV FORMWORK FOR SPECIAL STRUCTURES 9

Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

UNIT V CASE STUDIES 9

Formwork failures: Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

1. Understand the overall and detailed planning of formwork.
2. To impart knowledge on formwork materials, accessories, pressures and labor requirement.
3. To develop the conceptual understanding of design, construction and erection of formwork.
4. To impart the knowledge about different types of form work used for special structures.
5. To understand the errors in design and judge the formwork failures through case studies.

TEXT BOOKS:

1. Peurify R.L and Oberlender G.D , Formwork for Concrete Structures, , McGraw Hill Education India ,2015
2. Jha K N, Formwork for Concrete Structures, Tata McGraw Hill Education, 2012.

REFERENCES:

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute,
3. Detroit, 1996
4. Michael P. Hurst, Construction Press, London and New York, 2003.
5. Christopher Souder , (2014), Temporary Structure Design, Wiley Publications, London.
6. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS

SEMESTER VI

PROFESSIONAL ELECTIVE – III

		L	T	P	C
CE1611A	**URBAN PLANNING AND DEVELOPMENT**	**3**	**0**	**0**	**3**

OBJECTIVE:

To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

UNIT I BASIC ISSUES 9

Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri - urban areas, Metropolitan, Urban Migration, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II PLANNING PROCESS 9

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Regional Delineation, Surveys and Questionnaire Design, Case Study.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 9

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-Case Studies

UNIT IV PLANNING & DESIGN OF URBAN DEVELOPMENT PROJECTS 9

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V LEGISLATION MANAGEMENT OF URBAN SYSTEM 9

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Describe basic issues in urban planning
2. Formulate plans for urban and rural development and
3. Plan and analyse socio economic aspects of urban and rural planning
4. Design of urban development projects.
5. Manage urban development projects.
6. Municipalities and Development Authorities

TEXTBOOKS:

1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978

REFERENCES:

1. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2002
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
4. CMDA, Second Master Plan for Chennai, Chennai 2008.
5. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
6. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986.

CE1612A TALL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the design philosophy of tall buildings
2. To know about loading and behaviour of structural systems.
3. To introduce various structural systems for medium rise buildings with their behaviour and analysis
4. To enlighten the students on modern techniques available for the analysis of tall buildings.
5. To impart knowledge about stability analysis of various systems

UNIT I DESIGN CRITERIA AND MATERIALS 8

Design Philosophy - Modern concepts – Materials used - High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self-Compacting Concrete, Glass, High strength steel, composites.

UNIT II LOADING 9

Gravity Loading – Dead load, Live load – Live load reduction techniques, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads

UNIT III BEHAVIOUR OF STRUCTURAL SYSTEMS 9

Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, in filled frames, Shear walls, Coupled Shear walls, Wall – Frames, Tubular, and Outrigger braced Hybrid systems.

UNIT IV ANALYSIS 10

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for member forces, drift and twist. Computerized 3D analysis, Evaluation of frequency of vibration of structures – Buckling analysis of tall structures

UNIT V DESIGN PARAMETERS 9

Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

TOTAL: 45 PERIODS

OUTCOMES:

1. Explain the design aspects and the various innovative materials which can be used for the construction of tall buildings.
2. Apply the knowledge of engineering fundamentals to characterize various types of loading which could be considered for the analysis of tall buildings.
3. Identify various structural systems, their behavior and performance under different loading conditions.
4. Analyze the structures as an integral unit for drift and twist.
5. Design tall structures under different conditions like stability considerations, creep, shrinkage, and temperature and fire resistance.
6. Knowledge about the rudimentary principles of designing tall buildings as per the existing codes.

TEXTBOOKS:

1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 1991.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings, McGraw Hill, 1988

REFERENCES:

1. Lin T.Y. and Burry D.Stotes, Structural Concepts and Systems for Architects and Engineers, John Wiley, 1994.
2. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.
3. Wolfgang Schuler, High Rise Building Structures, John Wiley & Sons, New York, 1986.
4. Kolousek V, Pimer M, Fischer O and Naprstek J, Wind effects on Civil Engineering Structures. Elsevier Publications.1984.

CE1613A	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To give an overview of latest ground improvement techniques and to understand the problems related to soil and select the best method

UNIT I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 8

Role – Problems in Soils-methods of ground improvement-selection of ground improvement techniques-stabilization of expansive soil.

UNIT II DEWATERING TECHNIQUES 10

Introduction-Well points -Vaccum / electro osmatic methods - Analysis of seepage -Two Dimensional Flow - heat treatment, ground freezing.

UNIT III INSITU TREATMENT OF SOIL 10

Types of Soils-Consolidation, dynamic compaction-Vibro flotation- Compaction piles, Sand drains-Preloading-Stone column, Construction methods -Merits and demerits of various techniques.

UNIT IV EARTH REINFORCEMENT AND GEOSYNTHETICS 9

Concepts -materials, Types and application of reinforced earth – Introduction to Geosynthetics - geo-textiles-separation and road work – Case studies.

UNIT V GROUTING TECHNIQUES 8

Injection methods-monitoring: - Cement lime, Lime-flyash and chemical stabilization, Deep mixing Techniques.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Gain knowledge on methods and selection of ground improvement techniques.
2. Understand dewatering techniques and design for simple cases.
3. Get knowledge on in-situ treatment of cohesionless and cohesive soils.
4. Understand the concept of earth reinforcement and design of reinforced earth.
5. Get to know types of grouts and grouting technique.
6. Develop new innovative techniques ground improvement.

TEXT BOOKS:

1. Mittal.S, "An Introduction to Ground Improvement Engineering", Medtech Publisher, First Edition, 2013.
2. Purushothama Raj. P, "Ground Improvement Techniques", Lakshmi Publications, 2nd Edition, 2016.

REFERENCES

1. Shashi K Gulhati & Manoj Datta (2005), Geotechnical Engineering, Tata Mc-Graw Hill Companies, New Delhi.
2. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing House, First Edition, 2012.
3. Moseley, M.P., "Ground Improvement" Blockie Academic and Professional, 1992.
4. Moseley, M.P and Kirsch. K., 'Ground Improvement", Spon Press, Taylor and Francis Group, London, 2nd Edition, 2004.
5. Jones C.J.F.P. "Earth Reinforcement and Soil Structure", Thomas Telford Publishing, 1996.
6. Winterkorn, H.F. and Fang, H.Y. "Foundation Engineering Hand Book". Van Nostrand Reinhold, 1994.
7. Das, B.M., "Principles of Foundation Engineering" (seventh edition), Cengage learning, 2010.
8. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2011.
9. Koerner, R.M., "Designing with Geosynthetics" (Sixth Edition), Xlibris Corporation, U.S.A, 2012.
10. IS Code 9759: 1981 (Reaffirmed 1998) "Guidelines for Dewatering During Construction", Bureau of Indian Standards, New Delhi.

11. IS Code 15284 (Part 1): 2003 “Design and Construction for Ground Improvement – Guidelines” (Stone Column), Bureau of Indian Standards, New Delhi.

CE1614A	INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the functional planning of industrial structures including lighting and ventilation
2. To design of steel gable frame with knee joint, beam column, base plate and anchor bolt are dealt with here
3. To design RC silos, bunkers
4. To design of RC cooling tower
5. To understand general principles of prefabrication and functional requirements of precast concrete units and composite sections

UNIT I PLANNING AND LAYOUT 9

Classification of industries and industrial structures – General requirements of various industries –Planning and layout of low-rise buildings for different functions such as residences, office buildings, shopping centers, hospitals, auditoria, etc.

UNIT II FUNCTIONAL REQUIREMENTS 9

Lighting – Ventilation – Noise and Vibration control – Fire safety- Guidelines from factories act.

UNIT III DESIGN OF STEEL STRUCTURES 9

Industrial roofs – Crane girders – pre-engineered and Mills buildings – Design of Chimney.

UNIT IV DESIGN OF R.C. STRUCTURES 9

Corbels, Brackets and Nibs – Design of Bunkers and silos – Principles of folded plates and shell roofs

UNIT V PREFABRICATION 9

Principles of prefabrication – Prestressed precast roof trusses - Construction of roof and floor slabs - Wall panels- storage/transportation/handling in yard/site and erection –joints in precast structures.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the student shall be able to

1. know the requirements of various industries and planning of various industrial buildings
2. Understand the functional requirements for industrial structures.
3. Analyze and Design of Chimney
4. Analyze and Design of special RC structures like corbels, Canopy, silos, bunkers.
5. Understand the principles of prefabrication and prestressing

6. Design special steel structures like bunkers, silos, power plant structures, chimneys and pre-engineered buildings and design of Industrial structures.

TEXTBOOKS:

1. Ramamrutham.S., Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, 2007.
2. Varghese.P.C., Advanced Reinforced Concrete Design, PHI, Eastern Economy Editions, Second Edition, 2005.

REFERENCES:

1. Henn W. Buildings for Industry, Vol.I and II, London Hill Books, 1995
2. Handbook on Functional Requirements of Industrial buildings, SP32–1986, Bureau of Indian Standards, 1990.
3. Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982.
4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH,1971.
5. Bhavikatti.S.S., Design of Steel Structures, J.K. International Publishing House Pvt. Ltd., 2009.
6. Ramachandra and Virendra Gehlot, Design of steel structures -2, Scientific Publishers 2012.

CE1615A	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To provide a basic understanding of the EIA process as it is used for research, planning, project or program evaluation, monitoring, and regulatory enforcement.

UNIT I INTRODUCTION 9

Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; Rapid EIA and Comprehensive EIA; General Framework for Environmental Impact Assessment. Characterization and site assessment

UNIT II METHODOLOGIES AND ASSESSMENT 9

Environmental Risk Analysis, Definition of Risk, Matrix Method. Checklist method, Fault tree analysis, Consequence Analysis; Life Cycle Assessment

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Environmental Legislation; Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Audit

UNIT IV ECONOMIC ANALYSIS 9

Cost Benefit Analysis; Resource Balance, Energy Balance & Management Review; Operational Control;

UNIT V CASE STUDIES 9

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Understand the EIA process to apply for research, planning, project.
2. Acquire the knowledge on Assessment methodologies.
3. Understand the concepts of legal, economic, social, administrative and technical process.
4. Knowledge to prepare environmental impact assessment reports.
5. Experience and training in environmental planning and related professions
6. Prepare environmental management plans

TEXT BOOKS:

1. Canter, L.W., "Environmental Impact Assessment", McGraw-Hill, New York. 2006.
2. Lawrence, D.P., "Environmental Impact Assessment - Practical solutions to recurrent problems", Wiley-Interscience, New Jersey 2003.

REFERENCES:

1. Biswas, A.K. and Agarwala, S.B.C., "Environmental Impact Assessment for Developing Countries",Butterworth Heinemann, London. 2004.
2. The World Bank Group, "Environmental Assessment Source Book Vol. I, II and III. The World Bank, Washington. 2001.
3. John G. Rau and David C Hooten (Ed)., Environmental Impact Analysis Handbook, McGraw-Hill Book Company, New York, 2010.
4. Judith petts, handbook of environmental impact assessment vol. i & ii, blackwell science, 1999
5. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010
6. Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Conwell Science London.2009.
7. https://nptel.ac.in/courses/120/108/120108004.pdf

PROFESSIONAL ELECTIVE IV

SEMESTER VII

		L	T	P	C
CE1711A	**PRESTRESSED CONCRETE**	**3**	**0**	**0**	**3**

OBJECTIVE:

- To introduce the need for prestressing in a structure
- To explain the methods, types and advantages of prestressing to the students.
- To make the students to design a prestressed concrete structural elements and systems
- To introduce the students the effect of prestressing in the flexural and shear behaviour of structural elements.

UNIT I THEORY AND BEHAVIOUR 9

Basic concepts – Advantages and disadvantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept– Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections - Losses of prestress – Estimation of crack width.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9

Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9

Analysis and design of composite beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V TENSION AND COMPRESSION MEMBERS 9

Role of prestressing in members subjected to Tensilr forces and compressive forces - Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Understand the behaviour of prestressed concrete members and able to analyze the prestressed concrete beams.
2. Design the prestressed concrete members for flexure and shear as per the relevant design code (IS 1343).
3. Analyze for deflection of prestressed concrete members and design the anchorage zone.
4. Analyze and design of composite beams and continuous beams.
5. Design of prestressed concrete structures - sleepers, Tanks, pipes and poles.

TEXT BOOKS:

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt.

REFERENCES:

1. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
2. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013
3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012
5. IS 3370- Part 4 (2008) Indian standard Code of practice for concrete structures for the storage of liquid- Design tables, code of practice, bureau of Indian standards, new Delhi.

CE1712A	SAFETY IN CONSTRUCTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know causes of accidents related to construction activities and human factors associated with these accidents.
- To understand the construction regulations and quality assurance in construction.
- To have the knowledge in hazards of construction and their prevention methods.
- To know the working principles of various construction machinery.
- To gain knowledge in health hazards and safety in demolition work.

UNIT I ACCIDENTS CAUSES AND MANAGEMENT SYSTEMS 9

Problems impeding safety in construction industry- causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accident – construction regulations, contractual clauses – Pre contract activities, preconstruction meeting – design aids for safe construction – permits to work – quality assurance in construction – compensation – Recording of accidents and safety measures – Education and training.

UNIT II HAZARDS OF CONSTRUCTION AND PREVENTION 9

Excavations, basement and wide excavation, trenches, shafts – scaffolding , types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling – tunnelling – blasting, pre blast and post blast inspection – confined spaces – working on contaminated sites – work over water - road works – power plant constructions – construction of high rise buildings.

UNIT III WORKING AT HEIGHTS 9

Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings , requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection , safety belts, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies.

UNIT IV CONSTRUCTION MACHINERY 9

Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder’s hoist, winches, chain pulley blocks – use of conveyors - concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders,

dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling.

UNIT V SAFETY IN DEMOLITION WORK 9

Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – interesting experiences at the construction site against the fire accidents.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. identify the problems, types and causes of accidents in construction industries.
2. understand the various hazards during construction work.
3. understand the safety procedure for working at heights during construction.
4. explain safe operation, inspection and testing of various construction machinery.
5. list out construction regulations and Indian standards for construction and demolition work.

TEXTBOOKS:

1. Davies V.J and Thomasin K "Construction Safety Hand Book" Thomas Telford Ltd., London, 1996.
2. David L. Goetsch, "Construction Safety and the OSHA Standards", Prentice Hall, 2009.

REFERENCES:

1. Hudson, R. "Construction hazard and Safety Hand book", Butter Worth's, 1985.
2. Jonathan D.Sime, "Safety in the Built Environment", London, 1988.
3. Charles D. Reese and James V.Edison "Handbook of OSHA Construction safety and health" CRC Press, 2nd edition, 2012.
4. Philip Hagan, "Accident Prevention Manual for Business and Industry", N.S.C. Chicago, 13th edition 2009.
5. R. K. Mishra, "Construction Safety", AITBS Publishers, 2011.

CE1713A	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an overview of Traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.

UNIT I TRAFFIC PLANNING AND CHARACTERISTICS 9

Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town ,country ,regional and all urban infrastructure – Towards Sustainable approach. – land use & transport and modal integration.

UNIT II TRAFFIC SURVEYS 9

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

UNIT III TRAFFIC DESIGN AND VISUAL AIDS 9

Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.

UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 9

Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

UNIT V TRAFFIC MANAGEMENT 9

Area Traffic Management System - Traffic System Management (TSM) with IRC standards –- Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Analyse traffic problems and plan for traffic systems various uses
2. Design Channels, Intersections, signals and parking arrangements
3. Develop Traffic management Systems

TEXTBOOKS:

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
3. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd. 1996.

REFERENCES:

1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning,New Delhi, 2010
3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994

4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996
5. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005
6. Taylor MAP and Young W, "Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.

CE1714A	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

To provide students an exposure to disasters, their significance and types.

- To ensure that students begin to understand the relationship between vulnerability,
- disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential
- disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Differentiate the types of disasters, causes and their impact on environment and society
2. Assess vulnerability and various methods of risk reduction measures as well as mitigation.
3. Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13**:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

CE1715A	IRRIGATION ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The student is exposed to different phases in irrigation practices and Planning and management of irrigation. Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.

UNIT I CROP WATER REQUIREMENT 9

Need and classification of irrigation- historical development and merits and demerits of irrigation-types of crops-crop season-duty, delta and base period- consumptive use of crops-estimation of Evapotranspiration using experimental and theoretical methods

UNIT II IRRIGATION METHODS 9

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Water distribution system- Irrigation efficiencies.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Types of Impounding structures - Gravity dam – Forces on a dam -Design of Gravity dams; Earth dams, Arch dams- Diversion Head works - Weirs and Barrages.

UNIT IV CANAL IRRIGATION 9

Canal regulations – direct sluice - Canal drop – Cross drainage works-Canal outlets – Design of prismatic canal-canal alignments-Canal lining - Kennedy's and Lacey's Regime theory.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Modernization techniques- Rehabilitation – Optimization of water use-Minimizing water losses-On form development works-Participatory irrigation management- Water resources associations-Changing paradigms in water management-Performance evaluation-Economic aspects of irrigation

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Have knowledge and skills on crop water requirements.
2. Understand the methods and management of irrigation.
3. Gain knowledge on types of Impounding structures
4. Understand methods of irrigation including canal irrigation.
5. Get knowledge on water management on optimization of water use.
6. Develop analytical skills relevant to design of irrigation and drainage projects.

TEXTBOOKS:

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

REFERENCES:

1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi, 1997. 69
4. Sharma R.K.. "Irrigation Engineering", S.Chand & Co. 2007.

5. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 2008
6. Asawa, G.L., "Irrigation Engineering", NewAge International Publishers, New Delhi, 2000.
7. Basak, N.N, "Irrigation Engineering", Tata McGraw Hill Publishing Co. New Delhi,1999

PROFESSIONAL ELECTIVE- V
SEMESTER VIII

CE1811A ELECTRONIC WASTE MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the socio environmental impacts of e waste on environment
- To understand the recycling and metal recovery from e waste
- To gain knowledge in laws applicable in e waste handling and management

UNIT I INTRODUCTION 9

E-waste – sources, composition, classification – Generation of e-waste – Environmental and health hazard – Quantification of e- waste – methods of estimation – Economic assessment of e-waste – Recycle and reuse – Social impacts of recycling e waste

UNIT II HAZARDOUS SUBSTANCES FROM E-WASTE 9

Characterizing waste from electrical and electronics equipment (WEEE) – Routes of exposure – Hazardous substances characteristics – Potential health effects of heavy and toxic metals exposure –Polychlorinated biphenyl (PCB), Polybrominated diphenyl ethers(PBDE) – health effects – control measures – environmental standards

UNIT III HEALTH RISK ASSESSMENT 9

Basic definitions – hazard identification – toxicity testing on animals – human studies – exposure and diseases – Epidemiologic data analysis – Potential carcinogens – Dose response assessment – Potency factor – Estimation of concentration – Non carcinogens – Bio concentration

UNIT IV METAL RECOVERY FROM E WASTE 9

Process description – E-waste recycling techniques – Pyrometallurgical process – Hydrometallurgical process – Extractions of metals – Bio metallurgical process – Hybrid technology –E waste management in India

UNIT V E WASTE MANAGEMENT AND HANDLING 9

Control measures - Regulatory frameworks – Objectives of E-waste rules – Application to stakeholder – Responsibilities of Pollution control boards – Guidelines of E-waste rules – Sustainability – Life cycle assessment – Case studies – E-waste management

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. The knowledge in sources, composition and quantification of e waste generated.
2. An insight into various hazardous substances generated from e waste and its potential health hazards
3. An ability to assess the health risk associated with e waste
4. The knowledge in various metal recovery methods from e waste
5. The knowledge in distinguishing the role of various national and internal act and laws applicable for e-waste management and handling.
6. Analyse the E – waste management measures proposed under national and global legislations.

TEXT BOOKS:

1. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009
2. M.N.V Prasad and Methithika Vithanage, Electronic waste management and treatment technology, 2019 Elsevier

REFERENCES:

1. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi
2. Fowler B, Electronic Waste – 1st Edition (Toxicology and Public Health Issues), 2017 Elsevier.
3. Lawrence K. Wang, Handbook of Industrial and Hazardous Waste Treatment, Marcel Dekker 2004.
4. https://archive.nptel.ac.in/courses/105/105/105105169/#

CE1812A	**COASTAL ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- The main purpose of coastal engineering is to protect harbors and improve navigation.
- The students to the diverse topics as wave mechanics, wave climate, shoreline protection methods and laboratory investigations using model studies

UNIT I INTRODUCTION TO COASTAL ENGINEERING 9

Indian Scenario - Classification of Harbours. Introduction - wind and waves - Sea and Swell - Introduction to small amplitude wave theory - use of wave tables- Mechanics of water waves - Linear (Airy) wave theory, Introduction to Tsunami

UNIT II WAVE PROPERTIES AND ANALYSIS 9

Behaviour of waves in shallow waters, Introduction to non-linear waves and their properties - Waves in shallow waters - Wave Refraction, Diffraction and Shoaling -Hindcast wave generation models, wave shoaling; wave refraction; wave breaking; wave diffraction random and 3D wavesShort term wave analysis - wave spectra and its utilities - Long term wave analysis- Statistics analysis of grouped wave data

UNIT III COASTAL SEDIMENT TRANSPORT 9

Dynamic beach profile; cross-shore transport; along shore transport (Littoral transport), sediment movement

UNIT IV COASTAL DEFENSE 9

Field measurement; models, groins, sea walls, offshore breakwaters, artificial nourishment - planning of coast protection works - Design of shore defense structures

UNIT V MODELING IN COASTAL ENGINEERING 9

Physical modeling in Coastal Engineering - Limitations and advantages - Role of physical modeling in coastal engineering - Numerical modeling - Modeling aspects - limitations - Tsunami mitigation measures

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. Understand coastal engineering aspects of harbors methods to improve navigation
2. Understand the wave properties and analysis of wave.
3. Understand the concepts of sediment transport.
4. Design of shore defense structures.
5. Gain knowledge in modeling in coastal engineering

TEXTBOOKS:

1. Mani J.S., Coastal Hydrodynamics. PHI Pvt. Ltd. New Delhi - 2012.
2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994.

REFERENCES:

1. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill, Inc., New York, 1978.
2. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Pub. New York, 1978.
3. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006

CE1813A	GROUNDWATER ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers,
- To understand the techniques of development and management of groundwater

UNIT I HYDROGEOLOGICAL PARAMETERS 9

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity –- Dupuit Forchheimer assumption – Steady Radial Flow into a Well

UNIT II WELL HYDRAULICS 9

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery

UNIT III GROUNDWATER MANAGEMENT 9

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty – Development of a model

UNIT IV GROUNDWATER QUALITY 9

Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water – Industrial water – Irrigation water - Ground water Pollution and legislation - Environmental Regulatory requirements.

UNIT V GROUNDWATER CONSERVATION 9

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR)Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Understand aquifer properties and its dynamics
2. Get an exposure towards well design and practical problems
3. Develop a model for groundwater management.
4. Students will be able to understand the importance of artificial recharge and groundwater quality concepts
5. Gain knowledge on conservation of groundwater

TEXTBOOKS:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000

REFERENCES:

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

CE1814A	INTEGRATED WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I IWRM FRAMEWORK 9

Definition of IWRM – Key elements of IWRM - Principles - Water as a global issue: Key challenges – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

UNIT II WATER ECONOMICS 9

Economic view of water issues: Economic characteristics of water good and services – Non-market monetary valuation – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT III LEGAL AND REGULATORY SETTINGS 9

Basic notion of law and governance: Principles of International and National law in the area of water management - Understanding UN law on non-navigable uses of International water courses - International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework: Case Studies.

UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT 9

Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT V AGRICULTURE IN THE CONCEPT OF IWRM 9

Water for food production: 'blue' versus 'green' water debate – Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to relook pricing.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to

4. Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.
5. Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
6. Apply law and governance in the context of IWRM.
7. Discuss the linkages between water-health; develop a HIA framework.
8. Analyse how the virtual water concept pave way to alternate policy options.

TEXTBOOKS:

1. Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. Fourth Edition 2018.
2. Mollinga.P. etal "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications.

REFERENCES:

1. Murthy, J.V.S., "Watershed Management in India", Wiley Eastern Ltd., New York, 1995.
2. Dalte, S.J.C., "Soil Conservation and Land Management", International Book Distribution, India, 1986.
3. Sithamparanathan, Rangasamy, A., and Arunachalam, N., "Ecosystem Principles and Sustainable Agriculture", Scitech Publications (India) Pvt.Lt, Chennai, 1999.
4. Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee Background Paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
5. Tony Allan, Virtual Water: Tackling the Threat to Our Planet's Most Precious Resource, I. B. Taurus, 2011.

GE1801A PROFESSIONAL ETHICS IN ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of others.

UNIT I HUMAN VALUES **9**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES **9**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able to

1. Exhibit human values in society and to develop integrity.
2. Practice ethics in their profession using the ethical theories.
3. Work Engineers as responsible experimenters with a balanced outlook of law.
4. Apply risk benefit analysis and to utilize the Intellectual Property Rights (IPR).
5. Apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.
6. Understand the role as Engineers as Managers and develop corporate social responsibility.

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, 'Value Education', Vethathiri publications, Erode, 2011.
7. www.onlineethics.org
8. www.nspe.org
9. www.globalethics.org
10. www.ethics.org

PROFESSIONAL ELECTIVE- VI

SEMESTER VIII

		L	T	P	C
CE1821A	**PREFABRICATED STRUCTURES**	**3**	**0**	**0**	**3**

OBJECTIVE:

- To impart knowledge to students on modular construction, industrialised construction and design of prefabricated elements and construction methods.

UNIT I INTRODUCTION 9

Need for prefabrication – Principles of prefabrication – Modular coordination – Standarization – Materials – Systems – Production – Transportation – Erection

UNIT II PREFABRICATED COMPONENTS 9

Behaviour and types of structural components – Large panel systems – roof and floor slabs – Walls panels - Beams - Columns - Shear walls

UNIT III DESIGN PRINCIPLES 9

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems.

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS 9

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction, contraction, expansion. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

UNIT V DESIGN FOR ABNORMAL LOADS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

1. The student will have good knowledge about design principles, layout of factory and stages of loading in precast construction.
2. Acquire knowledge about panel systems, slabs, connections used in precast construction and they will be in a position to design the elements.
3. Acquire knowledge about types of floor systems, stairs and roofs used in precast construction.
4. Acquire knowledge about types of walls used in precast construction, sealants, design of joints.
5. Acquire knowledge about components in industrial building.

TEXT BOOKS:

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers,USA,1991.
2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.
3. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011.

REFERENCES:

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.

3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

CE1822A	MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students to gain the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion

UNIT III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURE 9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – DEMOLITION TECHNIQUES - Engineered demolition methods - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to

1. To develop an appreciation to understand the major importance of maintenance of structures.
2. To develop an understanding of the relationships between deterioration and damaged structure of Concrete.

3. To understand and experience experimental analysis of the crack and durability properties commonly used in engineering practice.
4. To understand and be able to apply the special concretes used in construction engineering practice(a) High performance concrete; (b) Geo polymer concrete (c) concrete made with industrial wastes.
5. To develop good technical aspects regarding corrosion protection techniques.

TEXTBOOKS:

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987

REFERENCES:

1. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2018.
2. Dov Kominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
3. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
5. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013
6. B.Vidivelli., "Rehabilitation of Concrete Structures", Standard Publishers Distributors, 2009

CE1823A **STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING** **L T P C**

3 0 0 3

OBJECTIVES:

- The main objective of the course is to introduce dynamic loading and the dynamic performance of the structures to the students. Different types of dynamic loading also to be discussed. The detailed study on the performance of structures under earthquake loading is also one of the focuses of the course.

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF) system – Formulation of equation of motion for various SDOF system – D' Alembert's Principles – Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic forces.

UNIT II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multidegree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

UNIT III INTRODUCTION TO EARTHQUAKE ENGINEERING 9

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seism tectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters.

UNIT IV EARTHQUAKE EFFECTS ON STRUCTURES 9

Effect of earthquake on different types of structures – Behavior of RCC, Steel and prestressed Concrete Structures under earthquake loading – Pinching Effect – Bouchinger Effects – Evaluation of Earthquake forces – IS Code 1893: 2002 – Response Spectra – Lessons learnt from past earthquakes.

UNIT V CONCEPTS OF EARTHQUAKE RESISTANT DESIGN 9

Causes of damage – Planning considerations/Architectural concept (IS 4326–1993) – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry buildings – Design consideration – Guidelines – Earthquake resistant design of R.C.C. buildings – Lateral load analysis – Design and detailing (IS 13920:1993).

TOTAL: 45 PERIODS

OUTCOMES:

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

1. To analyze the structure with single DOF
2. To analyze the structure with multiple DOF
3. To understand the basics of elements of seismology
4. To analyse structures subjected to dynamic loading
5. To design the structures for seismic loading as per code provisions.

TEXTBOOKS:

1. Chopra, A.K., "Dynamics of Structures - Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2011.
2. Agarwal. P and Shrikhande. M., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2007

REFERENCES:

1. Biggs, J.M., "Introduction to Structural Dynamics", McGraw Hill Book Co., New York, 1964.
2. Dowrick, D.J., "Earthquake Resistant Design", John Wiley & Sons, London, 2009.
3. Paz, M. and Leigh.W. "Structural Dynamics - Theory & Computation", 4th Edition, CBS Publishers & Distributors, Shahdara, Delhi, 2006.

CE1824A	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the student to know about various bridge structures, selection of appropriate bridge structures and its design for given site conditions.

UNIT I BOX CULVERT AND BRIDGE BEARING 9

Introduction: Importance of site Investigation in Bridge Design- Highway Bridge loading standards-Impact Factor-Railway Bridge loading Standards (B.G, ML Bridge) various loads in bridges.

Box culvert: General aspects- Design load- Design of box culvert subjected to RC Class AA Tracked vehicle only.

Bridge Bearing: General Features – types of bearings- Design principles of steel rocker & roller bearings – Design of a steel rocker bearing – Design of elastometric pad bearing.

UNIT II DECK SLAB BRIDGE 9

Introduction – Effective width method of analysis design of deck slab bridge (simply supported) subjected to class AA tracked vehicle only.

UNIT III T- BEAM BRIDGE 9

General features – Design of interior panel of slab – Pigeauds method – Design of a T – beam bridge subjected to class AA tracked vehicle only.

UNIT IV PLATE GIRDER AND COMPOSITE BRIDGES Plate

Girder bridge: Introduction- elements of a plate girder and their design- design of a deck type welded plate girder- bridge of single line B.G.

Composite bridge: Introduction – Advantages – Design Philosophy of composite bridges consisting of RCC slabs over steel girders including shear connectors.

UNIT V PIERS AND ABUTMENTS 9

Genral features – Bed Blocks – Materials piers and abutments- types of piers – forces acting on piers – stability analysis of piers – general requirements of abutments – forces acting on abutments – stability analysis of abutments – types of wing walls – approaches – types of bridge foundations (excluding design)

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Identify loads on bridges and selection of type of bridge for the site condition
2. Analyze the super structure by various methods.
3. Design the trussed bridge and plate girder bridges
4. Design reinforced concrete slab and T beam bridges and prestressed concrete bridges
5. Decide the appropriate sub structural systems, bearings and expansion joints for the bridges.

TEXTBOOKS:

1. Johnson Victor D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Co., New Delhi, 2009.
2. Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013

REFERENCES:

1. Phatak D.R., “Bridge Engineering”, Satya Prakashan, New Delhi, 1990.
2. Ponnuswamy S., “Bridge Engineering”, Tata McGraw-Hill, New Delhi, 1996.

3. Rajagopalan. N. "Bridge Superstructure", Alpha Science International, 2006

CE1825A SUSTAINABLE AND LEAN CONSTRUCTION L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

UNIT I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - Recycled and Manufactured aggregate - Life cycle and sustainability.

UNIT II ENERGY CALCULATIONS 9

Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy in relation to operational energy in conditioned Building - Life Cycle energy use.

UNIT III GREEN BUILDINGS 9

Control of energy use in buildings – National Building Code (NBC), ECBC code - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building

UNIT IV CORE CONCEPTS IN LEAN 9

Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

UNIT V LEAN CONSTRUCTION TOOLS AND TECHNIQUES 9

Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping– 5S , Collaborative Planning System (CPS)/ Last Planner™ System (LPS) – Big Room Approach.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student is expected to be able to

1. Describe the various sustainable materials used in construction.
2. Explain the method of estimating the amount of energy required for building.
3. Describe the features of LEED, TERI and GRIHA ratings of buildings.
4. Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.
5. Apply lean tools & techniques to achieve sustainability in construction projects.
6. Apply Sustainable and Lean Construction concepts in Practice.

TEXTBOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016.
2. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.

REFERENCES:

1. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
2. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment,Butterworth Heinemann Publishers, 2011.
3. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.
4. Energy Conservation Building code, 2017.
5. The National Building Code of India, 2016.
6. https://onlinecourses.nptel.ac.in/noc23_ce22/preview Introduction to Lean Construction (Module 1 - Lean Basics)
7. https://nptel.ac.in/courses/105102195 Sustainable Materials and Green Buildings.

OPEN ELECTIVE OFFERED BY CIVIL ENGINEERING
SEMESTER V
OPEN ELECTIVE – I

		L	T	P	C
OCE501A	**GEOGRAPHICAL INFORMATION SYSTEM**	**3**	**0**	**0**	**3**

OBJECTIVES:

1. To introduce the fundamentals and components of Geographic Information System
2. To provide details of spatial data structures and input, management and output processes.

UNIT I FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS 9

Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - Conceptual, logical and physical models - spatial data models – Raster Data Structures – RasterData Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID datamodels.

UNIT III DATA INPUT AND TOPOLOGY 9

Scanner - Raster Data Input – Raster Data File Formats – Geo referencing – Vector Data Input –Digitiser – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological file Formats - Attribute Data linking – Linking External Databases – GPS Data Integration

UNIT IV DATA QUALITY AND STANDARDS 9

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporalaccuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC -Spatial Data Infrastructure

UNIT V DATA MANAGEMENT AND OUTPUT 9

Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion -Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise vs. Desktop GIS distributed GIS.

TOTAL: 45 PERIODS

OUTCOMES:

This course equips the student to

1. Have basic idea about the fundamentals of GIS.
2. Understand the types of data models.
3. Get knowledge about data input and topology.
4. Gain knowledge on data quality and standards.
5. Understand data management functions and data output

TEXT BOOKS:

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw HillPublishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education, 2nd Edition, 2007.

REFERENCE:

1. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006.

OCE502A	REMOTE SENSING AND GIS TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To introduce the students to the basic concepts and principles of various components of remote sensing.
2. To provide an exposure to GIS and its practical applications in civil engineering.

UNIT I EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL 9

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

UNIT II PLATFORMS AND SENSORS 9

Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active Sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and space borne TIR and microwave sensors.

UNIT III IMAGE INTERPRETATION AND ANALYSIS 9

Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancementtechniques – multispectral image classification – Supervised and unsupervised.

UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT V DATA ENTRY, STORAGE AND ANALYSIS 9

Data models – vector and raster data – data compression – data input by digitization and scanning– attribute data analysis – integrated data analysis – Modeling in GIS Highway Alignment studies – Land Information System.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course the students will have knowledge on

1. Principles of Remote Sensing and GIS
2. Analysis of RS and GIS data and interpreting the data for modeling applications

TEXTBOOKS:

1. Lillesand, T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" 5th Edition. John Willey and Sons Asia Pvt. Ltd., New Delhi, 2004.
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System"2nd edition. BS Publications, Hyderabad, 2001.

REFERENCES:

1. Lo. C.P.and A.K.W.Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India Pvt. Ltd., New Delhi, 2002
2. Peter A.Burrough, Rachael A. McDonnell, " Principles of GIS", Oxford University Press,2000
3. Ian Heywood "An Introduction to GIS", Pearson Education Asia, 2000

OCE503A AIR AND NOISE POLLUTION

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the aspects of atmospheric pollution
2. To know about the issues such as atmospheric composition, monitoring, acidic deposition, urban air quality
3. To understand the use of models in air pollution studies

UNIT I SOURCES AND EFFECTS OF AIR POLLUTION 9

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory –Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion,Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants –Principles.

UNIT II TRANSPORT OF AIR POLLUTION 9

Elements of atmosphere and dispersion of pollutants – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutions – Gaussian dispersion models – Applications.

UNIT III CONTROL OF AIR POLLUTION 9

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment, gaseous pollutant control byadsorption & absorption, condensation, combustion – Pollution control for specific major industries.

UNIT IV AIR QUALITY MANAGEMENT 9

Air quality standards – Air quality monitoring – Air pollution control efforts – Zoning – Town planning regulation ofnew industries – Legislation and enforcement – Environmental Impact Assessment – Methods.

UNIT V NOISE POLLUTION & CONTROL 9

Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution -fundamentals of sound generation - propagation, sound measurement - sound level meters – types, components, Noise prevention & control measures, environmental and industrial noise - noise control legislation.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Describe the main chemical components and reactions in the atmosphere and examine the factors responsiblefor perturbing these
2. Implement the methods for monitoring and modeling spatial and temporal patterns of pollution
3. Explore air pollution issues at a range spatial scales and how these are relaxed.
4. Assess the environmental impacts of atmospheric pollution.

TEXT BOOKS:

1. Noel De Nevers (2000), Air Pollution Control Engineering, 2nd Edition, McGraw Hill International Edition.
2. Singal, S.P. (2000), Noise Pollution and Control, First Edition, Narosa Publishing House, New Delhi.

REFERENCES:

1. Rao C.S. (2006) Environmental Pollution Control Engineering, 2nd edition, New Age International, New delhi
2. W.L.Heumann (1997), Industrial Air Pollution Control Systems, McGraw Hill, New York.
3. Rao M.N. & Rao H V N. (1996), Air Pollution Control, Tata-McGraw Hill, New Delhi.

OCE504A POLLUTION CONTROL AND MONITORING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the factors that must be satisfied for potable water, land and air for the removal and treatment of pollutants.
2. To provide a strong link between the Pollution Damage, Public Authority Control Systems and Technical Control Systems.
3. To know the relationship between social, legislative and biological constraints in a modern developed society.

UNIT I WATER POLLUTION & CONTROL 9

Natural process-pollution due to industrial, agricultural and municipal wastes-limitations of disposal by dilution-BODconsideration in streams – Oxygen Sag Curve-Water pollution control legislation.

UNIT II AIR POLLUTION AND CONTROL 9

Pollution and their sources-effects of pollution on human health, vegetation and climate-prevention and control ofparticulate-industry and air-pollution surveys and sampling-Air quality monitoring- air pollution control legislation.

UNIT III NOISE POLLUTION AND CONTROL 9

Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution;fundamentals of sound generation, propagation etc; sound measurement; sound level meters – types, components,Measures for prevention and control of noise; environmental and industrial noise; noise control legislation.

UNIT IV SOLID WASTE MANAGEMENT 9

Source characteristics – quantities – collection methods and disposal techniques – sanitary landfill – incineration – andpyrolysis, composting, aerobic and anaerobic- economics of composting; recycling and reuse.

UNIT V ENVIRONMENTAL SANITATION 9

Relation of food to disease-principles of food sanitation-sanitation of kitchens, restaurants and other cateringestablishments-quality changes in milk-milk as carrier of infection-pasteurization of milk-HTST and LTLT processes –cattle shed sanitation. Orientation of buildings with respect to the direction of prevailing winds and solar movement.Air movement inside the buildings for a healthy residential environment.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Describe the principles of the biological and chemical treatment processes that are required to ensure adequate quality and quantities of potable water.
2. Implement the principal techniques currently in use for wastewater treatment and to review operational procedures for the plant involved.

3. Use advanced methods for monitoring and modeling spatial and temporal patterns of pollution

TEXT BOOKS:

1. Peavy, H.S., Rowe,D.R and George Tcnobanoglous (2001), Environmental Engineering, Mc-Graw Hill company, New Delhi.
2. Rao C.S. (1996), Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi.

REFERENCES:

1. Vesilind (1997), Introducing to Environmental Engineering, PWS Publishing Company.
2. Gerard Kiley (1997), Environmental Engineering, Irwin McGraw-Hill.

OCE505A	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects.

UNIT I INTRODUCTION 9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIAin project cycle –EIA Notification and Legal Framework–Stakeholders and their Role in EIA–Selection & Registration Criteria for EIA Consultants

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices –Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis ofalternatives.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Public Hearing- Environmental Clearance Post Project Monitoring.

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal –Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects –Roads andBridges – Mass Rapid Transport Systems – Airports - Power plants – CETPs- Waste Processing and Disposal facilities.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have ability to

1. Carry out scoping and screening of developmental projects for environmental and socialassessments
2. Explain different methodologies for environmental impact prediction and assessment
3. Plan environmental impact assessments and environmental management plans
4. Evaluate environmental impact assessment reports.

TEXTBOOKS:

1. Canter, R.L, "Environmental impact Assessment ", 2nd Edition, McGraw Hill Inc, NewDelhi,1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L.b Tu,"Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.

REFERENCES:

1. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment"conceptual and methodological advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training ResourceManual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", BlackwellScience New York, 1998.
4. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government ofIndia, New Delhi, 2010.
5. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, 2009.

OPEN ELECTIVE-II
SEMESTER VII

OCE701A HAZARDOUS WASTE MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on sources and classification of hazardous waste.
- To understand the suitable treatment facility and disposal methods for handling hazardous wastes.
- To make the students conversant with the hazardous management rules and regulations.

UNIT I INTRODUCTION TO HAZARDOUS WASTE 9

Hazardous waste definition, sources, identification and classification; Collection, handling, storage and transport, treatment storage and disposal facility (TSDF) Hazardous waste management rules and regulations.

UNIT II NUCLEAR WASTE 9

Characteristics – Types – Nuclear waste – Uranium mining and processing – Power reactors – Refinery and fuel fabrication wastes – spent fuel – Management of nuclear wastes – Decommissioning of Nuclear power reactors – Health and environmental effects

UNIT III BIOMEDICAL WASTE 9

Introduction to biomedical wastes, sources, classification, collection, segregation, treatment and disposal. Biomedical waste management rules.

UNIT IV E-WASTE 9

Introduction - e-waste characteristics, e-waste generation, collection, transport, recycling and disposal methods; Effects of e-wastes on the society and environment. E-waste waste management rules

UNIT V PLASTIC WASTE 9

Plastic Waste – Sources, Production, Global and Indian Context; Plastic Waste Management Practices – Plastic management- recycling, energy production, landfilling, other application

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

1. Identify the sources and classify the hazardous wastes.
2. Examine physical, chemical and biological characteristics of hazardous wastes
3. Analyse activities associated with the management of hazardous wastes
4. Formulate and plan suitable treatment facility for handling hazardous wastes
5. Design a secured landfill for the disposal of hazardous wastes
6. Apply the hazardous management rules and regulations

TEXT BOOKS:

1. Hazardous Waste Management, LaGrega M.D., Buckingham P.L. and Evans J.C., Waveland Pr Inc., 2010, Reissue Edition
2. Waste Management Practices: Municipal, Hazardous and Industrial, John Pichtel, CRC Press, 2014, 2nd Edition

REFERENCES:

1. Hazardous Wastes - Sources, Pathways, Receptors, Richard J. Watts, John Wiley and Sons, 1998, 1st Edition.
2. Solid and Hazardous Waste Management M.N. Rao, Razia Sultana and Sri Harsha Kota BS Publications 2017.
3. Geotechnical Aspects of Landfill Design and Construction, Qian X, Koerner R M and Gray D H, Prentice Hall, 2002, 1st Edition

OCE702A GREEN BUILDING AND TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- Learn the principles of planning and orientation of buildings.
- Acquire knowledge on various aspects of green buildings

UNIT I INTRODUCTION TO GREEN BUILDINGS 9

Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

UNIT II SITE SELECTION AND PLANNING 9

Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc.

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

UNIT III ENERGY EFFICIENCY 9

Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT IV BUILDING MATERIALS 9

Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management

UNIT V INDOOR ENVIRONMENTAL QUALITY 9

Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be expected to:

1. Understand the concepts of green buildings
2. Explain the principles of building planning, its bylaws and provide facilities for rainwater harvesting
3. describe the concepts of sustainable design and green building techniques including energy efficiency
4. Understand the concepts of materials used
5. Understand indoor environmental quality management

TEXT BOOKS:

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.

REFERENCES:

1. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
2. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
3. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
4. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley &Sons, New York, 2008.
5. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

OCE703A TESTING OF MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various destructive and non-destructive testing methods of materials and its industrial applications with these accidents.

UNIT I INTRODUCTION TO MATERIALS TESTING 9

Overview of materials, Classification of material testing, Purpose of testing, Selection of material, Development of testing, Testing organizations and its committee, Testing standards, Result Analysis, Advantages of testing.

UNIT II MECHANICAL TESTING 9

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT III NON DESTRUCTIVE TESTING 9

Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT IV MATERIAL CHARACTERIZATION TESTING 9

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

UNIT V OTHER TESTING 9

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo-mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

1. Identify suitable testing technique to inspect industrial component
2. Ability to use the different technique and know its applications and limitations.

TEXTBOOKS:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2. Cullity, B. D., "Elements of X-ray diffraction", 3rd Edition, Addison-Wesley Company Inc., New York, 2000.
3. P. Field Foster, "The Mechanical Testing of Metals and Alloys" 7th Edition, Cousens Press, 2007.

REFERENCES:

1. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.
2. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA.
3. Brandon D.G., "Modern Techniques in Metallography", Von Nostrand Inc. NJ, USA, 1986.