MA19101 **MATRICES AND CALCULUS** **3 1 0 4**

(COMMON TO ALL BRANCHES)

OBJECTIVES

To enable the students to

- find the Eigenvalues and Eigenvectors of a real matrix and discuss their properties, reduce a real symmetric matrix from quadratic form to canonical form.
- acquire knowledge on single variable calculus.
- explain functions of several variables, Taylor's series expansion, Jacobians and compute the maximum & minimum values.
- acquaint the student with the concepts of basic integration and integration by parts.
- explain the double & triple integrals, discuss the change of order of integration and use multiple integrals to find the area & volume.

UNIT I MATRICES **12**

Characteristic equation - Eigenvalues and Eigenvectors of a real matrix - Properties – Statement and applications of Cayley-Hamilton theorem - Diagonalisation of a real symmetric matrix by orthogonal transformation - Quadratic form - Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS **12**

Limits and Continuity, properties of limit and classification of discontinuities - Tangent problems. Differentiation - Standard forms, Successive differentiation and Leibnitz theorem**.** Mean value theorem - Rolle's theorem, Maxima and Minima, Concavity.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **12**

Partial derivatives - Euler's theorem for homogenous functions - Total derivatives - Differentiation of implicit functions - Jacobians - Taylor's expansion - Maxima and Minima - Method of Lagrangian multipliers.

UNIT IV INTEGRAL CALCULUS **12**

Area Problem - Indefinite and definite integrals - Properties of integrals. Methods of integration - Substitution method, Integration by parts, Bernoulli's formula - Reduction formulae involving exponential and trigonometric functions.

UNIT V MULTIPLE INTEGRALS **12**

Double integration - Cartesian and polar coordinates - Change of order of integration - Change of Variables. Triple integration in Cartesian co-ordinates - Area as double integral - Volume as triple integral.

TOTAL PERIODS: 60

OUTCOMES

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

- identify the solutions of the characteristic equations and to understand the technique of diagonalizing a matrix which would render the eigen solution procedure very simple.
- understand the concepts of calculus of single variate functions.
- know the functions of more than one variable, from the points of view of their differentiation, series expansions and extreme values, which are encountered in engineering studies.
- understand the basic solving techniques of integration.
- apply the methods of single, double and triple integration, which are needed in their studies in other areas and gain confidence to handle integrals of higher orders.

TEXT BOOKS

1. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,(2011).
2. Dr.P.Jayakumar, and Dr.B.Kishokkumar "Matrices and Calculus", Global Publishers, Chennai.,(2015).
3. T. Veerarajan., "Engineering Mathematics", 3rd Edition, Tata McGraw Hill, (2011).

REFERENCE BOOKS

1. James Stewart, "Calculus ", 8th Edition, Cengage Learning, USA 2015 reprint.
2. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition, Wiley Publications.
3. Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd.,(2011).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education,(2012).
5. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2008).

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	2	3

EN19101 **ENGLISH COMMUNICATIONSKILLS I** **2 0 2 3**

(COMMON TO ALL BRANCHES)

COURSE OBJECTIVES

To enable the students to

- impart knowledge about the importance of vocabulary andgrammar.
- help the students of engineering and technology develop a strong base in the use ofEnglish.
- improve the reading skills of the students so as to enable them to communicate with confidence inEnglish.
- develop their basic speaking skills in delivering impromptu talks and participating in conversations withconfidence.
- enable the students to write / draft effective essays and emails for effectivecommunication.

UNITI VOCABULARYANDGRAMMAR 9

General Vocabulary - Word Formation - Prefix and suffix - Synonyms - Antonyms - Spelling – Homophones - Homonyms - Word used as Nouns and Verbs - Comparative Adjectives - Phrasal verbs - Acronyms - Abbreviations - Tenses - Cause and Effect Expressions - Subject Verb Agreement - Wh questions - Yes or No questions - Articles - Sentence Structures - Discourse Markers - Single line definition.

UNITII LISTENING 6

Listening and transferring of information, listening to dialogues, listening to informal conversation- listening to short talks and answering questions- understanding the structure of conversations- telephone etiquette.

UNITIII READING 3

Reading - Sub-Skills of Reading - skimming-scanning – predicting - Reading Comprehension (Reading short passages and answering multiple choice and open-ended questions) - developing hints.

UNITIV WRITING 9

Writing - Describing - Defining - Classifying - Providing examples or evidence - Writing Introduction and Conclusion - Use of Cohesive devices and reference words - Writing essays (issue based, compare and contrast, Description, Narrative, Persuasive, Creative writing) - E-Mails (Business Correspondence, Letter Inviting delegates, Accepting, Declining) Instructions - Note-Making - Minutes of meeting - Jumbled Sentences - Interpreting visual information - Flow Chart, Pie Chart, Bar Chart(Transcoding).

UNITV SPEAKING 3

Introducing oneself - (personal information name, background, study details, areas of interest- speaking about one's hobbies, strengths and weaknesses, role model and future ambition)- Role Play- impromptu talks.

TOTALPERIODS: 30

LIST OF EXERCISES

1. Me-chart
2. Roleplay
3. Informalchat
4. Formalconversation
5. Narration of a story, Narrating anincident
6. JAM
7. Turncourt
8. PresentationSkills

TOTALPERIODS: 30

COURSE OUTCOMES

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

- use suitable vocabulary and grammar with confidence and express their ideas both in speech and writing.
- listen and comprehend classroom lectures, short talks and conversations.
- read, interpret and analyze a given text effectively, and use cohesive devices in spokenand written English.
- understand English and converseeffectively.
- write flawless sentences, essays andletters.

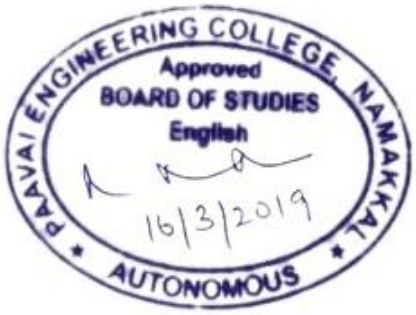
TEXT BOOKS

1. N P Sudharshana, C.Savitha. English Technical Communication. Cambridge UniversityPress India Pvt.Ltd, NewDelhi.2016.
2. Mahalakshmi.S.N. English and Workbook for Engineers. V.K. Publications, Sivakasi.2017.

REFERENCE BOOKS

1. Raman, Meenakshi&Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi.2011.
2. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi.2005
3. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi,2001.

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	2	1	2	2	1	-	-
CO2	-	-	-	-	2	3	2	3	1	3	1	-	-	-
CO3	-	-	-	3	-	2	-	2	2	2	2	2	-	-
CO4	-	-	-	-	-	2	2	2	2	3	1	1	-	-
CO5	-	-	-	2	-	-	-	3	3	3	3	1	-	-



MA19101 **MATRICES AND CALCULUS** **3 1 0 4**

(COMMON TO ALL BRANCHES)

OBJECTIVES

To enable the students to

- find the Eigenvalues and Eigenvectors of a real matrix and discuss their properties, reduce a real symmetric matrix from quadratic form to canonical form.
- acquire knowledge on single variable calculus.
- explain functions of several variables, Taylor's series expansion, Jacobians and compute the maximum & minimum values.
- acquaint the student with the concepts of basic integration and integration by parts.
- explain the double & triple integrals, discuss the change of order of integration and use multiple integrals to find the area & volume.

UNIT I MATRICES **12**

Characteristic equation - Eigenvalues and Eigenvectors of a real matrix - Properties – Statement and applications of Cayley-Hamilton theorem - Diagonalisation of a real symmetric matrix by orthogonal transformation - Quadratic form - Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS **12**

Limits and Continuity, properties of limit and classification of discontinuities - Tangent problems. Differentiation - Standard forms, Successive differentiation and Leibnitz theorem**.** Mean value theorem - Rolle's theorem, Maxima and Minima, Concavity.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **12**

Partial derivatives - Euler's theorem for homogenous functions - Total derivatives - Differentiation of implicit functions - Jacobians - Taylor's expansion - Maxima and Minima - Method of Lagrangian multipliers.

UNIT IV INTEGRAL CALCULUS **12**

Area Problem - Indefinite and definite integrals - Properties of integrals. Methods of integration - Substitution method, Integration by parts, Bernoulli's formula - Reduction formulae involving exponential and trigonometric functions.

UNIT V MULTIPLE INTEGRALS **12**

Double integration - Cartesian and polar coordinates - Change of order of integration - Change of Variables. Triple integration in Cartesian co-ordinates - Area as double integral - Volume as triple integral.

TOTAL PERIODS: 60

OUTCOMES

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

- identify the solutions of the characteristic equations and to understand the technique of diagonalizing a matrix which would render the eigen solution procedure very simple.
- understand the concepts of calculus of single variate functions.
- know the functions of more than one variable, from the points of view of their differentiation, series expansions and extreme values, which are encountered in engineering studies.
- understand the basic solving techniques of integration.
- apply the methods of single, double and triple integration, which are needed in their studies in other areas and gain confidence to handle integrals of higher orders.

TEXT BOOKS

1. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,(2011).
2. Dr.P.Jayakumar, and Dr.B.Kishokkumar "Matrices and Calculus", Global Publishers, Chennai.,(2015).
3. T. Veerarajan., "Engineering Mathematics", 3rd Edition, Tata McGraw Hill, (2011).

REFERENCE BOOKS

1. James Stewart, "Calculus ", 8th Edition, Cengage Learning, USA 2015 reprint.
2. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th Edition, Wiley Publications.
3. Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Ltd.,(2011).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education,(2012).
5. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2008).

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	2	3

EN19201 **ENGLISH COMMUNICATIONSKILLSII** **2 0 2 3**

(COMMON TO ALL BRANCHES)

COURSE OBJECTIVES

To help the students of engineering and technology to

- enhance their ability to listen, read, write and speakEnglish.
- comprehend and write essays and prepare short project reports related to their branches of specialization.
- enhance their ability to read and comprehend technicaltexts.
- make effective presentations on topics in engineering andtechnology.
- participate successfully in GroupDiscussions.

UNITI VOCABULARYANDGRAMMAR **9**

General Vocabulary - Prefixes & Suffixes - One word substitutions - Active Voice and Passive Voice - Collocations - Fixed expressions (adhere to, on the part of etc.) - Idioms and Phrases - Compound Nouns - Numerical Expression - Preposition - Direct into Indirect Speech - If Conditionals - Purpose expression - Editing - Extended Definitions - Simple, Compound and ComplexSentences.

UNITII LISTENING **3**

Listening to news and announcements, listening to a telephone conversation- Listening to model interviews - TED Talks.

UNITIII READING **6**

Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading - Critical reading- Reading articles in newspapers, journals.

UNITIV WRITING **9**

Check list – Recommendation - Writing a job application - Resume (E-mail format) - Technical Report-Writing (Industrial Visit report, Accident report, Feasibility report, Survey report, Mini project proposal) - Paragraph Writing - Advertisement writing - Designing poster - Film Book review.

UNITV SPEAKING **3**

Syllable - Stress - Intonation - Silent Letters - Presentations on a given topic - Mini presentation in small groups - Group discussion - Interview Techniques - mock interviews.

TOTALPERIODS: 30

LIST OF EXERCISES

1. ShipWreck
2. Introducing a product (SpotLight)
3. Vocabulary Buildinggames
4. Description of an event /Competition
5. Master of Ceremony (MC, Welcome Address, Vote of thanks, prizedistribution)
6. MC (Introducing a Guest, Feed back of theparticipant)
7. GD
8. MockInterview

TOTALPERIODS: 30

COURSE OUTCOMES

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

- speak with clarity and confidence.
- read, interpret and analyse a given text.
- write comprehensive reports, job applications and draft effective e-mails.
- make effective presentations using power point.
- participate successfully in GroupDiscussions.

TEXT BOOKS

1. N P Sudharshana, C.Savitha. English Technical Communication. Cambridge UniversityPress India Pvt.Ltd, NewDelhi.2016.
2. Mahalakshmi.S.N. English and Workbook for Engineers. V.K. Publications, Sivakasi.2017.

REFERENCE BOOKS

1. Raman, Meenakshi&Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi.2011.
2. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi.2005
3. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi.2001.

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	2	-	3	2	1	-	-
CO2	-	-	2	-	-	3	2	3	1	3	-	-	-	-
CO3	-	-	-	3	-	2	-	2	2	2	2	2	-	-
CO4	-	-	-	-	-	2	2	2	3	3	-	-	-	-
CO5	-	-	-	2	-	-	-	3	3	3	3	-	-	-

ME19201 **ENGINEERING MECHANICS** **3 2 0 4**

(COMMON TO AERO / AGRI / CIVIL / MCT / MECH)

COURSE OBJECTIVES

- To solve basic concepts of engineering problems such as force, displacement, velocity and acceleration.
- To gain knowledge in the concepts involved in equilibrium of rigid bodies.
- To impart analytical skills to solve problems in moments of surfaces and solids
- To develop knowledge in the dynamics of particles due to force.
- To understand the rigid body problems subjected to friction and elements.

UNIT I BASICS & STATICS OF PARTICLES 15

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem, Parallelogram and triangularLaw of forces - Vectors - Vectorial representation of forces and moments - Vector operations: additions, subtraction, dot product, cross product - Coplanar Forces - Resolution and Composition of forces - 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 15

Free body diagram - Types of supports and their reactions - requirements of 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 - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS 15

Determination of Areas and Volumes - First moment of area and the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, - Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia

UNIT IV DYNAMICS OF PARTICLES 15

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

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 15

Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction.

Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

TOTAL: 75 PERIODS

COURSE OUTCOMES

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

- apply the differential principles to solve engineering problems.
- gain in-depth knowledge in the equilibrium of rigid bodies.

- identify and calculate the various properties of surfaces and solids
- categorize the various forces analysis in structures.
- solve rigid body problems subjected to dynamic forces.

TEXT BOOKS

1. Dr.N.Kottiswaran., "Engineering Mechanics"10th Edition, Sri Balaji Publications 2010.
2. Palanichamy, M.S., Nagam, S., "Engineering Mechanics - Statics & Dynamics", Tata McGraw-Hill, (2001).

REFERENCES

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education AsiaPvt. Ltd.,
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics",4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", VikasPublishing House Pvt. Ltd., (2000).

WEBLINKS

1. http://www.nptel.ac.in/courses/112103109/
2. https://www.coursera.org/learn/engineering-mechanics-statics/home/info
3. http://www.myopencourses.com/subject/engineering-mechanics-2

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	**Programme Outcomes(POs)**													
	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	-	-	-	2	2	3
CO2	3	3	3	3	2	-	-	-	-	-	-	2	2	3
CO3	3	3	3	3	2	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	2	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	2	-	-	-	-	-	-	2	2	3

CS19201 PROGRAMMING IN PYTHON 2 0 2 3

(COMMON TO AERO/AGRI/BM/CIVIL/CHEM/ECE/EEE/MECH/MCT/ME/FT/PHARMA)

COURSE OBJECTIVES

To enable the students to

- understand the basics of computer and basic elements of python programming.
- study various looping statements, control statements and functions in python.
- analyze different string operations and lists.
- learn how to use tuples and dictionaries in python program.
- study the exception handling mechanism and file handling.

UNIT I BASICS OF COMPUTER AND PYTHON PROGRAMMING 6

Introduction to Computers: Generation and classification of computers – basic organization of computer – Number Systems (Binary, Decimal, Octal and Hexadecimal) – Algorithm – Flowchart – Pseudo code.

Introduction to Python: Python Interpreter-Interactive and script mode -Values and types, operators, expressions, statements, precedence of operators, multiple assignments, comments.

UNIT II CONTROL STATEMENTS AND FUNCTIONS IN PYTHON 6

Conditional and looping Statements: Conditional (if), alternative (if-else), chained conditional (if-else-if)-Iteration-while, for, break, continue, pass.

Functions: Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.

UNIT III STRINGS AND LISTS 6

Strings: String slices, immutability, string methods and operations.

Lists: creating lists, list operations, list methods, mutability, aliasing, cloning lists

UNIT IV TUPLES AND DICTIONARIES 6

Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value.

Dictionaries: operations and methods, Nested Dictionaries.

UNIT V FILES AND MODULES 6

Files: Text files, reading and writing files(read number of characters, lines and words in a file) , format Operator , command line arguments – errors and exceptions.

Modules: Python Modules - Creating own Python Modules.

TOTAL PERIODS 30

LIST OF EXPERIMENTS

1. Implement various control statements in python.
2. Create python programs to implement looping statements.
3. Implement user defined functions using python.
4. Develop python programs to perform various string operations.
5. Develop python programs to perform operations on list.

6. Develop python programs to work with Tuples.
7. Create python program to implement dictionary.
8. Implement python program to perform file operations.
9. Implement python programs using modules.
10. Create python program to handle exceptions.

TOTAL PERIODS 30

COURSE OUTCOMES

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

- classify and make use of python programming elements to solve and debug simple logical problems
- experiment various control statements, looping statements and functions in python.
- develop python programs using strings and lists.
- implement tuples and dictionaries in python program.
- create python programs to work with files and handling exceptions.

TEXT BOOKS

1. Ashok NamdevKamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education,2018.

REFERENCES

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013.

Mapping of Course Outcomes with Programming Outcomes
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												Programme Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	2	3	3	-	-	-	-	-	-	-	2	3	3
CO3	2	3	1	-	-	-	1	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	1	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	3	2

CE16301 **ENGINEERING GEOLOGY** **3 0 0 3**

COURSE OBJECTIVES

- To describe weathering process and mass movements
- To gain knowledge about various properties of minerals and their engineering significance.
- To acquire knowledge of various classification of rocks.
- To interpret the importance of different geological features and their effects.
- To apply the principles of geological investigations in civil engineering structures.

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.

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 METHOD **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 GEOLOGICAL INVESTIGATION **9**

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings; Coastal protection structures; Investigation of Landslides and earthquakes - causes and mitigation ; seismic zonation – seismic zones of India.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the various geological agents and processes involved.
- identify the available minerals by their properties and behavior.
- classify and identify the available rock in the construction site.
- interpret the different geological features and their engineering importance.
- apply the geological concepts in civil engineering projects.

TEXT BOOKS

1. Parbin Singh, "Engineering and General Geology", S.K.Kataria& Sons, 2008.
2. Venkatareddy. D. Engineering Geology, Vikas Publishing House Pvt. Ltd. 2010.

REFERENCES

1. Muthiayya, V.D.(1969), " A Text of Geology", Oxford IBH Publications, Calcutta.
2. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
3. F.G.Bell. Fundamentals of Engineering Geology, B.S. Publications. Hyderabad 2011.
4. Dobrin, M.B An introduction to geophysical prospecting, McGraw-Hill, New Delhi, 1988
5. Varghese, P.C., Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi, 2012.
6. MarlandP.Billings, "Structural Geology", PHI Learing Pvt. Ltd. New Delhi, 2012

WEB LINKS

1. http://studentsuvidha.com/forum/Forum-Engineering-Geology-btech-Notes-study-material
2. https://www.examrace.com/IES/IES-Free-Study-Material/Civil-Engineering/Engineering-Geology

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	2	-	-	-	-	-	2	-
CO2	2	-	-	2	2	-	-	-	2	-	-	-	2	-
CO3	2	2	1	2	-	-	-	-	2	-	-	-	2	-
CO4	2	2	-	2	2	2	2	2	-	-	2	2	2	-
CO5	-	-	2	2	-	2	2	2	2	-	2	2	2	-

CE16302 CONSTRUCTION MATERIALS 3 0 0 3

COURSE OBJECTIVES

- To identify the characteristics of various building materials.
- To analyse various materials commonly used in civil engineering construction and their properties
- To gain knowledge about various processes involved in the manufacturing of concrete
- To study the importance and benefits of timber and other products
- To gain knowledge of various modern materials used in construction.

UNIT I STONES – BRICKS – CONCRETE BLOCKS 9

Stones as building material – Criteria for selection - Test on stones – Deterioration and preservation of stone work; Bricks – Classification – Manufacturing of clay bricks – Test on bricks – Compressive strength – Water Adsorption – Efflorescence – Bricks for special use – Refractory bricks ; Cement Concrete blocks –Light weight concrete blocks.

UNIT II LIME – CEMENT – AGGREGATES – MORTAR 9

Lime – Preparation of lime mortar; Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and cement mortar – Hydration – Compressive strength – Tensile strength – Fineness – Soundness and consistency – Setting time – Industrial by products – Fly ash; Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance - Grading – Sand Bulking.

UNIT III CONCRETE 9

Concrete – Ingredients – Manufacturing process – 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 - High strength concrete and HPC – Self compacting concrete – Other types of concrete – Durability of Concrete.

UNIT IV TIMBER AND OTHER MATERIALS 9

Timber - Market forms – Industrial timber – Plywood –Veneer – Thermacole – Panels of laminates; Steel - Aluminum and Other metallic materials – Composition – Aluminum composite panel – Uses – Market forms - Mechanical treatment; Paints – Vanishes – Distempers; Bitumen's.

UNIT V MODERN MATERIALS 9

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the various construction materials
- familiarize themselves with the characteristics of basic building materials
- understand the behavior and manufacture of cement and concrete.
- identify the timber materials.
- understand and conserve the modern materials.

TEXT BOOKS

1. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.

REFERENCES

1. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
2. Gambhir. M.L., &NehaJamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd.,2008.
4. Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004
5. Duggal.S.K., "Building Materials", 4th Edition, New Age International, 2008.

WEB LINKS

1. http://ceae.colorado.edu/~saouma/Lecture-Notes/s4a.pdf
2. http://pareto.uab.es/xmg/Docencia/IO-en/IO-Introduction.pdf

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	2	-	3	-	2	-	-	-	-	3	-
CO2	3	-	3	-	1	-	1	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	1	-	-	3	3
CO4	3	-	-	-	-	-	-	-	-	-	2	-	3	-
CO5	2	-	-	2	-	-	-	2	-	-	-	1	3	2

CE16303 STRENGTH OF MATERIALS I 3 0 0 3

COURSE OBJECTIVES

- To understand the fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin shells.
- To analyze the truss elements under complex state of stress by means of analytical methods.
- To acquire knowledge about shear force and bending moment for all statically determinate beams by recognizing the beam type and loading.
- To know the behavior of members subjected to pure torsion and also to develop knowledge about springs.
- To find deflection of beam with different load and different method and to provide exposure of the concepts of internal stress in beams of various cross sections.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid and deformable bodies – Stability, strength and stiffness - Axial and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Biaxial state of stress – Elastic Constants; Stresses and deformation of thin cylindrical and spherical shells; Stresses at a point – Stresses on inclined planes - Principal stresses and principal planes – Mohr's circle of stress

UNIT II ANALYSIS OF PLANE TRUSSES 9

Stability and equilibrium of plane frames – Perfect frames - Types of trusses – Analysis of forces in truss members – Method of joints – Method of tension co-efficient – Method of sections.

UNIT III BENDING OF BEAMS 9

Beams – Types and transverse loading on beams – Shear force and bending moment in beams – Cantilever beams – Simply supported beams and over-hanging beams; Theory of simple bending – Bending stress distribution – Load carrying capacity – Proportioning of sections; Leaf springs; Flitched beams – Shear stress distribution.

UNIT IV TORSION 9

Theory of simple torsion - Stresses and deformation in circular and hollow shafts – Stepped shafts – Shafts fixed at both ends; Stresses and deflection in helical springs- introduction to torsion of rectangular sections- Warping.

UNIT V DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method for computation of slopes and deflections in determinate beams- deflection due to shear.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the fundamental concepts of stresses and strains in one and two dimensional states.
- analyse determinate beams and plane trusses.
- understand the bending of different types of beams.
- get sufficient knowledge about designing shafts to transmit required power and also springs for its maximum energy storage capacities.
- find the deflection of beams.

TEXT BOOKS

1. Bansal R.K, Strength of Materials (Mechanics of Solids), Laxmi publishing PvtLtd,New Delhi, 2012
2. Rajput.R.K. Strength of Materials, S.Chand& Company Ltd., New Delhi 2014.

REFERENCES

1. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
2. Punmia B.C, Ashok K. Jain and Arun K. Jain, Theory of Structures (SMTS II), Laxmi publishing Pvt Ltd, New Delhi,2004.
3. Punmia B.C, Ashok K. Jain and Arun K. Jain, Mechanics of Structures (SMTS I), Laxmi publishing pvt Ltd,New Delhi,2011
4. Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014

WEB LINK

1. http://www.esm.psu.edu/courses/emch213d/tutorials/animations.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	3	-	2	-	-	-	-	-	-	-	1	2	1
CO3	2	3	2	2	-	-	-	-	-	-	-	1	1	1
CO4	2	3	2	2	-	-	-	-	-	-	-	1	2	1
CO5	2	3	2	2	-	-	-	-	-	-	-	1	1	1

CE16304 **FLUID MECHANICS** **3 0 0 3**

COURSE OBJECTIVES

- To understand the importance, application and inter-relationship of various properties of fluid.
- To obtain knowledge in kinematic and dynamics flow of fluid and various devices used to measure the velocity and discharge of fluid.
- To gain knowledge of dimensional analysis of fluid.
- To interpret the applications of the conservation laws to flow through pipes (both laminar and turbulent)
- To gain knowledge about boundary layers

UNIT I FLUIDS PROPERTIES AND FLUID STATICS **9**

Scope of fluid mechanics - Definitions of a fluid - Methods of analysis - Dimensions and units - viscosity, density, perfect gas, vapour pressure and surface tension - Basic equation of fluid statics - Pressure measurements - Manometers - Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies - Relative equilibrium.

UNIT II BASIC CONCEPTS OF FLUID FLOW **9**

(a) Kinematics – Methods of describing fluid motion - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets; (b) Dynamics - Dimensional Concepts of System and Control volume - Application of control volume to continuity, energy and momentum - Euler's equation of motion along a stream line - Bernoulli's equation - Applications to velocity and discharge measurements - Linear momentum equation and moment – of – momentum equations and their applications.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES **9**

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted Models.

UNIT IV INCOMPRESSIBLE VISCOUS FLOW **9**

Laminar flow between parallel plates, and pipes - Development of laminar and turbulent flows in pipes - Reynolds experiment – Darcy-Weisbach equation - Moody diagram - Major and minor losses of flow in pipes - Pipes in series and in parallel.

UNIT V BOUNDARY LAYERS AND TRANSPORT BY ADVECTION AND DIFFUSION **9**

Definition of boundary layers - Displacement, momentum and energy thickness - Laminar and turbulent boundary layers - Momentum integral equation – Steady molecular diffusion and conduction – Turbulent transport equations – Channel diffusion and Dispersions and Applications.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- attain a thorough knowledge about various fundamental properties of fluids.
- apply the continuity, energy and momentum equations to fluid flow.
- gain knowledge about various dimensional analysis of fluid.
- distinguish laminar and turbulent flow through pipes and compute the energy losses in pipe flow.
- select appropriate model to provide solution to a real time problem related to hydraulics.

TEXT BOOKS

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, 9th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2017.
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi, 20th edition, 2015.

REFERENCES

1. Jain A. K. "Fluid Mechanics", Khanna Publishers, 2010
2. R.K.Rajput., “A text book of Fluid Mechanics”, S.Chand and Company, NewDelhi, 2007.
3. Roberson J.A and Crowe C.T., Engineering Fluid Mechanics. Jaico Books Mumbai, 2000.
4. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th ed) Tata McGraw Hill, New Delhi, 1998

WEB LINKS

1. http://bookboon.com/en/engineering-fluid-mechanics-ebook
2. http://www.engineeringtoolbox.com/fluid-mechanics-t_21.html
3. http://www.efunda.com/formulae/fluids/overview.cfm
4. http://nptel.ac.in/courses/105101082/
5. http://nptel.ac.in/courses/105103095/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	-	1	-	-	-	-	-	-	1	3	-
CO2	2	1	1	-	1	-	-	-	-	-	-	1	3	-
CO3	2	2	2	-	1	-	-	-	-	-	1	1	3	1
CO4	2	2	2	-	1	-	-	-	-	-	1	1	3	1
CO5	2	3	2	-	1	-	-	-	-	-	1	1	3	1

CE16305 **SURVEYING I** **3 0 0 3**

COURSE OBJECTIVES

- To understand the importance of surveying in the field of civil engineering
- To gain knowledge of chain surveying, compass surveying and plane table surveying.
- To find the elevation of points by using various leveling methods.
- To use the basics of leveling application in civil engineering field
- To gain knowledge about theodolite survey in elevation and angular measurements.

UNIT I FUNDAMENTALS AND CHAIN SURVEYING 9

Definition- Classifications - Basic principles-Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing - Plotting – applications- enlarging the reducing the figures – Areas enclosed by straight line irregular figures- digital planimetre.

UNIT II COMPASS AND PLANE TABLE SURVEYING 9

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 III LEVELLING 9

Level line - Horizontal line - Datum - Bench marks -Levels and staves - temporary andpermanent adjustments – Methods of levelling - Fly levelling - Check levelling - Procedure in levelling - Booking -Reduction - Curvature and refraction - Reciprocal levelling – Sources of Errors in leveling - Precise levelling - Types of instruments - Adjustments - Field procedure

UNIT IV LEVELLING APPLICATIONS 9

Longitudinal and Cross-section-Plotting - Contouring - Methods - Characteristics and uses ofcontours – Plotting – Methods of interpolating contours – Computations of cross sectional area sand volumes - Earthwork calculations - Capacity of reservoirs - Mass haul diagrams.

UNIT V THEODOLITE SURVEYING 9

Theodolite - Types - Description - Horizontal and vertical angles - Temporary and permanent adjustments – Heights and distances– Tangential and Stadia Tacheometry – Subtense method - Stadia constants - Anallactic lens.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the working principles of survey instruments.
- calculate included angles and bearings by using compass, plotting and adjustment of traverse by plane table survey.
- describe the uses of levelling instruments
- interpret survey data and compute areas and volumes.
- calculate horizontal angles and vertical angles by using tacheometer.

TEXT BOOKS

1. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 2010.
2. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2013.

REFERENCES

1. Chandra A.M., "Plane Surveying", New Age International Publishers, 2015.
2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 2008.
3. Alak De, "Plane Surveying", S. Chand & Company Ltd., 2014.
4. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice",7thEdition,McGraw Hill, 2001.
5. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
6. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2011.

WEB LINKS

1. nptel.ac.in/courses/105104101/1
2. https://sites.google.com/a/mitr.iitm.ac.in/iitmcivil/ce2080

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak													
Cos	**Programme Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	1	2	-	-	-	2	1	-	1	2	1
CO2	1	1	1	1	1	-	-	-	1	1	-	1	1	1
CO3	2	2	1	2	2	-	-	-	1	1	-	1	2	1
CO4	2	2	1	2	1	-	-	-	2	1	-	1	2	1
CO5	1	1	1	1	2	-	-	-	2	1	-	1	2	1

CE16306 **SURVEY PRACTICAL I** **0 0 4 2**

COURSE OBJECTIVES

- To impart knowledge about measuring area and offset by using chain surveying.
- To familiarize themselves with the concepts of bearing and area measurement using different compass.
- To provide training in different methods of plane table surveying.
- To acquirethe knowledge of finding the reduced levels using different methods of leveling.

LIST OF EXPERIMENTS

1. Study of chains and its accessories
2. Aligning, Ranging and Chaining
3. Chain Traversing
4. Compass Traversing
5. Plane table surveying: Radiation
6. Plane table surveying: Intersection
7. Plane table surveying: Traversing
8. Plane table surveying: Resection –Three point problem
9. Plane table surveying: Resection – Two point problem
10. Study of levels and levelling staff
11. Fly levelling using Dumpy level
12. Fly levelling using tilting level
13. Check leveling
14. LS and CS
15. Contouring

TOTAL PERIODS 60

COURSE OUTCOMES

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

- handle the conventional surveying instruments such as chain/tape, compass, plane table, and theodolite in the field of civil engineering.
- undergo traverse using various instruments
- prepare contour using levelling instrument.
- use the theodolite effectively for various applications

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	-	-	2	1	-	-	2	1	-	1	2	-
CO2	2	1	-	-	2	2	-	-	2	1	-	1	3	-
CO3	2	2	-	-	2	-	-	-	2	1	-	2	2	1
CO4	2	2	-	-	3	2	-	-	2	1	-	2	2	2

CE16307 **STRENGTH OF MATERIALS LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

- To understand the technical concepts and ways to solve engineering problems through theoretical calculations by conducting experiments.
- To apply the concepts of mechanics of materials to determine the behaviour of materials under load.
- provide the skill sets required to perform experiments and write lab reports.
- obtain practical knowledge on double shear test and impact test on metal.

LIST OF EXPERIMENTS

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

TOTAL PERIODS 60

COURSE OUTCOMES

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

- apply the concepts of mechanics for determining stresses and strains from the member forces.
- determine the behavior of structural elements such as bars, beams and columns subjected to tension, compression, shear, bending and torsion by means of experiments.
- understand the behavior of materials under various loading conditions.
- calculate the double shear and impact strength on metal.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	-	-	1	-	-	-	1	-	-	1	1	1
CO2	2	2	-	-	1	-	-	-	1	-	-	1	1	1
CO3	2	2	-	-	1	-	-	-	1	-	-	1	1	1
CO4	2	2	-	-	1	-	-	-	1	-	-	1	1	1

CE16308 COMPUTER AIDED BUILDING DRAWING 0 0 4 2

COURSE OBJECTIVES

- To provide knowledge of different views of components of a building.
- To familiarize the students with creating, modifying and annotating commands using software.
- To create plan, section and elevation of buildings using drafting software.
- Transfer design into drawings as per IS codes

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
6. Perspective view of single storey building

TOTAL PERIODS 60

COURSE OUTCOMES

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

- have fundamental understanding of 2D and 3D views of buildings and understand the different views of the components of a building.
- use, create, modify and annotation commands.
- create plan, section and elevation of different buildings and take the print out.
- draw the detailing of R.C.C structures.

TEXT BOOKS

1. Sikka V.B., A Course in Civil Engineering Drawing, 4TH Edition, S.K.Kataria and Sons, 2015.
2. George Omura, Mastering in Autocad 2005 and Autocad LT 2005– BPB Publications, 2008

REFERENCES

1. Shah.M.G.,Kale.C.M. andPatki.S.Y., Building Drawing with an Integrated Approach to Built Environment, Tata McGraw Hill Publishers Limited, 2007.
2. Verma.B.P., Civil Engineering Drawing and House Planning, Khanna Publishers, 2010.
3. Marimuthu V.M., Murugesan R. and Padmini S., Civil Engineering Drawing-I, Pratheeba Publishers, 2008.

WEB LINKS

1. www.iitk.ac.in/cad/
2. www.cadl.iiscx.ernet.in/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	3	1	3	-	-	-	-	-	-	2	2	3
CO2	2	2	3	1	3	-	-	-	-	-	-	2	2	3
CO3	2	2	3	1	3	-	-	-	-	-	-	2	2	3
CO4	2	2	3	1	3	-	-	-	-	-	-	2	2	3

SEMESTER IV

NUMERICAL METHODS

MA16404 **(COMMON TO AERO,CIVIL,EEE,MECH & MCT)** **3 2 0 4**

COURSE OBJECTIVES

- To analyse different methods to find solution for a large system of linear equations
- To find the intermediate values for a series of given data
- To develop efficient algorithms for solving problems in science, engineering and technology
- To solve the non linear differential equations that cannot be solved by regular conventional method.
- To apply finite element method to increase the accuracy of second order differential equations

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 15

Solution of equation – Iteration method : Newton Raphson method – Solution of linear system by Gaussianelimination and Gauss - Jordon method – Iterative method – Gauss-Seidel method – Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION 15

Lagrangian Polynomials – Divided differences – Newton's Divided Difference, Hermite Interpolation Polynomial and Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 15

Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpson's 1/3– Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons' rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 15

Single step methods: Taylor series method – Modified Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 15

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL PERIODS 75

COURSE OUTCOMES

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

- comprehend the basics of linear equations.
- apply the interpolation methods for constructing approximate polynomials
- demonstrate the knowledge of numerical differential equations in computational and simulation process
- utilize the concept of initial value problems in the field of science and engineering
- describe the computational procedure of the amount of heat emitted or transferred from an object

TEXT BOOKS

1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2nd ed., Tata McGraw-Hill, 2006.
3. Sankar Rao K " Numerical Methods For Scientisits And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003
2. Gerald C.F. and Wheatley, P.O., "Applied Numerical Analysis" 6th Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyangar , R.K.Jain , "Numerical Methods For Scientific & Engineering Computation"
4. New Age International (P) Ltd , New Delhi , 2005.
5. M.B.K. Moorthy and P.Geetha, "Numerical Methods" , Tata McGraw Hill Publications company, New Delhi, 2011.

WEB LINKS

1. https://www.youtube.com/watch?v=QTQ8bO1F-Dg
2. https://www.youtube.com/watch?v=AT7Olelic8U
3. https://www.youtube.com/watch?v=TH06N7Q7FJw
4. https://www.youtube.com/watch?v=DnBJLpdVHCY
5. https://www.youtube.com/watch?v=5TccPEz2nB8

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO4	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	1	3	2

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Mathematics

CE16401 **SURVEYING II** **3 0 0 3**

COURSE OBJECTIVES

- To understand the trignometrical levelling.
- To adjust the errors encountered during surveying
- To work with total station
- To understand the concept of GPS
- To know the various types of advanced surveying methods.

UNITI CONTROL SURVEYING **9**

Working from whole to part - Horizontal and vertical control methods - Triangulation - Signals - Base line - Instruments and accessories - Corrections - Satellite station - Reduction to centre – Trignometrical leveling-Single and reciprocal observations - Modern trends – Bench marking

UNIT II SURVEY ADJUSTMENT **9**

Errors Sources- precautions and corrections – classification of errors – true and most probable values - weighed observations – method of equal shifts – principle of least squares - normalequation – correlates - level nets- adjustment of simple triangulation networks.

UNIT III TOTAL STATION SURVEYING **9**

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

UNIT IV GPS SURVEYING **9**

Basic Concepts - 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.

UNIT V ADVANCED TOPICS IN SURVEYING **9**

Route Surveying-Reconnaissance- Route surveys for highways, railways and waterways- Curve ranging - Horizontal and vertical curves - Simple curves - Setting with chain and tapes, tangential angles by theodolite, double theodolite - Compound and reverse curves - Transition curves - Functions and requirements. Hydrographic surveying- Tides-MSL- Sounding methods- Three-point problem- Strength of fix-Sextants and station pointer- Astronomical Surveying-field observations and determination of Azimuth by altitude and hour angle methods- fundamentals of Photogrammetry and Remote sensing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- distinguish between the stations calculated by single and reciprocal levelling.
- identify the errors and adjust them in the real time applications.
- gain knowledge about principles and methods of measurement using total station.

- understand the working principle of GPS, its components, signal structure, processing techniques used in GPS observations and error sources.
- demonstrate methods of survey in water bodies by hydrographic surveying, basic concepts adopted in photogrammetry.

TEXT BOOKS

1. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 2010.
2. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2013.

REFERENCES

1. Chandra A.M., "Plane Surveying", New Age International Publishers, 2015.
2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 2008.
3. Alak De, "Plane Surveying", S. Chand & Company Ltd., 2014.
4. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice",7thEdition,McGraw Hill, 2001.
5. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
6. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2011.
7. Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 2004.

WEB LINKS

1. nptel.ac.in/courses/105107122/
2. http://nptel.ac.in/courses/105107122/20

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak													
Cos	**Programme Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	1	2	-	-	-	2	-	-	1	2	1
CO2	1	2	1	1	2	-	-	-	2	-	-	1	2	1
CO3	1	2	1	1	2	-	-	-	1	-	-	2	2	1
CO4	1	2	1	1	2	-	-	-	2	-	-	2	2	1
CO5	1	2	1	1	2	-	-	-	2	-	-	2	2	1

CE16402 APPLIED HYDRAULIC ENGINEERING 3 0 0 3

COURSE OBJECTIVES

- To identify the characteristics uniform flow
- To analyse gradually varied flow and their properties
- To gain knowledge about rapidly varied flow and hydraulic depth
- To understand about the pumps and its characteristics.
- To study the types and characteristics of turbine

UNIT I UNIFORM FLOW 9

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS 9

Dynamic equations of gradually varied and spatially varied flows - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Applications

UNIT III RAPIDLY VARIED FLOWS 9

Application of the energy equation for RVF - Critical depth and velocity - Critical, Sub-critical and Super-critical flow - Application of the momentum equation for RVF - Hydraulic jumps - Types Energy dissipation - Surges.

UNIT IV PUMPS 9

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Flow separation conditions - Air vessels, indicator diagrams and its variations - Savings in work done - Rotary pumps: Gear pump.

UNIT V TURBINES 9

Turbines - Classification - Reaction turbines - Francis turbine, Radial flow turbines, draft tube and cavitation - Propeller and Kaplan turbines - Impulse turbine - Performance of turbine - Specific speed - Runaway speed - Similarity laws.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know about the uniform flow and its computation
- familiarize themselves with the characteristics varied flow
- understandthe behavior of rapidly varied flow
- understand the various type of pumps and its characteristics
- identify the turbine and its characteristics

TEXT BOOKS

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, 9th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2017.
2. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2000

REFERENCES

1. Jain A. K. "Fluid Mechanics", Khanna Publishers, 2010
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi, 20th edition, 2015.
3. Rajesh Srivastava, Flow through open channels, Oxford University Press, New Delhi, 2008

WEB LINKS

1. http://nptel.ac.in/courses/105103021/
2. http://nptel.ac.in/courses/105107059/
3. ebookbrowsee.net › ap › applied-hydraulic-engineering

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	1	-	-	-	-	-	-	1	3	1
CO2	2	2	2	1	1	-	-	-	-	-	-	1	3	1
CO3	2	2	2	1	1	-	-	-	-	-	-	1	3	1
CO4	2	2	2	1	1	-	-	-	-	-	-	1	3	1
CO5	2	2	2	1	1	-	-	-	-	-	-	1	3	1

CE16403 CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICES 3 0 0 3

COURSE OBJECTIVES

- To study the properties, testing and handling of concrete for the construction projects.
- To know the appropriate techniques and practices used in the construction according to the current scenario.
- To gain knowledge about various constructions methodology adopted for substructure construction.
- To acquire emerging ideas in the field of Super structure construction.
- To create awareness about the new construction equipment and its usage in the project.

UNIT I CONCRETE TECHNOLOGY 9

Cements – Grade of cements - concrete chemicals and Applications – Grade of concrete manufacturing of concrete – Batching – mixing – transporting – placing – compaction of concrete –curing and finishing - Testing of fresh and hardened concrete – quality of concrete – Extreme Weather Concreting - Ready Mix Concrete - Non-destructive testing.

UNIT II 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 –pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes –acoustic and fire protection.

UNIT III SUB STRUCTURE CONSTRUCTION 9

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

UNIT IV SUPER STRUCTURE CONSTRUCTION 9

Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks.

UNIT V CONSTRUCTION EQUIPMENT 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the material properties, strength and durability of concrete.
- use suitable construction techniques and practices for the particular project.
- gain exposure in the modern construction techniques adopted in the construction projects.
- use advanced techniques towards speedy and guaranteed projects.
- acquire knowledge about the usage & suitability of new construction equipment in large projects.

TEXT BOOKS

1. Varghese, P.C. "Building construction", Eastern Economy Edition, Second Edition, 2016
2. Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and CompanyLtd, New Delhi, 2008.
3. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", DhanpatRai and Sons, 1997

REFERENCES

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers,1999.
2. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers New Delhi,2002
3. Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi,2012.
4. Dr. Mahesh Varma, “Construction Equipment and its Planning and Application”,Metropolitan Book Company, New Delhi, 1983.
5. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd,New Delhi, 2004

WEB LINKS

1. https://www.youtube.com/watch?v=bA3OsOsrRgc
2. http://www.youtube.com/watch?v=-srRW8Gfvnk

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	-	-	-	1	-	-	1	1	1
CO2	2	-	-	-	1	-	-	-	1	-	-	1	1	1
CO3	2	-	-	-	1	-	-	-	1	-	-	1	1	1
CO4	2	-	-	-	1	-	-	-	1	-	-	1	1	1
CO5	2	-	-	-	1	-	-	-	1	-	-	1	1	1

CE16404 **CONCRETE TECHNOLOGY** **3 0 0 3**

COURSE OBJECTIVES

- To describe the various compositions of concrete
- To understand the usage of admixtures
- To gain knowledge about types of concrete
- To evaluate the quality of concrete
- To know about the uses of modern concrete

UNITI CONSTITUENT MATERIALS **9**

Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements- Water- Quality of water for use in Concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURES **9**

Accelerators-Retarders- Plasticizers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline - Their effects on concrete properties

UNIT III PROPORTIONING OF CONCRETE MIX **9**

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materialsrequired for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design – Mix Design Examples

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE **9**

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete-Determination of Young's Modulus

UNIT V SPECIAL CONCRETES **9**

Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferrocement – Ready mix concrete-SIFCON-Shotcrete – Polymer concrete - High performance concrete- Geopolymer Concrete-Self Compactng concrete

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire and apply fundamental knowledge in the fresh and hardened properties of concrete
- identify the functional role of raw materials and apply this knowledge to mix design philosophy.
- select the correct raw material components and mix design needed to formulate a concrete that meets prescribed specification requirements
- assess the quality of concrete
- understand the use of special concretes

TEXT BOOKS

1. Gupta.B.L.,Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003

REFERENCES

1. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007
2. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, NewDelhi, 2007
3. IS10262-2009 Indian standard concrete mix design

WEB LINK

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=105104030

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	-	-	-	-	-	-	2	1	1
CO2	2	-	-	-	1	-	-	-	-	-	-	2	1	1
CO3	2	-	-	-	1	-	-	-	-	-	-	2	1	1
CO4	2	-	-	-	1	-	-	-	-	-	-	2	1	1
CO5	2	-	-	-	1	-	-	-	-	-	-	1	1	1

CE16405 STRENGTH OF MATERIALS II 3 0 0 3

COURSE OBJECTIVES

- To understand the concept of energy principles.
- To learn the computation of deflection of beams using energy principles and to know the concept of analysis of indeterminate beams.
- To estimate the load carrying capacity of columns and analysis of three dimensional state of stress.
- To understand the concept of theories of failure of materials.
- To understand advanced concepts like unsymmetrical bending, shear center and fracture of materials.

UNIT I ENERGY PRINCIPLES 9

Strain energy and strain energy density – Strain energy in axial force - Shear, flexure and torsion – Castigliano's and Engessor's theorems – Principle of virtual work – Application of energy theorems for computing deflections in beams – Maxwell's reciprocal theorem.

UNIT II INDETERMINATE BEAMS 9

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading – Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.

UNIT III COLUMNS 9

Behaviour of short and long columns. Euler's theory of long columns – Critical loads for prismatic columns with different end conditions - Rankine-Gordon Formula - Eccentrically loaded long columns -Eccentrically loaded short columns - middle third rule – Core of section.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9

Determination of principal stresses and principal planes – Volumetric strain – Theories of failure –Principal stress, principal strain, shear stress, strain energy and distortion energy theories –Application in analysis of stress, load carrying capacity and design of members. Interaction problems - Interaction curves.

UNIT V ADVANCED TOPICS 9

Unsymmetrical bending of beams - symmetrical and unsymmetrical sections, shear centre – stresses on curved beams for simple solid sections – Winkler Bach Formula – Thick cylinders –Compound cylinders - residual stresses, stress concentration, fatigue, torsion of thin walled sections.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand the fundamental concepts of energy principles.
- gain knowledge about analysis of indeterminate beams and use of energy method for estimating the slope and deflections.
- analyse behaviour of columns.
- describe the failure of materials.
- understand unsymmetrical bending, shear center and fracture of materials

TEXT BOOKS

1. Rajput.R.K. Strength of Materials, S.Chand& Company Ltd., New Delhi 2014.
2. Punmia, B.C.,Theory of Structures (SMTS) Vol.I and II, Lakshmi Publishing Pvt. Ltd., New Delhi,2004.

REFERENCES

1. Malhotra, D.R. Gupta, H.C., The Strength of Materials, SatyaPrakashan, No. (Tech.India Publications), New Delhi 1995.
2. William A.Nash, Schaum's Outline Series, McGraw Hill International Editions, Fifth Edition, 2011.
3. Rattan S.S., Strength of Materials, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011
4. Ramamrutham.SDhanapatRai Publishing Company (P) Ltd.,New Delhi 2009.
5. Elangovan.A, Porul Valimaiyiyal - II, Anna University, 2011.

WEB LINKS

1. http://nptel.ac.in/courses/105105108/
2. http://studentskey.in/strength-of-materials-notes/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	-	-	-	-	-	-	-	-	2	1	2
CO2	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO3	2	3	2	3	-	-	-	-	-	-	-	2	1	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO5	2	3	2	3	-	-	-	-	-	-	-	2	1	2

CE16406 HYDRAULIC ENGINEERING LABORATORY 0 0 4 2

COURSE OBJECTIVES

- To understand various flow measuring techniques available to measure the discharge of liquids flowing through pipes and in open channels.
- To study the performance of various types of pumps.
- To acqire thorough knowledge about various types of turbines.
- To test the performance of pumps and turbines.

LIST OF EXPERIMENTS

1. Determination of co-efficient of discharge for orifice
2. Determination of co-efficient of discharge for notches
3. Determination of co-efficient of discharge for Venturimeter
4. Determination of co-efficient of discharge for orifice meter
5. Study of losses in pipes
6. Study of bernoulis theorem apparatus
7. Study on performance characteristics of Pelton turbine
8. Study on performance characteristics of Francis turbine
9. Study on performance characteristics of Kaplan turbine
10. Study on performance characteristics of Centrifugal pumps
11. Study on performance characteristics of Reciprocating pump.
12. Study on performance characteristics of Gear pump

TOTAL PERIODS 60

COURSE OUTCOMES

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

- determine the flow in pipes and in open channels..
- select an appropriate pump for a specific application.
- select a suitable type of turbine for the given situation.
- select a suitable type of turbine for the given situation.

REFERENCES

1. Sarbajit Singh. Experiments in Fluid Mechanics, PHI Learning Private Ltd., New 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, 19th edition, 2013.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	1	2	-	-	-	-	-	-	2	3	1
CO2	2	2	1	1	2	-	-	-	-	-	-	2	3	1
CO3	2	2	1	1	2	-	-	-	-	-	-	2	3	1
CO4	2	2	1	1	2	-	-	-	-	-	-	2	3	1

CE16407 **SURVEY PRACTICAL II** **0 0 4 2**

COURSE OBJECTIVES

- To apply geometric and trigonometric principles of surveying.
- To set out a curve by different methods.
- To give exposure to modern surveying instruments like GPS and Total station.
- To set out a curve by different methods.

LIST OF EXPERIMENTS

1. Study of theodolite
2. Measurement of horizontal angles by reiteration and repetition and vertical angles
3. Theodolite survey traverse
4. Heights and distances - Triangulation - Single plane method.
5. Tacheometry - Tangential system - Stadia system - Subtense system.
6. Setting out works - Foundation marking - Simple curve (right/left-handed) - Transition curve.
7. Field work using Total Station.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- determine the heights, distances, and gradient using trigonometric methods
- apply field procedures in setting out of a curve
- use modern surveying instruments like total station, GPS.
- apply field procedures in setting out of a curve

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	3	-	-	-	1	-	-	2	3	1
CO2	2	2	2	1	3	-	-	-	1	-	-	2	3	1
CO3	3	2	2	1	3	-	-	-	1	-	-	2	3	1
CO4	3	2	2	1	3	-	-	-	1	-	-	2	3	1

SEMESTER V

CE16501 DESIGN OF REINFORCED CONCRETE ELEMENTS 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- develop an understanding on the basic concepts in the behaviour and design of reinforced concrete systems and elements using limit state method.
- present the design principles of RC members for shear, bond, and torsion.
- announce the concepts in the design of RC column design
- get the knowledge in the concept of RC footings.
- develop an understanding on the basic concepts in the behaviour and design of staircase.

Prerequisite: Nil

UNIT I INTRODUCTION AND DESIGN OF FLEXURAL MEMBERS 9

Stages in Structural Design – Design philosophies – Introduction to working stress method, ultimate load Design (Principles only) – Limit state method – Comparison – General principles of design – Design of beams and slabs – Procedure for the analysis of section by strain compatibility method.

UNIT II DESIGN FOR BOND, ANCHORAGE, SHEAR & TORSION 9

Design of flanged beams – Behaviour of RC members in bond and Anchorage – Curtailment of reinforcement – Behavior of RC beams in shear and torsion – Design of RC members for combined bending, shear and torsion.

UNIT III DESIGN OF COLUMNS 9

Columns – Assumptions – Effective length – Classification – Design guidelines – Axially loaded short columns with lateral ties and helical reinforcement – Columns – Uniaxial bending – Biaxial bending.

UNIT IV DESIGN OF FOOTING 9

Foundations – Classification – Design guidelines – Codal provisions – Design of wall footing – Design of axially and eccentrically loaded square, rectangular and circular footing – Design of combined footing – Standard method of detailing the RC footing.

UNIT V DESIGN OF STAIRCASE 9

Types of stairs – Design of ordinary stairs, dog–legged stairs, Open newel stairs and stairs with stringer beams – Standard method of detailing of staircase.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- design flexural members using limit state method under different loading and end conditions.
- enterprise flexural members of any cross–sectional shape for shear, bond and torsion
- plan RC columns of any cross section with different end conditions
- select and design RC footing of different cross section under various site conditions.
- choose and design various types of staircase as per the site/building requirements

TEXT BOOKS

1. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw–Hill Publishing Company Ltd., New Delhi 2009.
2. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers & Distributors, New Delhi,2003.

REFERENCES

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd., New Delhi 2010
2. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw–Hill Publishing Company Ltd., New Delhi 2014.
3. Subramanian, N., "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.
4. IS 456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.
5. SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999.

WEB LINKS

1. http://nptel.ac.in/video.php?subjectId=105105105

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	1	2
CO3	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	1	2
CO5	2	3	2	2	-	-	-	-	-	-	-	2	1	2

CE16502 HIGHWAY ENGINEERING 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- gain knowledge on planning of roadways.
- illustrate proficiency in the geometric design of various highway elements.
- gain knowledge on planning and design of flexible and rigid pavements.
- illustrate exposure of materials used for highways and construction procedures.
- gain knowledge on highway projects under public–private sector participation.

Prerequisite: Nil

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of road development in India – Classification of highways – Institutions for Highway planning, design and construction at different levels – Factors influencing in highway alignment; Road ecology; Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Typical cross sections of Urban and Rural roads — Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses – IRC standards – Road sign and safety.

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Design principles – Pavement components and their role – Design practice for flexible and rigid pavements (IRC methods only).

UNIT IV HIGHWAY CONSTRUCTION AND MAINTENANCE 9

Highway construction materials, properties, testing methods – Construction practice including modern materials and methods of concrete and flexible pavements, Highway drainage – Special considerations for hilly roads; Evaluation and Maintenance of pavements.

UNIT V HIGHWAY ECONOMICS AND FINANCE 9

Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under public – Private sector participation, Bidding process, Highway finance.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- plan and align the highway components.
- execute geometric design of various highway components.
- prepare the design of flexible and rigid pavements.
- apply knowledge of construction procedure of various roads.
- perceive the economic analysis of highways.

TEXT BOOKS

1. Veeraragavan.A, Khanna.K and Justo.C.E.G. "Highway Engineering", Nem Chand & Bros Publishers, 2014.
2. Subramanian.K.P., "Highways, Railways, Airport and Harbour Engineering", Sci tech Publications(India), Chennai, 2010.

REFERENCES

1. Kadiyali.L.R., "Principles and Practice of Highway Engineering", Khanna Technical Publications,Delhi, 1997.
2. Subhash C Saxena, "Textbook of Highway and Traffic Engineering", CBS Publishers, 2014.
3. Partha Chakroborty and Animesh Das, "Principles of Transportation Engineering", PHI Learning Pvt. Ltd., 2005
4. Indian Road Congress(IRC), Guidelines and Special Publications on Planning and design of Highways
5. IRC Standards (IRC 37 – 2001 & IRC 58 –1998)

WEB LINKS

1. http://nptel.ac.in/downloads/105101087/
2. http://transportationengineering2012onwards.blogspot.in/2014/04/highway–economics–and–finance–part–1.html
3. https://www.dot.state.mn.us/planning/program/benefitcost.html

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	1	-	-	-	-	-	1	2
CO2	2	2	3	-	-	-	1	-	-	-	-	2	1	3
CO3	2	2	3	-	-	-	1	1	1	-	2	3	1	3
CO4	2	-	-	-	2	2	1	1	-	-	2	3	1	3
CO5	1	-	-	-	2	2	1	1	1	-	2	3	1	2

CE16503 STRUCTURAL ANALYSIS – I 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- gain knowledge on computing slopes and deflections using energy methods.
- gain knowledge on influence lines for statically determinate and indeterminate structures
- analyse and solve arched structures.
- analyse the indeterminate structures for internal forces by slope deflection method.
- analyse the indeterminate structures for internal forces by moment distribution method.

Prerequisite: Nil

UNIT I DEFLECTION OF DETERMINATE STRUCTURES 9

Principles of virtual work for deflections – Deflections of beams, pin-jointed plane frames and rigid plane frames – Deflection of trusses.

UNIT II MOVING LOADS AND INFLUENCE LINES 9

(Determinate & Indeterminate Structures with Redundancy Restricted To One)

Influence lines for reactions in statically determinate structures – Influence lines for members forces in pin–jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads – Muller Breslau's principle – Influence lines for continuous beams and single storey rigid frames – Indirect model analysis for influence lines of indeterminate structures

UNIT III ARCHES 9

Arches as structural forms – Examples of arch structures – Types of arches – Eddy's theorem – Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches – Settlement and temperature effects

UNIT IV SLOPE DEFLECTION METHOD 9

Analysis of continuous beams (with and without support yielding) and rigid frames (with and without sway) – Symmetry and antisymmetry – Support displacements.

UNIT V MOMENT DISTRIBUTION METHOD 9

Distribution and carryover of moments – Stiffness and carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- determine the slopes and deflections of beams and frames.
- draw influence lines for statically determinate and indeterminate structures.
- analyse and solve arched and cable profiled structures.
- analyse the indeterminate structures by exact analysis.
- analyse the indeterminate structures by iterative procedure.

TEXT BOOKS

1. Bhavikatti,S.S, "Structural Analysis, Vol.1", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2010.
2. Bhavikatti,S.S, "Structural Analysis, Vol.2", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2013
3. Vaidyanathan, R. and Perumal. P., "Comprehensive structural Analysis – Vol. I & II", Laxmi Publications, New Delhi, 2003

REFERENCES

1. Punmia B.C., "Theory of Structures (SMTS) Vol II" Laxmi Publishing Pvt ltd, New Delhi, 2004.
2. L.S. Negi& R.S. Jangid, "Structural Analysis", Tata McGraw–Hill Publications, New Delhi, Sixth Edition, 2003..
3. Gambhir. M.L., "Fundamentals of Structural Mechanics and Analysis", PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Reddy. C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

WEB LINKS

1. http://www.ce.memphis.edu/3121/notes/notes.html
2. http://elearning.vtu.ac.in/CV42.html

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	2	1	-	-	-	-	-	-	-	2	1	2
CO2	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO3	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2	1	2
CO5	1	3	2	2	-	-	-	-	-	-	-	2	1	2

CE16504 WATER SUPPLY ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the knowledge on sources, effect and control of water pollution.
- know the principles of dispersion characteristics of pollution in water.
- impose the knowledge in the control of water pollution.
- know the concepts behind the water pollution management.
- deliver the sources, effect and control of water pollution.

Prerequisite: Nil

UNITI PLANNING FOR WATER SUPPLY SYSTEM 9

Public water supply system – Planning – Objectives – Design period; Population forecasting-Water demand; Sources of water and their characteristics – Surface and Groundwater – Impounding Reservoir Well hydraulics – Development and selection of source – Water quality – Characterization and standards – Impact of climate change.

UNIT II CONVEYANCE SYSTEM 9

Water supply – Intake structures – Functions and drawings ; Pipes and conduits for water – Pipe materials; Hydraulics of flow in pipes –Transmission main design; Laying, jointing and testing of pipes – Drawings Appurtenances ;Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions, design and drawing of Chemical feeding, Flash mixers, flocculator, sedimentation tanks and sand filters – Disinfection ; Residue management; Construction and Operation & Maintenance aspects of Water Treatment Plants.

UNIT IV ADVANCED WATER TREATMENT 9

Principles and functions of Aeration – Iron and manganese removal; De–fluoridation and demineralization ; Water softening ; Desalination – Membrane Systems ; Recent advances.

UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9

Requirements of water distribution – Components – Service reservoirs ;Functions and drawings Network design – Economics – Computer applications – Analysis of distribution networks Appurtenances – Operation and maintenance; Leak detection, Methods. Principles of design of water supply in buildings; House service connection – Fixtures and fittings; Systems of plumbing and drawings of types of plumbing.

TOTAL PERIODS 45

COARSE OUTCOMES

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

- analyze the structure of drinking water supply systems, including water transport, treatment and distribution.
- understand the water quality criteria and standards, and their relation to public health.
- design and evaluate water supply project alternatives on basis of chosen selection criteria.
- aware on the water pollution management ideas.
- aware with the sources, effects and control of water pollution.

TEXT BOOKS

1. Garg, S.K., "Environmental Engineering", Vol. 1 Khanna Publishers, New Delhi, 2009.
2. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2010.

REFERENCES

1. Government of India, "Manual on Water Supply and Treatment", CPHEEO, Ministry of Urban Development, New Delhi, 2003
2. Syed R. Qasim and Edward M. Motley Guang Zhu, "Water Works Engineering Planning, Design and Operation", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Garg, S.K., "Environmental Engineering Vol. I", Khanna Publishers, New Delhi,2009.
4. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2005.

WEB LINKS

1. http://nptel.ac.in/courses/103107084/
2. http://nptel.ac.in/courses/105106119/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	3	1	-	-	-	1	1	-
CO2	2	1	1	1	-	2	3	1	-	-	-	1	1	1
CO3	2	1	1	1	-	2	3	1	-	-	-	1	1	1
CO4	2	-	-	-	-	2	3	1	-	-	-	1	1	-
CO5	2	1	1	1	1	2	3	1	-	-	-	1	1	1

CE16505 SOIL MECHANICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- describe the soil properties.
- discuss about the seepage analysis and flow nets.
- know about the components of settlement and behaviour of soils.
- define the shear strength and pore pressure parameters.
- understand the stress analysis and failure mechanisms.

Prerequisite: Nil

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

Nature of soil – Phase relationships – Soil description and classification for engineering purposes, their significance – Index properties of soils – BIS Classification system – Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.

UNIT II SOIL WATER AND WATER FLOW 9

Soil water – Static pressure in water – Effective stress concepts in soils – Capillary stress – Permeability measurement in the laboratory – Factors influencing permeability of soils – Seepage – Introduction to flow nets – Simple problems.

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Stress distribution – Soil media – Boussinesq theory – Use of New marks influence chart – Components of settlement – Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. – √t and log t methods – E–log p relationship – Factors influencing compression behaviour of soils.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesionless soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY 9

Slope failure mechanisms – Types – Infinite slopes – Finite slopes – Total stress analysis for saturated clay – Swedish Circle method – Friction circle method – Use of stability number – Slope protection measures.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- list the soil properties.
- confess about the seepage analysis and static pressure in water.
- determine the components of settlements and behavior of soils.
- perceive the concept of shear strength and its measurements.
- analyze the total stress for slope failure mechanism.

TEXT BOOKS

1. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2018
2. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2006

REFERENCES

1. Craig. R.F., "Soil Mechanics". E & FN Spon, London and New York, 2007
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley Eastern Ltd, New Delhi (India), 2000.
3. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education,2013

WEBLINKS

1. nptel.ac.in/courses/105103097/
2. https://www.slideshare.net/vlmvv2/soil–mechanicsfullcoursenotesandlectures

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO2	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO3	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO4	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO5	2	2	2	1	1	-	-	-	-	-	-	1	1	2

LIST OF PROGRAMME ELECTIVES

PROGRAMME ELECTIVE I

CE16151 HYDROLOGY AND WATER RESOURCES ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- have good understanding of all the components of the hydrological cycle
- gain knowledge about the estimation of runoff
- realize the importance of flood control and mitigation measures
- study reservoir and its classification
- understand the dynamics of ground water flow and their implication

Prerequisite: Nil

UNIT I PRECIPITATION AND ABSTRACTIONS 10

Hydrological cycle – Meteorological measurements – Requirements, types and forms of precipitation – Rain Gauges – Spatial analysis of rainfall data using Thiessen and Isohyetal methods Interception ; Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression ; Infiltration – Horton's equation – Double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed- catchment and basin – Catchment characteristics ; Factors affecting runoff – Runoff estimation using empirical ; Strange's table and SCS methods ; Stage discharge relationships flow measurements ; Hydrograph – 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 – IMD method – NDVI analysis – Drought Prone Area Programme (DPAP).

UNIT IV RESERVOIRS 8

Classification of reservoirs- General principles of design, site selection, spillways, elevation – Area – Capacity – storage estimation, sedimentation – Life of reservoirs – Rule curve.

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin – Classification and types – Properties of aquifers – Governing equations – Steady and unsteady flow – Artificial recharge – RWH in rural and urban areas – Seawater intrusion.

TOTAL PERIODS 45

COURSE OUTCOMES:

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

- estimate the mean areal precipitation and their significance in design of various hydraulic structures.
- calculate the runoff and measurements of flow
- estimate the flood by various methods and concept of flood routing.
- confess about the various classification of reservoirs
- perceive the dynamics of ground water flow and their estimation

TEXT BOOKS

1. Subramanya .K. "Engineering Hydrology" – Tata McGraw Hill, 4th Edition, 2017
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 3rd Edition, 2016.

REFERENCES

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. VenTe Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 2010.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 2004

WEB LINKS

1. http://nptel.ac.in/downloads/105101002/.
2. http://nptel.ac.in/courses/105101002/8
3. http://nptel.ac.in/courses/105107129/.
4. https://www.ipcc.ch/ipccreports/tar/wg2/pdf/wg2TARchap4.pdf.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	1	-	2	3	-	-	-	-	1	1	1
CO2	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO3	2	-	-	-	2	2	3	-	-	-	-	1	1	-
CO4	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO5	2	-	-	-	-	2	3	-	-	-	-	1	1	-

CE16152 TOTAL STATION AND GPS SURVEYING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the working of total station equipment and solve the surveying problems
- understand the concepts of electromagnetic waves and impact of RI
- impart the knowledge on the total station principles and its applications
- impart the knowledge of GPS and its applications.
- impart the knowledge of the advantages of electronic surveying over conventional surveying methods

Prerequisite: Surveying II

UNIT I FUNDAMENTALS OF TOTAL STATION AND GPS 9

Methods of Measuring Distance – Basic Principles of Total Station – Historical Development – Classifications – Applications and comparison with conventional surveying ; Basic concepts of GPS – Historical perspective and development – Applications – Geoid and Ellipsoid – Satellite orbital motion – Keplerian motion – Kepler's Law – Perturbing forces – Geodetic satellite – Doppler effect – Positioning concept – GNSS

UNIT II ELECTROMAGNETIC WAVES 9

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

UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9

Electro-optical system – Measuring principle – Working principle – Sources of Error – Infrared and Laser Total Station instruments – Microwave system – Measuring principle – Working principle – Sources of Error – Microwave Total Station instruments – Comparison between Electro – Optical and Microwave system – Care and maintenance of Total Station instruments – Modern positioning systems – Traversing and Trilateration.

UNIT IV SATELLITE SYSTEM 9

GPS – Different segments – Space, control and user segments – Satellite configuration – GPS signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability – Task of control segment – GPS receivers.

UNIT V GPS DATA PROCESSING 9

GPS observables – Code and carrier phase observation – Linear combination and derived observables – Concept of parameter estimation – Downloading the data – Data processing – Software modules – Solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS – Semi Kinematic and pure Kinematic methods – Basic constellation of satellite geometry & accuracy measures – Applications – Long baseline processing – Use of different software's available in the market.

TOTAL PERIODS 45

COURSE OUTCOMES:

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

- attain knowledge on working of modern surveying equipment such as total station and GPS.
- perceive the concepts of electromagnetic waves and impact of RI
- confess the total station and its applications
- evaluate the concepts of GPS and its different methods and its applications
- perceive the advantages of electronic surveying over conventional surveying methods

TEXT BOOKS

1. Rueger, J.M. "Electronic Distance Measurement", Springer–Verlag, Berlin, 2007.
2. Satheesh Gopi, Sathishkumar, N madhu, "Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007.

REFERENCES

1. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993.
2. GuochengXu, "GPS Theory, Algorithms and Applications", Springer – Verlag, Berlin, 2003.
3. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004.

WEB LINKS

1. nptel.ac.in/courses/105104100/lectureA_3/A_3_3_TS.htm
2. nptel.ac.in/courses/Webcourse–contents/IIT–KANPUR/.../ui/Course_homeA_3.htm

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	1	2	-	-	-	-	-	-	2	2	1
CO2	2	1	2	1	3	-	-	-	-	-	-	2	2	1
CO3	2	1	2	1	3	-	-	-	-	-	-	2	2	1
CO4	2	1	2	1	3	-	-	-	-	-	-	2	2	1
CO5	2	1	2	1	2	-	-	-	-	-	-	2	2	1

CE16153 CONSTRUCTION PLANNING AND SCHEDULING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the necessity of the planning in the diverse construction projects.
- know the appropriate techniques used for scheduling the resources.
- have exposure on various costs, control methods and departmental procedure for accounting.
- study the quality control and monitoring techniques and the necessity of training to personnel.
- provide awareness about management information system and usage of data base in the project accountings.

Prerequisite: Nil

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 – Crashing and time/cost tradeoffs – Improving the Scheduling process – Introduction to application software.

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 PERIODS 45

COURSE OUTCOMES:

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

- confess the requirement of planning techniques exercised in the construction projects.
- choose suitable scheduling technique for the particular project.
- get exposure in the modern cost account systems and control techniques adopted in the construction projects.
- make use of advanced management tools for quality control and monitoring techniques towards speedy and guaranteed projects.
- experience how to use the data base for complex large projects.

TEXT BOOKS

1. Dr.S.Seetharaman, "Construction Planning and Scheduling", Revised edition, Anuradha Publication, Chennai 2014.
2. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw–Hill Publishing Co., New Delhi, 1998.

REFERENCES

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Srinath,L.S., "Pert and CPM Principles and Applications ", Third edition, Affiliated East West Press, 2001

WEB LINKS

1. http://nptel.ac.in/courses/Webcourse–contents/IIT–%20Guwahati /cpm/index.html

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO2	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO3	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO4	2	-	-	-	1	-	-	-	1	-	2	1	1	1
CO5	2	-	-	-	1	-	-	-	1	-	2	1	1	1

CE16154 AIR POLLUTION AND CONTROL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the knowledge on sources, effect and control of air pollution.
- know the principles of dispersion characteristics of pollution in atmosphere.
- impose the knowledge on the control of air pollution.
- know the concepts behind the air pollution management.
- deliver the sources, effect and control of noise pollution.

Prerequisite: Nil

UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS 9

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation and animals – Global warming – Ozone layer depletion, sampling – Basic principles – Source and ambient sampling – Analysis of pollutants.

UNIT II DISPERSION OF POLLUTANTS 9

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

UNIT III AIR POLLUTION CONTROL 9

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – Gaseous pollutants control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

UNIT IV AIR QUALITY MANAGEMENT 9

Air quality standards – Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental impact assessment on air quality.

UNIT V NOISE POLLUTION 9

Sources of noise pollution – Effects – Assessment – Standards – Control methods – Prevention measures.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the sources and effects of air pollution.
- realize the dispersion characteristics and modeling of air pollution.
- get an exposure to know about air pollution control methods.
- apply on the air pollution management ideas.
- aware with the sources, effects and control of noise pollution.

TEXT BOOKS

1. Rao M.N. and Rao H.V.N., "Air Pollution" McGraw Hill Education, New Delhi, 2013.
2. Rao, C.S. "Environmental Pollution Control Engineering", New Age international, 2018.
3. Mahajan SP, "Air Pollution Control" TERI Press, New Delhi, 2009.

REFERENCES

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2011.
2. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi.
3. Mahajan, S.P., "Pollution Control in Process Industries", Tata McGraw–Hill, New Delhi, 2010.
4. Heumann.W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New York, 1997

WEB LINKS

1. http://www.tutorialspoint.com/air pollution
2. http://nptel.ac.in/courses/105104099/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO2	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO3	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO4	2	-	-	-	1	2	3	-	-	-	-	1	1	1
CO5	2	-	-	-	1	2	3	-	-	-	-	1	1	1

CE16155 COASTAL ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know about the basic concept of coastal area
- provide exposure on types of waves and their characteristics
- gain knowledge in wave transformation
- give exposure to coastal structures and shore protection
- identify about the modeling of coastal areas

Prerequisite: Nil

UNIT I INTRODUCTION TO COASTAL ENGINEERING 9

Introduction – Wind and waves – Sea and Swell – Introduction to small amplitude wave theory – Use of wave tables – Mechanics of water waves – Linear (Airy) wave theory – Wave measurement.

UNIT II WAVE PROPERTIES AND ANALYSIS 9

Introduction to non–linear waves and their properties – Waves in shallow waters – Wave Refraction, diffraction and shoaling – Hind casting of waves – Short term wave analysis – Wave spectra and its utilities – Long term wave analysis – Statistical analysis of ground wave data.

UNIT III TYPES AND WAVE TRANSFORMATION 9

Tide analysis and prediction, storm surge, seiches and seasonal fluctuations – Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction.

UNIT IV COASTAL STRUCTURES AND SHORE PROTECTION 9

Risk analysis – Design wave – Break waters – Shore protection – Groins, seal walls, offshore break water sand artificial nourishment.

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.

TOTAL PERIODS 45

COURSE OUTCOMES:

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

- calculate the wave transformations
- comprehend the characteristics of the waves
- analyse and predict the wave transformations
- appreciate the multi–faceted nature of coastal problems and the techniques of coastal engineering analysis
- perceive the different role in modelling of coastal areas

TEXT BOOKS

1. Kamphuis, J.W., "Introduction to coastal engineering and management", 2000
2. Dean, R.G. and Dalrymple, R.A., "Water wave mechanics for Engineers and Scientists", Prentice–Hall, Inc., Englewood Cliffs, New Jersey, 1994.

REFERENCES

1. Mani, J. S. "Coastal Hydrodynamics". PHI Learning Pvt. Ltd., 2012.
2. Coastal Engineering Manual, Vol. I–VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006.
3. Ippen, A.T., "Estuary and Coastline Hydrodynamics", McGraw–Hill Book Company, Inc., New York, 1978.
4. Sorenson, R.M., "Basic Coastal Engineering", A Wiley–Inter Science Publication, New York, 1978.

WEB LINKS

1. nptel.ac.in/courses/114106032/
2. https://www.nap.edu/read/11764/chapter/5
3. nptel.ac.in/courses/114106032/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO2	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO3	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO4	2	-	-	-	-	2	2	-	-	-	-	1	1	1
CO5	2	-	-	-	-	2	2	-	-	-	-	1	1	1

CE16506 HIGHWAY ENGINEERING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to,

- gain knowledge on various tests of coarse aggregate.
- explain about various workability tests on fresh concrete.
- find out the strength parameters of hardened concrete.
- have a hand–on practice, with reference to various tests on bitumen.

Prerequisite: Concrete Technology

LIST OF EXPERIMENTS

I TESTS ON FRESH CONCRETE 12

1. Slump cone test
2. Flow table
3. Compaction factor
4. Vee bee test

II TESTS ON HARDENED CONCRETE 12

1. Compressive strength – Cube & Cylinder
2. Flexure test
3. Modulus of Elasticity

III TESTS ON BITUMEN 12

1. Penetration
2. Softening Point
3. Ductility
4. Viscosity
5. Elastic Recovery

IV TESTS ON AGGREGATES 12

1. Soundness
2. Proportioning of Aggregates
3. Water Absorption
4. Fineness modulus of aggregate
5. Impact strength
6. Crushing strength

V TESTS ON BITUMINOUS MIXES (DEMONSTRATION ONLY) 12

1. Determination of Binder Content
2. Marshall Stability and Flow values
3. Specific Gravity
4. Density

TOTAL PERIODS 60

COURSE OUTCOMES

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

- assess the quality of coarse aggregate used in concrete.
- do various workability tests on fresh concrete.
- analyze the strength characteristics of the given concrete.
- apply sufficient idea of practice and procedure of using bitumen in road works.

REFERENCES

1. Shetty, M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
2. Santhakumar, A.R; "Concrete Technology", Oxford University Press, New Delhi, 2007

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	1	-	-	-	-	-	-	1	1	1

CE16507 SOIL MECHANICS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- gain knowledge on classification of soil based on index properties.
- estimate optimum moisture content and maximum dry density.
- estimate the shear strength of soil and compressibility of soil.
- acquire knowledge about the CBR..

Prerequisite: Soil Mechanics

LIST OF EXPERIMENTS

1. Specific gravity of soil
2. Grain size distribution – Sieve analysis
3. Liquid limit and Plastic limit tests
4. Shrinkage limit
5. Field density test
6. Determination of moisture – density relationship using standard proctor compaction test.
7. Permeability determination (constant head and falling head methods)
8. Direct shear test in cohesionless soil
9. Unconfined compression test in cohesive soil
10. Laboratory vane shear test in cohesive soil
11. California Bearing Ratio test
12. Triaxial Compression test (Demonstration only)
13. Consolidation test (Demonstration only)

TOTAL PERIODS 60

COURSE OUTCOMES

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

- classify soil based on its properties.
- assess the optimum moisture content required in the field.
- check stability of slopes by knowing shear strength and compressibility characteristics of soil.
- analyze the characteristics of soil.

REFERENCES

1. "Soil Engineering Laboratory Instruction Manual", Published by the Engineering College Co–operative Society, Chennai, Anna university, Chennai, 2010.
2. Head, K.H, "Manual of Soil Laboratory Testing (Vol–1 to 3)", John Wiley & Sons, Chichester, 1998.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1990.

WEBLINKS

1. https://www.ltu.edu/engineering/civil/labs/tab.geotechnical.asp

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	1	-	-	-	-	-	-	2	1	1
CO2	2	2	2	1	1	-	-	-	-	-	-	2	1	1
CO3	2	2	2	1	1	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	1	-	-	-	-	-	-	2	1	1

SEMESTER VI

CE16601 DESIGN OF STEEL STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- describe limit state design concepts and the design of bolted and riveted joints.
- gain knowledge on design of tension members.
- acquire knowledge about design of compression member.
- gain knowledge about design of beams.
- acquire knowledge on designing the components of roof trusses

Prerequisite: Nil

UNIT I INTRODUCTION 9

Properties of steel – Structural steel sections – Limit state design concepts – Loads on Structures; Connections using bolting and welding – Design of bolted and welded joints – Eccentric Connections – Efficiency of joints.

UNIT II TENSION MEMBER 9

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

UNIT III COMPRESSION MEMBER 9

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base.

UNIT IV BEAMS 9

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to Uniaxial and biaxial Bending – Design of plate girders – Intermediate and bearing stiffeners – Flange and web splices.

UNIT V ROOF TRUSSES AND INDUSTRIAL STRUCTURES 9

Roof trusses – Roof and side coverings – Design loads, design of purlin and elements of truss – Design of gantry girder.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply knowledge of limit state design concepts and joints.
- design tension members.
- design compression members.
- apply knowledge on design of beams.
- design components of steel trusses such as Purlins and gantry girders.

TEXT BOOKS

1. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, International Publishing House Pvt. Ltd., 2009
2. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013

REFERENCES

1. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2010
2. Dayaratnam, P., "Design of Steel Structures", Second edition, S. Chand & Company, 2004.
3. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 StructuresPublications, 2009.
4. Ramachandra, S. and Virendra Gehlot, "Design of Steel Structures – Vol. I & II", Standard Publication, NewDelhi, 2007
5. IS800 :2007, General Construction in Steel – Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
6. IS 875: (Part 2 and 3) 1987 (Reaffirmed 1997), Code of practice for design loads (Other thanEarthquake) For Buildings and Structures.
7. Steel Tables

WEB LINKS

1. https://engineering.purdue.edu/~ahvarma/CE%20470/
2. http://www.learnerstv.com/Free–engineering–Video–lectures–ltv323–Page1.html
3. http://peer.berkeley.edu/~yang/courses/ce248/CE248_LN_Floor_vibrations.pdf

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO2	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO3	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO4	2	2	2	1	1	-	-	-	-	-	-	1	1	2
CO5	2	2	2	1	1	-	-	-	-	-	-	1	1	2

CE16602 STRUCTURAL ANALYSIS – II 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- analyse statically indeterminate structures by imposing boundary conditions on flexibility matrix.
- formulate the element stiffness matrix and assemble the structure stiffness matrix for solving indeterminate problems.
- understand the basics of finite element method and its application to structural analysis.
- introduce the importance of plastic analysis to calculate the collapse loads for beams and frames
- analyse a cable structures and stiffening girders.

Prerequisite: Structural Analysis I

UNIT I FLEXIBILITY METHOD 9

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

UNIT II STIFFNESS METHOD 9

Element and global stiffness matrices – Analysis of continuous beams – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames (with redundancy restricted to two)

UNIT III FINITE ELEMENT METHOD 9

Introduction – Element shapes, nodes, nodal unknowns and coordinate systems – Shape functions – Discretisation of a structure – Assembling stiffness equation – Displacement functions – Truss element – Beam element – Plane stress and plane strain – Triangular elements

UNIT IV PLASTIC ANALYSIS OF STRUCTURES 9

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

UNIT V CABLE STRUCTURES AND SUSPENSION BRIDGE AND BEAMS CURVED IN PLAN 9

Suspension cables – Suspension bridges with two and three hinged stiffening girders – Beams curved in plan.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyse statically indeterminate structures by imposing boundary conditions on flexibility matrix.
- form the element stiffness matrices and assemble the global stiffness matrix for solving indeterminate problems.
- apply the concept of finite element method to structural analysis.
- employ plastic analysis to calculate the collapse loads for beams and frames.
- determine the member forces in suspension bridges and space truss

TEXT BOOKS

1. Bhavikatti,S.S, "Structural Analysis, Vol.1", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2010.
2. Bhavikatti,S.S, "Structural Analysis, Vol.2", Vikas Publishing House Pvt. Ltd., New Delhi–4, 2013
3. Vaidyanathan, R. and Perumal, P., "Comprehensive structural Analysis – Vol. I & II", Laxmi Publications, New Delhi, 2003

REFERENCES

1. Punmia,B.C., Ashok Kumar and Arun Kumar Jain, " Theory of Structures", Laxmi Publications, 2004.
2. Ghali.A, Nebille,A.M. and Brown,T.G. "Structural Analysis" A unified classical and Matrix approach" – 5th edition. Spon Press, London and New York, 2003.
3. L.S. Negi & R.S. Jangid, "Structural Analysis", Tata McGraw–Hill Publications, New Delhi, 2003.
4. Coates R.C, Coutie M.G. and Kong F.K., "Structural Analysis", ELBS and Nelson, 1990
5. Gambhir, M.L., "Fundamentals of Structural Mechanics and Analysis"., PHI Learning Pvt. Ltd., New Delhi, 2011.
6. William Weaver Jr & James M. Gere, "Matrix Analysis of Framed Structures", CBS Publishers and Distributors, delhi, 2004.
7. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol. II, Khanna Publisers,2015.

WEB LINKS

1. http://www.ce.memphis.edu/3121/notes/notes.html.
2. http://elearning.vtu.ac.in/CV42.html

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	1	2	1	-	-	-	-	-	-	1	1	2
CO2	2	3	2	2	1	-	-	-	-	-	-	1	1	2
CO3	2	3	2	2	1	-	-	-	-	-	-	1	1	2
CO4	2	3	2	2	1	-	-	-	-	-	-	1	1	2
CO5	2	2	2	2	1	-	-	-	-	-	-	1	1	2

CE16603 DESIGN OF REINFORCED CONCRETE AND BRICK MASONRY STRUCTURES **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- familiarize the various steps involved in the design of retaining walls
- understand the design concept of water tank
- acquire knowledge in design of staircases, slabs, foundation and bridge
- learn concept of yield line theory
- gain the knowledge about brick masonry.

Prerequisite: Design of Reinforced Concrete Elements

UNIT I RETAINING WALLS **9**

Design of Cantilever and Counterfort Retaining walls.

UNITII WATER TANKS **9**

Design of rectangular and circular water tanks both below and above ground level – Design of circular slab.

UNIT III SELECTED TOPICS **9**

Design of staircases (ordinary and doglegged) – Design of flat slabs – Principles of design of box culvert and road bridges

UNIT IV YIELD LINE THEORY **9**

Assumptions – Characteristics of yield line – Determination of collapse load / Plastic moment – Application of virtual work method – Square, rectangular and circular slabs – Design problems

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 walls.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply knowledge about the design of retaining walls
- acquire knowledge about the design the water tank
- familiarize on the design of staircases, slabs, foundation and bridge
- confess concept of yield line theory
- apply the knowledge about brick masonry

TEXT BOOKS

1. Gambhir.M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012.
2. Dayaratnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH Publishing House, 2017

REFERENCES

1. Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.
2. Varghese.P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.
3. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
4. IS456:2000, "Code of practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi, 2007
5. SP16, IS456:1978 "Design Aids for Reinforced Concrete" to Bureau of Indian Standards, New Delhi, 1999.
6. IS1905:1987, "Code of Practice for Structural use of Unreinforced Masonry Bureau of Indian Standards", New Delhi, 2002

WEB LINKS

1. http://nptel.ac.in/courses/105105105/
2. http://nptel.ac.in/courses/10102088/27

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	3	1	1	-	-	-	-	-	-	2	1	2
CO2	2	2	3	1	1	-	-	-	-	-	-	2	1	2
CO3	1	2	3	1	1	-	-	-	-	-	-	2	1	2
CO4	2	2	3	1	1	-	-	-	-	-	-	2	1	2
CO5	2	2	3	1	1	-	-	-	-	-	-	2	1	2

CE16604 WASTE WATER ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- illustrate the principles of wastewater supply, treatment and distribution.
- distinguish the concept of transport of wastewater
- estimate the load carrying capacity of the treatment.
- gain knowledge on various advanced wastewater treatment.
- identify disposal method of sewage and sludge.

Prerequisite: Water Supply Engineering

UNIT I PLANNING FOR SEWERAGE SYSTEMS 9

Sources of wastewater generation – Effects ; Estimation of sanitary sewage flow ; Estimation of storm runoff ; Factors affecting Characteristics and composition of sewage and their significance ; Effluent standards – Legislation requirements.

UNIT II SEWER DESIGN 9

Sewerage – Hydraulics of flow in sewers – Objectives – Design period ; Design of sanitary and storm sewers – Small bore systems ; Computer applications ; Laying, joining & testing of sewers – Appurtenances ; Pumps – selection of pumps and pipe Drainage ; Plumbing System for Buildings – One pipe and two pipe systems.

UNIT III PRIMARY TREATMENT OF SEWAGE 9

Objective – Selection of treatment processes; Principles, Functions, Design and Drawing of Units – Onsite sanitation – Septic tank with dispersion – Grey water harvesting ; Primary treatment – Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks – Construction, operation and Maintenance aspects.

UNIT IV SECONDARY TREATMENT OF SEWAGE 9

Objective – Selection of Treatment Methods ; Principles, Functions, Design and Drawing of Units – Activated Sludge Process and Trickling filter ; Oxidation ditches; UASB; Waste Stabilization Ponds ; Reclamation and Reuse of sewage; Sewage recycle in residential complex ; Recent Advances in Sewage Treatment – Construction and Operation & Maintenance of Sewage Treatment Plants.

UNIT V DISPOSAL OF SEWAGE AND SLUDGE MANAGEMENT 9

Stand Standards for Disposal – Methods – Dilution – Self–purification of surface water bodies – Oxygen sag curve ; Land disposal ; Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – Disposal – Advances in Sludge Treatment and disposal.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- observe various wastewater resources of India and Tamil Nadu.
- apply the knowledge about the sewer design.
- have an elaborate knowledge about selection of wastewater treatment process.
- explain planning, design, operation and maintenance of STP.
- differentiate the proper disposal methods of sewage and sludge.

TEXT BOOKS

1. Garg, S.K., "Environmental Engineering" Vol. II, Khanna Publishers, New Delhi, 2007.
2. Punmia, B.C., Jain, A.K., and Jain. A., "Environmental Engineering, Vol.II", Lakshmi Publications, Newsletter, 2005

REFERENCES

1. Mark J. Hammer, Mark J. Hammer Jr, "Water and Waste Water Technology", Prentice hall of India 2008
2. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
3. Metcalf & Eddy, "Wastewater Engineering – Treatment and Reuse", Tata McGraw Hill Company, New Delhi, 2005.

WEB LINKS

1. http://nptel.ac.in/courses/105106119/
2. http://nptel.ac.in/courses/105104102/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	1	3	1	-	-	-	1	1	-
CO2	2	1	1	-	1	1	3	1	-	-	-	1	1	1
CO3	2	1	1	-	1	1	3	1	-	-	-	1	1	1
CO4	2	1	1	-	1	1	3	1	-	-	-	1	1	1
CO5	2	-	-	-	1	1	3	1	-	-	-	1	1	-

CE16605 FOUNDATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge about the geotechnical site investigation.
- understand the types of foundation and design principles
- gain knowledge of footings and special foundation
- discuss different types of pile foundation and its capacity
- study various earth pressure theories

Prerequisite: Soil Mechanics

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed; Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler; Penetration tests (SPT and SCPT) – Data interpretation – Strength parameters and Evaluation of Liquefaction potential – Selection of foundation based on soil condition – Bore log report.

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in–situ tests (SPT, SCPT and plate load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFTS 9

Types of Isolated footing, Combined footing; Mat foundation- Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision.

UNIT IV PILE FOUNDATION 9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil; Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Uplift capacity – Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift

UNIT V RETAINING WALLS 9

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- conduct sub surface investigation and select foundation based on soil condition
- calculate bearing capacity of soil and settlement
- confess contact pressure distribution below the footing
- describe the types of piles and their load carrying capacity
- check the stability of retaining wall

TEXT BOOKS

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd, New Delhi 2015
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi 2011.

REFERENCES

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2018.
2. GopalRanjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New age Ltd. InternationalPublisher New Delhi (India) 2006
3. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
4. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2002.
5. Venkatramaiah, C., "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint)
6. IS Code 6403: 1981 (Reaffirmed 1997) "Bearing capacity of shallow foundation", Bureau of Indian Standards, New Delhi.
7. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.

WEB LINKS

1. http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Foundation_Engineering/TOC–M1.htm
2. http://elearning.vtu.ac.in/06CV64.html

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO2	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO3	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO4	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO5	2	1	1	1	-	-	-	-	-	-	-	2	1	1

LIST OF OPEN ELECTIVES

OPEN ELECTIVE I

CE16901 BUILDING SERVICES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- know about the system of electrical work in building
- acquire the knowledge on various illumination and lighting process in building.
- learn the principles of electrical and air conditioning facilities.
- study the fire safety installation in various types of building.
- enhance the knowledge on water supply and drainage system in building.

Prerequisite: Nil

UNIT I ELECTRICAL SYSTEMS IN BUILDINGS 9

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

UNIT II PRINCIPLES OF ILLUMINATION AND DESIGN 9

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination; Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting – Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT III REFRIGERATION PRINCIPLES AND APPLICATIONS 9

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

UNIT IV FIRE SAFETY INSTALLATION 9

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

UNIT V PLUMBING AND DRAINAGE 9

Plumbing fixtures and fixture fittings – Water conserving fittings – Over flows – Strainers and connectors – Prohibited fixtures – Special fixtures – Installation of water closet – Urinals – Flushing devices – Floor drains – Shower stall – Bath tub – Bidets – Minimum plumbing facilities; Rain water harvesting systems – Necessity – Construction – Different types.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- perceive about the system of electrical work in building
- obtain the knowledge on various illumination and lighting process in building.
- confess the principles of electrical and air conditioning facilities.
- apply the fire safety installation in various types of building.
- gather the knowledge on water supply and drainage system in building.

TEXT BOOKS

1. David .V Chaddert on "Building Service Engineering", Routledge Taylor and Francise group, London and Network 2013.
2. E.R.Ambrose, "Heat pumps and Electric Heating", John and wiley and Sons, Inc., New York, 2011.

REFERENCES

1. William H.Severns and Julian R.Fellows, "Air–conditioning and Refrigeration", John Wiley and Sons, London, 2007.
2. Handbook for Building Services in fred hall and roger greeno, 2013
3. National Building Code 2016.

WEB LINKS

1. nptel.ac.in/courses/107106009/Downloads/LECTURE7.ppt
2. https://nptel.ac.in/courses/112105129/pdf/R&AC%20Lecture%2036.pdf
3. https://www.youtube.com/watch?v=1Hl1TXJUjmg
4. https://www.cibse.org/getmedia/56352fa8–370c–4943–9638–77920939fe3b/The–control–of–air–pressure–within–tall–building–drainage–SoPHE–ppt–Compatibility–Mode.pdf.aspx.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	2	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	2	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	2	-	-	-	-	-	-	1	1	1
CO5	2	-	-	-	2	-	-	-	-	-	-	1	1	1

CE16902 CONTRACT LAWS AND REGULATIONS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study various elements in the contract document.
- review different concepts of tender making process as per contract law.
- get an information on arbitration procedure during disputes.
- study the various taxes related to construction business and statutory recommendations.
- know the complexity of labour laws along with legislation in the construction industries.

Prerequisite: Nil

UNIT I CONSTRUCTION CONTRACTS 9

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts.

UNIT II TENDERS 9

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Preparation of Tender schedules – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act 1998 Rules 2000.

UNIT III ARBITRATION 9

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award.

UNIT IV LEGAL REQUIREMENTS 9

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations.

UNIT V LABOUR REGULATIONS 9

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act 1948 – Tamil Nadu Factory Act 1950 – Child Labour Act 1986 Amended in 2016 – Other Labour Laws.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- prepare contract document for various government & non–governmental works.
- make tender as per the current rates along with guidelines from sources.
- perceive the factors of arbitration during the time of court proceedings.
- exercise correctly the procedure during sell; buy their land & property oriented with various tax provisions.
- adopt and follow the various acts and laws related to labour in the field.

TEXT BOOKS

1. Jimmie Hinze, "Construction Contracts", McGraw Hill, New Delhi 2013.
2. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M.M. TripathiPrivate Ltd., Bombay, 2000

REFERENCES

1. Patil. B.S, "Civil Engineering Contracts and Estimates", Universities Press (India) Private Limited, 2015.
2. Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects", McGraw Hill, 2010.
3. Oxley Rand Posicit, "Management Techniques applied to the Construction Industry", GrandPublications, Noida,2009

WEB LINKS

1. http://nptel.ac.in/courses/105103093/11

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO5	2	-	-	-	-	-	-	-	-	-	-	1	1	1

CE16903 ARCHITECTURE 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart knowledge on the fundamentals of visual perception and principles
- get exposure about architectural principles in the design of buildings
- impart knowledge in the national traditions and the local regional heritage in architecture, landscape design including the vernacular tradition.
- provide the basic principles and appropriate application and performance of building envelope materials and assemblies
- demonstrate competency in the technical, practical skills of landscape architecture and their role in investigating complex and innovative ideas.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Definition – Architecture – Classification – Influencing factors – Region, culture, climate, topography, building materials, economic and technology – Historic structure – Prominent world architecture – Anthropometrics – Human scale – Space requirements in architecture.

UNITII ELEMENTS OF ARCHITECTURE 9

Elements – Mass and space visual emotional effects of geometric forms and their derivatives – Sphere, cube, pyramid, cylinder, and cone – Aesthetic qualities of architecture- proportion, scale, balance, symmetry, rhythm and axis – Contrast in form – Harmony.

UNIT III ORIENTATION AND PLANNING OF BUILDINGS 9

General – Factors affecting orientation – Sun – Wind – Rain – Orientation criteria for Indian conditions – Planning – specifications and standards – Planning of buildings – Green building – Carbon rating – Case studies.

UNIT IV INTERIOR DESIGN 9

General – Decorative materials – Cement bonded boards, water proof cement – Paint – Industrial glazing and roofing – Masonry – Plaster and dry wall – Wall surface materials – Effect of color – Home furnishing – Preparation of interior design plans – Case studies.

UNIT V LANDSCAPE DESIGN 9

Principles – Site planning – Design – Styles – Elements and materials – Plant characteristics and design – Landscape planning – Case studies

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply the fundamentals of visual perception in two and three–dimensional design
- perceive the architectural principles in the design of buildings and interior spaces
- make plan for the buildings by considering our Indian climatic conditions.
- choose the various building material as per the interior design aspects.
- perform landscape architecture according to the environmental conditions.

TEXT BOOKS

1. Francis D.K.Ching, "Architecture: Form, Space and Order", John Wiley & Sons, Inc. 2007.
2. Mohmohan, MuthuShoba G, "Principles of Architecture" Oxford University Press, New Delhi, 2009.

REFERENCES

1. Arvind Krishnan "Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings", McGraw Hill Education, New Delhi, 2013
2. Simon Unwin, "Analysing Architecture", Routledge, London, 2003

WEB LINKS

1. http://ocw.mit.edu/courses/architecture/

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO2	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO3	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO4	2	1	3	1	2	-	-	-	-	-	-	1	1	2
CO5	2	1	3	1	2	-	-	-	-	-	-	1	1	2

CE16904 SMART STRUCTURES AND SMART MATERIALS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- familiarize the basics in smart structures and smart materials
- understand the measuring techniques
- acquire knowledge on sensors
- learn concept of actuators
- gain the knowledge about signal processing and control systems.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self-diagnosis – Signal processing consideration – Actuation systems and effectors.

UNITII MEASURING TECHNIQUES 9

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

UNIT III SENSORS 9

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVDT – Fiber optic Techniques – Chemical and Bio–Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fiber Optic Chemical Sensing Systems and Distributed measurement.

UNIT IV ACTUATORS 9

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro orheological Fluids – Electromagnetic actuation – Role of actuators and Actuator Materials.

UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS 9

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Linear and Non – Linear Control System.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply knowledge about the smart materials and structures
- attain knowledge about the measuring techniques
- manage various types of sensors
- confess concept of actuators
- apply the knowledge about signal processing and control systems.

TEXT BOOKS

1. Brain Culshaw – "Smart Structure and Materials" Artech House – Borton. London 2003.
2. Gandhi, M.V and Thompson, B.S., "Smart Materials and Structures", Chapman and Hall, 2006.

REFERENCES

1. L. S. Srinath – "Experimental Stress Analysis" – Tata McGraw–Hill, 1998.
2. J. W. Dally & W. F. Riley – "Experimental Stress Analysis" – Tata McGraw–Hill, 1998.

WEB LINKS

1. https://www.electronics–tutorials.ws/blog/wheatstone–bridge.html
2. https://www.smart–material.com/ActuatorSensor.html

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO5	2	-	-	-	1	-	-	-	-	-	-	1	1	1

CE16905 REMOTE SENSING TECHNIQUES AND GIS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the concept of remote sensing and its components.
- list the types of platforms and various sensors used in GIS.
- analyze the GIS data and create digital elevation model.
- describe the various types of map projections and software used in GIS.
- know about the land information system and various data model.

Prerequisite: Nil

UNIT I EMR AND ITS INTERACTION WITH ATMOSPHERE AND 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 – Air borne 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 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 Modelling in GIS Highway alignment studies – Land Information System.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- attain the fundamental knowledge in the concept of remote sensing and its components.
- evaluate the various platforms and sensors in GIS.
- create the digital image using various image enhancement techniques.
- use the software's in GIS for map analysis.
- create the various data models and to understand the land information systems.

TEXT BOOKS

1. Lillesand, T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi 2007.
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information Systems" BS Publications, 2006.

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. 2011
2. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principles of Geographical Information Systems" Third Edition, Oxford University Press, 2000.
3. Ian Heywood, Sarah Cornelius, Steve Carver "An Introduction to Geographical Information Systems (4th Edition)" Pearson Education Asia, 2000.

WEB LINKS

1. nptel.ac.in/courses/105108077/
2. nptel.ac.in/courses/105108077/module1/lecture1.pdf

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO2	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO3	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO4	2	-	-	-	2	1	1	-	-	-	-	1	1	1
CO5	2	-	-	-	3	1	1	-	-	-	-	1	1	1

CE16606 COMPUTER AIDED DESIGN AND DRAFTING LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- design manually the retaining wall, water tank
- operate with software proficiency
- list the various IRC loadings and the concept of prestressing
- explain the design of plate girder and truss girder for various loading conditions

Design and Drafting of the following Structures

(Manual Design and Drafting by Software)

1. RCC Cantilever Retaining wall
2. RCC Counter fort Retaining wall
3. RCC Underground Water tank
4. RCC Overhead Circular and Rectangular Water Tanks
5. RCC slab culvert
6. Rectangular Steel Tank
7. Welded Plate Girders
8. Truss
9. Ductile Detailing of RC members

TOTAL PERIODS 30

COURSE OUTCOMES

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

- apply knowledge for the design and detailing of different types of retaining walls and will be able to apply the theoretical concepts in the real–world construction
- perceive the importance of measuring systems and the measuring instruments involved in drafting and related fields
- design and draw the detailing of various types of water tanks (RC and steel) along with the staging and foundation
- plot the drawing using scaling techniques as per industry requirements

TEXT BOOKS

1. N.Krishnaraju, “Design of Reinforced Concrete Structures”–CBS Publishers, 2016
2. Dr.Ramchandra and Virendra Gehlot “Design of Steel Structures”–Scientific Publishers , 2011

REFERENCES

1. B.C., Punmia, Ashok Kumar Jain & Arun Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications Pvt. Ltd., 2003
2. Krishnamurthy, D., "Structural Design & Drawing – Vol. II and III", CBS Publishers, 2010.
3. Shah V L and Veena Gore, "Limit State Design of Steel Structures" IS800–2007, Structures Publications, 2009.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	3	-	2	-	-	-	-	-	-	1	1	2
CO2	1	2	3	-	2	-	-	-	-	-	-	1	1	2
CO3	1	2	3	-	2	-	-	-	-	-	-	1	1	2
CO4	1	2	3	-	2	-	-	-	-	-	-	1	1	2

s

CE16607 ENVIRONMENTAL ENGINEERING LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- impart the principles of sampling and preservation of water and wastewater.
- convey the principles of testing of water and wastewater
- provide analyzing methods for water and wastewater
- acquire knowledge about importance of bacteria in wastewater

Prerequisite: Water supply Engineering & Waste Water Engineering

LIST OF EXPERIMENTS

1. Determination of
   i) pH, ii) Turbidity
2. Determination of
   i) Hardness, ii) Electrical conductivity
3. Determination of Alkalinity
4. Determination of Total, Suspended and Dissolved Solids
5. Determination of Residual Chlorine
6. Determination of Optimum Coagulant Dosage
7. Determination of Chlorides
8. Determination of Sulphate
9. Determination of available Ammonia Nitrogen
10. Determination of Dissolved Oxygen
11. Biochemical Oxygen Demand (B.O.D.) test
12. Chemical Oxygen Demand (C.O.D.) test
13. Introduction to Bacteriological Analysis (Demonstration only)

TOTAL PERIODS 60

COURSE OUTCOMES

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

- acquire the sampling and preservation methods of water and wastewater
- test the water and wastewater and their different characteristics as per standards
- do the different water and wastewater analysis as per standards
- know about importance of bacteria in wastewater

REFERENCES

1. Garg, S.K., “Environmental Engineering Vol. I & II”, Khanna Publishers, New Delhi, 2010
2. Modi, P.N., “Environmental Engineering Vol. I & II”, Standard Book House, Delhi–6, 2008

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (Pos)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	3	-	-	-	-	1	1	1
CO2	2	-	-	-	-	2	3	-	-	-	-	1	1	1
CO3	2	-	-	-	-	2	3	-	-	-	-	1	1	1
CO4	2	-	-	-	-	2	3	-	-	-	-	1	1	1

CE16608 SURVEY CAMP (2 Weeks – During V Semester) 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- gain knowledge on survey field techniques and to learn the various methods of surveying to solve the real–world problems.
- Know the basic concepts of advanced equipment.
- Apply to solve the description to engineering and surveying activities.
- Learn the various methods of surveying to solve the real world problems.

Prerequisite: Surveying I & Surveying II

SYLLABUS

Two weeks survey camp will be conducted during winter vacation to expose on field surveying such as

1. Triangulation
2. Vertical control by spirit leveling
3. Contouring

TOTAL PERIODS 30

COURSE OUTCOMES

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

- attain practical knowledge on handling survey instruments.
- Determine L.S and C.S by using advances equipment.
- Understand the surveying techniques infield.
- Prepare contour map for given area.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	2	1	3	-	-	-	-	-	-	3	1	2
CO2	3	1	2	1	3	-	-	-	-	-	-	3	1	2
CO3	3	1	2	1	3	-	-	-	-	-	-	3	1	2
CO4	3	1	2	1	3	-	-	-	-	-	-	3	1	2

SEMESTER VII

CE16701 ESTIMATION, COSTING AND VALUATION ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- estimate the quantities of item of works involved in buildings, joineries and arches.
- prepare the estimation of water supply and sanitary works, road works and irrigation work.
- analyse the concept of tender and contract in detail.
- study the valuation of properties and buildings.
- know the methods of preparing reports for estimation of various items.

Prerequisite: Nil

UNIT I ESTIMATION OF BUILDINGS 9

Load bearing and framed structures – Calculation of earthwork excavation – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof ; Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for paneled and glazed doors, windows, ventilators, handrails.

UNIT II ESTIMATE OF OTHER STRUCTURES 9

Estimating of septic tank – soak pit – Sanitary and water supply installations – Water supply pipe line, Sewer line ; Tube well – Open well ; Estimate of bituminous and cement concrete roads ; Estimate of retaining walls ; Culverts – Estimating of irrigation works – Aqueduct.

UNIT III SPECIFICATION AND TENDERS 9

Data – Schedule of rates, Analysis of rates, Specifications – Sources, Preparation of detailed and general specifications – Tenders – TTT Act 1998 Rules 2000, E-tender – Preparation of Tender Notice and Document – Contracts – Types of contracts – Drafting of contract documents – Arbitration and legal requirements.

UNIT IV VALUATION 9

Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease – Case study on Public Private Partnership in India.

UNIT V REPORT PREPARATION 9

Principles for report preparation – Report on estimate of residential building – Culvert – Roads – Water supply scheme and sanitary sewerage projects – Tube wells – Open wells.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- estimate the material quantities in buildings, joineries, arches and prepare a bill of quantities.
- estimate the material quantities in water supply & sanitary installation, road works and prepare a bill of quantities.
- gain the knowledge about specifications in schedule of rates and prepare tender documents.
- perceive the concepts and methods used in evaluating the properties of buildings.
- get an idea in the preparation of reports for estimation of various items.

TEXT BOOKS

1. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 28th Revised Edition, 2016.
2. Kohli, D. D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand &Company Ltd., 2004

REFERENCES

1. Tamil Nadu PWD Data Book- 2017.
2. Tamil Nadu Transparencies in Tender Act, 1998Tamil Nadu Transparency in Tenders Rules, 2000 and Tamil Nadu Transparency in Tenders (Public Private Partnership Procurement)Rules, 2012.
3. Arbitration and Conciliation Act, 1996

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	3	1	-	-	-	-	-	-	-	2	1	2
CO2	2	1	3	1	-	-	-	-	-	-	-	2	1	2
CO3	2	-	-	-	-	-	-	-	1	-	1	2	1	-
CO4	2	-	-	-	-	-	-	-	1	-	1	2	1	-
CO5	2	-	-	-	-	-	-	-	1	-	1	2	1	-

CE16702 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart knowledge on SDOF earthquake response of linear system
- study the behaviour and response of MDOF structures with various dynamic loading
- gain a preliminary knowledge of seismology
- enhance awareness of earthquake effects on structures
- understand the codal provisions to design the structure as earthquake resistant

Prerequisite: Nil

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' Alemberts 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 – Seismotectonics – 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 – Behaviour 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 PERIODS 45

COURSE OUTCOMES

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

- analyze the earthquake response of SDOF linear systems.
- analyze the structures with MDOF system under dynamic loading
- perceive the knowledge of earthquake and its origin
- predict the effects of earthquake on structures
- design the structures for seismic loading as per code provisions

TEXT BOOKS

1. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.

REFERENCES

1. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.
2. Mario Paz, Structural Dynamics – Theory and Computations, Fourth Edition, CBS publishers, 1997.
3. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	1	1	1	-	-	-	-	-	-	2	1	1
CO2	2	1	1	1	1	-	-	-	-	-	-	2	1	1
CO3	2	-	-	-	1	-	-	-	1	-	-	2	1	1
CO4	2	-	-	-	1	-	-	-	1	-	-	2	1	1
CO5	2	-	-	-	1	-	-	-	1	-	-	2	1	1

CE16703 IRRIGATION ENGINEERING 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- impart the basic knowledge about crop water requirement
- familiar with different irrigation methods
- impart knowledge about various dam structures
- understand on components of canal irrigation works
- manage the water loss in irrigation

Prerequisite: Nil

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 Evapo-transpiration using experimental and theoretical methods

UNIT II IRRIGATION METHODS 9

Tank irrigation - Well irrigation - Irrigation methods - Surface and Sub-Surface and Micro Irrigation, Merits and demerits –Irrigation scheduling - Water distribution system - Irrigation efficiencies.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

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

UNIT IV CANAL IRRIGATION 9

Canal regulations - Canal drop - Cross drainage works - Canal outlets - Canal alignments - Canal lining - Kennedy's and Lacey's Regime theory

UNIT V WATER MANAGEMENT IN IRRIGATION 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gather the basic knowledge about crop water requirements
- familiarize with methods and management of irrigation.
- gain knowledge on types of Impounding structures

- understood methods of irrigation including canal irrigation.
- update their knowledge on water management on optimization of water use.

TEXT BOOKS

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

REFERENCES

1. Sharma R.K.. "Irrigation Engineering", S.Chand & Co. 2007.
2. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
3. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, New Delhi, 2000.
4. Basak, N.N, "Irrigation Engineering", Tata McGraw Hill Publishing Co. New Delhi,1999

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	1	1	2	-	-	-	1	2	1	1
CO2	2	-	-	-	1	1	2	-	-	-	1	2	1	1
CO3	2	-	-	-	1	1	2	-	-	-	1	2	1	1
CO4	2	-	-	-	1	1	2	-	-	-	1	2	1	1
CO5	2	-	-	-	1	1	2	-	2	-	1	2	1	1

CE16704 PRESTRESSED CONCRETE STRUCTURES 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- impart knowledge on the basic principles of prestressed concrete structures
- understand the flexure and shear design for prestressed concrete beams
- gain knowledge of factors influencing deflection and anchorage zone design
- understand the performance of composite members
- gain knowledge on various prestressed concrete structural elements

Prerequisite: Nil

UNIT I INTRODUCTION 9

Historical developments – Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post-tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per I.S.1343 Code – Design of sections of Type I and Type II post – tensioned and pre–tensioned beams – Check for strength limit based on I.S. 1343 Code – 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 state of deflection – Determination of anchorage zone stresses in post-tensioned beams by Magnels method, Guyon's method and I.S. 1343 code – 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 – Shrinkage strain and its importance ; Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V MISCELLANEOUS STRUCTURES 9

Design of tension and compression members – Design of tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- selection of various types of prestressing
- design for flexure and shear on prestressed concrete beams.
- design of anchorage zone reinforcement
- design of composite and continuous beams.
- design various prestressed concrete structural elements

TEXT BOOKS

1. Krishna Raju N., "Prestressed concrete", Tata McGraw Hill Company, Fifth Edition, 2012.
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt Ltd., Second edition, 2014

REFERENCES

1. Sinha.N.C. and Roy.S.K., "Fundamentals of Prestressed Concrete", S.Chand and Co. Ltd., 2011
2. Lin T.Y. and Ned.H. Burns, "Design of prestressed Concrete Structures", John Wiley and Sons, 3rd Edition, 2010.
3. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2002.
4. IS1343 – 2012 – IS Code of Practice for Prestressed Concrete.
5. IS784 – 2001 – IS Specification for Prestressed Concrete Pipes
6. IS3370 – 1999 – Part III – IS Code of Practice for Concrete Structures for the storage of liquids
7. IS1678 – 1998 – Specification for Prestressed Concrete Pole for overhead Power Traction and Telecommunication lines.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	3	1	-	-	-	-	-	-	-	2	1	2
CO2	2	2	3	1	-	-	-	-	-	-	-	2	1	2
CO3	2	2	3	1	-	-	-	-	-	-	-	2	1	2
CO4	2	2	3	1	-	-	-	-	-	-	-	2	1	2
CO5	2	2	3	1	-	-	-	-	-	-	-	2	1	2

PROFESSIONAL ELECTIVE II

CE16251 INDUSTRIAL WASTE WATER ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the basic knowledge about waste water
- know the prevention methods of industrial pollutions
- impart knowledge in various treatment process of industrial waste
- acquire knowledge on discharge of waste water
- understand various process of water management

Prerequisite: Nil

UNIT I INTRODUCTION 9

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters

UNIT II INDUSTRIAL POLLUTION PREVENTION 9

Prevention versus Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis – Payback period.

UNIT III TREATMENT OF INDUSTRIAL WASTEWATERS 9

Physico-Chemical Treatment Processes – Equalization, Neutralization, Oil Separation, Floatation , Precipitation, Aerobic and Anaerobic Biological Treatment Processes ; Sequencing batch reactors, membrane bio-reactors, Advanced oxidation and Tertiary Treatment processes for removal of dissolved organics and inorganics- Ozonation, photo catalysis, Evaporation and membrane Technologies.

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9

Individual and Common Effluent Treatment Plants – Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse – Industrial reuse, Disposal on water and land – Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills.

UNIT V CASE STUDIES 9

Industrial manufacturing process description – Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries – Textiles – Pulp and Paper – Metal finishing – Sugar and Distilleries.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gather the basic knowledge about industrial waste water
- understood the prevention and control of irrigation.
- retrieve the concepts of treatment process of industrial waste water
- gain knowledge on irrigation including canal irrigation.
- execute skills on water management on optimization of water use.

TEXT BOOKS

1. Eckenfelder, W.W. "Industrial Water Pollution Control", Mc-Graw Hill, 2000.
2. Mahajan, S.P.Pollution Control in Process Industries, Tata McGraw Hill Publishing Co., New Delhi, 1991.
3. S.C.Bhatia, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003.

REFERENCES

1. Frank Woodard, "Industrial waste treatment Handbook", Butterworth Heinemann, NewDelhi, 2001.
2. Nelson Leonard Nemerow, "Industrial waste treatment – contemporary practice and vision for the future", Elsevier, Singapore, 2007.
3. Paul L. Bishop, "Pollution Prevention:- Fundamentals and Practice", Mc-Graw Hill International, Boston,2000.
4. Wang L.K., Yung-Tse Hung, Howard H.Lo and Constantine Yapijakis, "Handbook of Industrial and Hazardous Wastes Treatment", Marcel Dekker, Inc., USA, 2004.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	3	-	-	-	-	2	1	1
CO2	2	-	-	-	-	2	3	-	-	-	-	2	1	1
CO3	2	-	-	-	1	2	3	-	-	-	-	2	1	1
CO4	2	-	-	-	1	2	3	-	-	-	-	2	1	1
CO5	2	-	-	-	-	2	3	-	-	-	-	2	1	1

CE16252 TRAFFIC ENGINEERING AND MANAGEMENT 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- impart the fundamentals related to the traffic flow
- acquire knowledge on traffic surveys and its operation
- create awareness about the control measures for traffic signs and its regulations
- gain knowledge on accident risk and its management
- provide knowledge on traffic management measures.

Prerequisite: Nil

UNIT I TRAFFIC CHARACTERISTICS 9

Road Characteristics – Classification, Functions and standards – Road user characteristics –PIEV theory ; Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India.

UNIT II TRAFFIC SURVEYS 9

Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL 9

Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelisation – Grade separation ; Traffic signs and road markings.

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, health effects and abatement measures.

UNIT V TRAFFIC MANAGEMENT 9

Area Traffic Management System – One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options – Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM) – Introduction to Intelligent Transportation Systems (ITS) – ITS Applications in Traffic Management.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyse the various types of traffic flow
- understand traffic survey and its methods
- practice the traffic engineering regulations and its control measures
- analyse the causes and report the accident
- manage the traffic congestion using the available management measures

TEXT BOOKS

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2010.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.

REFERENCES

1. ParthaChakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005.
2. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
3. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,Upper Saddle River, New Jersey 1998.
4. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
5. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO3	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	1	-	-	-	-	-	-	1	1	1
CO5	2	-	-	-	3	-	-	-	-	-	-	1	1	1

CE16253 MUNICIPAL SOLID WASTE MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- discuss the source, types and characterization of municipal solid wastes.
- know the storage methods and the processing of solid wastes.
- discuss the methods of collection and transfer stations with option under Indian condition.
- gain knowledge on the processing techniques equipment used for processing.
- understand the disposal methods of solid waste and discuss leachate collection and treatment

Prerequisite: Nil

UNIT I SOURCES AND CHARACTERISTICS 9

Sources and types of solid wastes – Quantity – factors affecting generation of solid wastes – Characteristics ; Methods of sampling and characterization ; Effects of improper disposal of solid wastes – Public health effects; Principle of solid waste management – Social and economic aspects – Public awareness ; Role of NGOs, Legislation.

UNIT II ON-SITE STORAGE AND PROCESSING 9

On-site storage methods – Effect of storage, materials used for containers – Segregation of solid wastes – Public health and economic aspects of open storage – Waste segregation and storage options under Indian conditions – Reduction, Reuse and Recycling.

UNIT III COLLECTION AND TRANSFER 9

Methods of Collection – Types of vehicles – Manpower requirement – Collection routes – Transfer stations – Selection of location, operation & maintenance – Case study under Indian conditions.

UNIT IV OFF-SITE PROCESSING 9

Processing techniques and Equipment – Resource recovery from solid wastes – Composting, incineration, Pyrolysis – case study under Indian conditions.

UNIT V DISPOSAL 9

Dumping of solid waste – sanitary landfills – Site selection – design and operation of sanitary landfills – Landfill bio reactors – Leachate collection & treatment.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- perceive the nature and characteristics of municipal solid wastes.

- attain knowledge about the regulatory requirements regarding municipal solid waste management.
- confess the waste minimization.
- evaluate the design systems for storage, collection, transport, and processing.
- attain the knowledge about the disposal of municipal solid waste.

TEXT BOOKS

1. William A. Worrell, P. AarneVesilind, "Solid Waste Engineering", Cengage Learning, 2012
2. George Tchobanoglous and FrankKreith, "Handbook of Solid waste Management", McGrawHill, New York. 2002.

REFERENCES

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization", Government of India, New Delhi, 2014.
2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO2	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO3	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO4	2	-	-	-	-	2	3	-	-	-	-	1	1	-
CO5	2	-	-	-	-	2	3	-	-	-	-	1	1	-

CE16254 RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge on planning of geometric design of railway
- illustrate proficiency in Railway construction & maintenance
- impart knowledge on components of Airport & Airport Authority
- understand the design concepts & orientation of Runway
- acquire knowledge on Harbour Engineering & Coastal regulation

Prerequisite: Nil

UNIT I RAILWAY PLANNING AND CONSTRUCTION 9

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods – Geometric design of railway, gradient, super elevation, widening of gauge on curves – Level 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 –Railway Station and yards and passenger amenities.

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, Problems on basic and Actual Length, Geometric Design, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.

UNIT V HARBOUR ENGINEERING 9

Definition of Basic Terms – Harbour, 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 PERIODS 45

COURSE OUTCOMES

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

- plan and design of permanent way
- execute construction of Railway elements
- understood the terminologies in Airport & Authorities
- execute the design and orientation of Runways
- plan and design of Harbour and Coastal regulation

TEXT BOOKS

1. Subramanian.K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2013.
3. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels. Universities Press (India) Private Limited, Hyderabad, 2015.

REFERENCES

1. Rangwala, "Railway Engineering", Charotar Publishing House, 2013
2. Bindra S P, "A Course in Docks and Harbour Engineering", DhanpatRai and Sons, New Delhi, 2013
3. SaxenaSubhash, C.andSatyapalArora, ACourse in Railway Engineering, DhanapatRai and Sons, Delhi, 1998
4. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 1994

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	1	-	-	-	-	-	-	2	1	1
CO2	3	-	-	-	1	-	-	-	-	-	-	2	1	1
CO3	3	-	-	-	1	-	-	-	-	-	-	2	1	1
CO4	3	-	-	-	1	-	-	-	-	-	-	2	1	1
CO5	3	-	-	-	1	-	-	-	-	-	-	2	1	1

MA16751 OPERATIONS RESEARCH 3 0 0 3

COURSE OBJECTIVE

To enable the students to

- provide the concept and an understanding of basic concepts in Operations Research.
- understand, develop and solve mathematical model of Transport and assignment problems.
- Know the techniques for Analysis and Modeling in Computer Applications.
- understand, develop and solve mathematical model of linear programming problems.
- understand network modeling for planning and scheduling the project activities.

Prerequisite: Nil

UNIT I LINEAR PROGRAMMING MODELS 9

Mathematical Formulation – Graphical Solution of linear programming models – Simplex method – Big M-Method – Two phase methods.

UNIT II TRANSPORTATION AND ASSIGNMENT MODELS 9

Mathematical formulation of transportation problem – Methods for finding initial basic feasible solution – optimum solution – degeneracy – Assignment models – Balanced and unbalanced problems – Solution by Hungarian and Branch and Bound algorithms.

UNIT III INVENTORY MODELS 9

Inventory Models – EOQ and EBQ Models (With and without shortages) – Quantity Discount Models .

UNIT IV NETWORKING MODELS 9

Network construction – Critical path method – Project evaluation and review technique – Replacement models – Individuals replacement models (With and without time value of money) – Group replacement models.

UNIT V QUEUEING MODELS 9

Queuing Theory – Single and multi-channel models – Infinite number of customers and infinite calling source.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand and apply linear, integer programming to solve operational problem with constraints.

- apply transportation and assignment models to find optimal solution in warehousing and travelling.
- use optimization concepts in real world problems.
- prepare project scheduling using PERT and CPM
- identify and analyze appropriate queuing model to reduce the waiting time in queue.

TEXT BOOKS

1. R.Panneerselvam, "Operations research", Second edition prentice hall –USA-2007.
2. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education,Asia, 2005.

REFERENCES

1. Taha H.A, "Operations Research: An Introduction", 8th Edition, Pearson Education, 2008.
2. Prem Kumar Gupta, D.S. Hira, "Operations Research", S.Chand & Company Ltd, New Delhi, Third Edition , 2008.
3. John W. Chinneck, "Feasibility and Infeasibility in Optimization Algorithms andComputational Methods", Springer, 2008.
4. Ravindran, Phillips, Solberg, "Operations Research: Principles and Practice", Second Edition,John Wiley & Sons, 2007.
5. Gross, D. and Harris, C.M., "Fundamentals of Queuing Theory", Wiley Student, 3rd Edition, New Jersy, 2004.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	1	-	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	1	3	2

OPEN ELECTIVE II

CE16906 COMPUTER AIDED DESIGN OF STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- understand the fundamental concepts for implementing computer aided design
- ensure that students begin to understand the concepts of computer graphics and modeling
- enrich a knowledge on analysis of structures using software packages
- enhance the design of structures using software's and to optimize the structural components
- develop the artificial intelligence on knowledge based systems

Prerequisite: Nil

UNIT-I INTRODUCTION 9

Fundamental reason for implementing CAD – Software requirements ; Hardware components in CAD system – Design process – Applications and benefits.

UNIT-II COMPUTER GRAPHICS 9

Graphic Software – Graphic primitives ; Transformations – 2 Dimensional and 3 Dimensional transformations – Concatenation – Wire frame modeling – Solid modeling – Graphic standards – Drafting packages – Auto CAD.

UNIT III STRUCTURAL ANALYSIS 9

Principles of structural analysis – Fundamentals of finite element analysis – Concepts of finite elements – Stiffness matrix formulation – Variational Method – Weighted residual method – Problems – Conditions of convergence of functions – Analysis packages and applications.

UNIT IV DESIGN AND OPTIMIZATION 9

Principles of design of steel and RC structures – Beams and Columns – Applications to simple design problems – Optimization techniques – Algorithms – Linear programming.

UNIT V EXPERT SYSTEMS 9

Introduction to artificial intelligence – Knowledge based expert systems – Applications of KBES – Rules and decision tables – Inference mechanisms – simple applications

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire the knowledge in fundamentals of computer aided design.
- gain the skills on computer graphics and modeling

- retrieve the concepts of structural analysis by using analysis packages
- design and optimize the structural components by using software's
- access the artificial intelligence on knowledge based expert systems

TEXT BOOKS

1. Mikell.P.Groover. and Emory.W.Zimmers.Jr., "CAD / CAM, Computer Aided Design and Manufacturing", Prentice Hall of India Ltd, New Delhi, 2008.
2. Krishnamoorthy.C.S, Rajeev.S, Rajaraman.A "Computer Aided Design: Software and Analytical Tools" Narosa Publishing House, New Delhi, 2012.

REFERENCES

1. B.H.V. Topping "Developments in computer aided design and modeling for Structural Engineering" Civil comp press UK, 1995
2. Harrison H.B, "Structural Analysis and Design" Part I and II Pergamon Press, Oxford, 1990

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	-	3	-	-	-	-	-	-	2	1	1
CO2	2	2	2	-	3	-	-	-	-	-	-	2	1	2
CO3	2	2	2	-	3	-	-	-	-	-	-	2	1	1
CO4	2	2	2	-	3	-	-	-	-	-	-	2	1	2
CO5	2	2	2	-	3	-	-	-	-	-	-	2	1	2

CE16907 DISASTER MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

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

Prerequisite: Nil

UNIT-I INTRODUCTION TO DISASTERS 9

Definition - Disaster, Hazard, Vulnerability, Resilience, Risks ; Disaster - Types of disasters - Earthquake, Landslide, Flood, Drought, Fire ; 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 ; Do's and Don'ts during various types of Disasters

UNIT-II APPROACHES TO DISASTER RISK REDUCTION 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR- Structural - non-structural 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 ; Climate Change Adaptation ;IPCC Scenario and Scenarios inthe 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, and Waste Management, Institutional arrangements (Mitigation, Response and Preparedness; Disaster Management Act and Policy - Other related policies, plans, programs 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: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 PERIODS 45

COURSE OUTCOMES

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

- differentiate the types of disasters, causes and their impact on environment and society
- assess vulnerability and various methods of risk reduction measures as well as mitigat
- draw the hazard and vulnerability profile of India and Scenarios in the Indian context
- retrieve disaster damage assessment and management.
- gain the skills on disaster management case studies and field works

TEXT BOOKS

1. A.K Gupta, Sreeja S. Nair, SandhyaChatterji. "Disaster Management and Risk Reduction", Narosa Public House, 2013.
2. Singhal J.P. "Disaster Management", Laxmi Publications, 2010.

REFERENCES

1. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
2. KapurAnu "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.
3. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
4. Government of India, National Disaster Management Policy, 2009.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	3	-	1	-	-	1	1	-
CO2	2	-	-	-	-	2	3	-	1	-	-	1	1	-
CO3	2	-	-	-	-	2	3	-	1	-	-	1	1	-
CO4	2	-	-	-	2	2	3	-	1	-	-	1	1	-
CO5	2	-	-	-	-	2	3	-	1	-	-	1	1	-

CE16908 FINITE ELEMENT TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- equip with the finite element analysis fundamentals.
- understand the direct stiffness matrix method to solve civil engineering problems.
- give exposure to select suitable mathematical model for complex problems.
- form and solve two dimensional problems.
- introduce the advanced topics in FEM.

Prerequisite: Nil

UNIT I FUNDAMENTAL CONCEPTS 9

Concept of an element – Various element shapes – One, two and three-dimensional elements – Finite element procedure – Stresses and equilibrium – Boundary conditions – Strain displacement relations – Stress strain relations – Potential energy and equilibrium – Weighted residual and weak formulations – Variational approach – Rayleigh Ritz method.

UNIT II DIRECT STIFFNESS METHOD 9

Steps in direct method of FEA – Element stiffness matrix – Global stiffness matrix – Boundary conditions – Simple problems on beams and trusses.

UNIT III ELEMENT SHAPES, NODAL UNKNOWNS AND COORDINATE 9

Discretisation – Basic element shapes – Element properties – Node numbering procedure – Convergence requirements – Generalized co-ordinates – Natural co-ordinates – Shape functions for linear & quadratic models – stiffness matrix – Nodal load factor – Static condensation – Simple problems.

UNIT IV TWO DIMENSIONAL PROBLEMS 9

Introduction – Finite element modeling – Constant strain triangle – Isoparametric representation – Potential energy approach – Element stiffness – Force terms – Stress calculations – Introduction to beam element – Application of FEM Software

UNIT V ISOPARAMETRIC ELEMENTS AND NUMERICAL INTEGRATION 9

Introduction – Higher order elements and its applications – Concept of sub, iso and super parametric elements – Shape Functions – Gaussian quadrature – Examples in one and two – dimensional elements.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- perceive the fundamentals of Finite Element Analysis
- use the direct stiffness matrix method for solving civil engineering problems.

- declare suitable mathematical model for complex problems
- form and solve two dimensional problems
- apply the various vibration control techniques in structures.

TEXT BOOKS

1. Chandrupatla, R.T. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice Hall of India, 2012 .
2. Krishnamoorthy C. S., "Finite Element Analysis Theory and Programming", Tata McGraw Hill Education, 2011 .

REFERENCES

1. Rao S.S, "The Finite Element Method in Engineering", Pergaman Press, 2010
2. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", McGraw – Hill, 2005.
3. Rajasekaran, S., "Finite Element Methods in Engineering Design", Wheeler, 2006

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	1	-	-	-	-	-	-	2	1	2
CO2	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO3	2	2	2	1	1	-	-	-	-	-	-	2	1	2
CO4	2	2	2	1	1	-	-	-	-	-	-	2	2	2
CO5	2	2	2	1	1	-	-	-	-	-	-	2	1	2

CE16909 ENGINEERING ECONOMICS AND COST ANALYSIS 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart knowledge on basic economic principles.
- know about the law of demand and supply schedule.
- gain knowledge on business organization.
- understand the financial terms.
- know the concept of cost and break even analysis.

Prerequisite: Nil

UNIT I BASIC ECONOMICS 9

Definition of Economics – Nature and scope of economic science – Nature and scope of managerial economics – Basic terms and concepts – Goods, Utility, Value, Wealth – Factors of production – Land and its peculiarities – Labour – Economics of large and small scale – Consumption wants – characteristics and classification – Law of diminishing marginal utility – Relation between economic decision and technical decision.

UNIT II DEMAND AND SCHEDULE 9

Demand – Demand schedule, Demand curve, Law of demand – Elasticity of demand – Types of elasticity – Factors determining elasticity, Measurement, significance, Supply, Supply schedule, Supply curve – Law of supply – Elasticity of supply – Time element in determination of value Market price and normal price – perfect competition – Monopoly – Monopolistic competition.

UNIT III ORGANISATION 9

Forms of business – Proprietorship – Partnership – Joint stock company – Cooperative organization – State enterprise – Mixed economy – Money and banking – Banking – kinds – Commercial banks – Central banking functions – Control of credit– Monetary policy – Credit instrument.

UNIT IV FINANCING 9

Types of financing – Short term borrowing – Long term borrowing – Internal generation of funds External commercial borrowings – Assistance from government budgeting support and international finance corporations– Analysis of financial statement – Balance sheet – Profit and loss account – Funds flow statement.

UNIT V COST AND BREAK EVEN ANALYSES 9

Types of costing – Traditional costing approach – Activity based costing – Fixed cost – Variable cost Marginal cost – Cost output relationship in the short run and in long run – Pricing practice – Full

cost pricing – Marginal cost pricing – Going rate pricing – Bid pricing – picking for a rate of return Appraising project profitability – Internal rate of return – Payback period – Net present value – Cost benefit analysis Feasibility reports – Appraisal process – Technical feasibility – Economic feasibility Financial feasibility – Break even analysis – Basic assumptions – Break even chart – Managerial uses of break-even analysis.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- define the economic principles.
- draw the demand and supply curves based on the laws.
- identify the various banking types and organize a business team.
- understand the fund flow statement based on generation of funds.
- apply the concept of break-even analysis.

TEXT BOOKS

1. Dewett K K and Varma J D "Elementary Economic Theory", S Chand & Co. Publications, 2006
2. Khan MY and Jain PK, "Financial Management" McGraw Hill Publishing Co Ltd., 2006.

REFERENCES

1. SatyaPrakashan ,Sharma J C "Construction Management and Accounts" New Delhi, 2004.
2. Barthwal R R, "Industrial Economics – An Introductory Textbook", New Age Publications, 2000.
3. Samuelson P A, "Economics An Introductory Analysis" McGraw – Hill Publications, 2000

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	-	-	-	1	1	-	1	1	1	2	1	1	-
CO2	1	-	-	-	1	1	-	1	1	1	2	1	1	-
CO3	1	-	-	-	1	1	-	1	1	1	2	1	1	-
CO4	1	-	-	-	1	1	-	1	1	1	2	1	1	-
CO5	1	-	-	-	1	1	-	1	1	1	2	1	1	-

CE16910 ENVIRONMENTAL IMPACT ASSESSMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart knowledge on Environmental management and Environmental Impact Assessment.
- know about the methodologies of Environmental Impact Assessment.
- learn about the prediction and assessment of Impact on land, water, air.
- understand the Environmental Management Plan based on the adverse impact.
- gain knowledge on various case studies.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Impact of development projects – Sustainable development- Need for Environmental Impact Assessment (EIA) – Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA - Stages of EIA – Types of EIA

UNIT II METHODOLOGIES 9

Methods of EIA – Check lists – Matrices – Networks – Cost benefits - Analysis of alternatives

UNIT III PREDICTION AND ASSESSMENT 9

Assessment of Impact on land, water, air, social and cultural activities and on flora and fauna – Mathematical models – Public participation.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air, land and on flora and fauna – Addressing the issues related to the Project affected people – Post project monitoring

UNIT V CASE STUDIES 9

EIA for infrastructure projects – Dams – Highways – Multi-storey Buildings, Water Supply and Drainage Projects – Waste water treatment plants, STP.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- carry out scoping and screening of developmental projects for environmental and social assessments
- explain different methodologies for environmental impact prediction and assessment.

- identify the assessment of Impact on land, water and air.
- plan environmental adverse impact assessments.
- evaluate environmental impact assessment reports.

TEXT BOOKS

1. Canter, R.L., "Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1996.
2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

REFERENCES

1. John G. Rau and David C Hooten, "Environmental Impact Analysis Handbook", McGraw Hill Book Company, 1990.
2. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	-	2	3	-	-	-	-	1	1	-
CO2	2	1	-	-	-	2	3	-	-	-	-	1	1	-
CO3	2	1	-	-	2	2	3	-	-	-	-	1	1	-
CO4	2	1	-	-	-	2	3	-	-	-	-	1	1	-
CO5	2	1	-	-	-	2	3	-	-	-	-	1	1	-

CE16705 ENVIRONMENTAL AND IRRIGATION ENGINEERING DRAWING 0 0 4 2

COURSE OBJECTIVES

To enable the students to

- design and draw the coagulation and sedimentation tank in detail which showing the plan, elevation and sections.
- design and draw the rapid sand filter in detail which showing the plan, elevation and sections.
- design and draw the canal drop, canal regulator in detail which showing the plan, elevation and sections.
- design and draw the siphon aqueduct in detail which showing the plan, elevation and sections.

Prerequisite: Water Supply & Waste Water Engineering

LIST OF EXPERIMENTS

PART A : ENVIRONMENTAL ENGINEERING

1. Design and Drawing of coagulation and sedimentation tank.
2. Design and Drawing of rapid sand filter
3. Design and Drawing of screen chamber and grit chamber.
4. Design and Drawing of septic tank.
5. Design and Drawing of trickling filter.

PART B : IRRIGATION ENGINEERING

6. Design and Drawing of canal drop.
7. Design and Drawing of canal regulator cum foot path.
8. Design and Drawing of syphon aqueduct.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- design and draw coagulation and sedimentation tank structures.
- design and draw rapid sand.
- design and draw canal drop, canal regulator.
- design and draw syphon aqueduct.

REFERENCES

1. Mohanakrishnan. A, “A few Novel and Interesting Innovative Irrigation Structures: Conceived, Designed and Executed in the Plan Projects in Tamil Nadu”, Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.
2. Raghunath, H.M. “Irrigation Engineering”, Wiley India Pvt. Ltd., New Delhi, 2011.

3. Garg, S.K., "Irrigation Engineering and Design of Structures", New Age International Publishers, New Delhi, 1997.
4. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	-	2	3	-	-	-	-	2	1	2
CO2	2	1	2	-	-	2	3	-	-	-	-	2	1	2
CO3	2	1	2	-	-	2	3	-	-	-	-	2	1	2
CO4	2	1	2	-	-	2	3	-	-	-	-	2	1	2

CE16706 DESIGN PROJECT **0 0 4 2**

COURSE OBJECTIVE

To enable the students to

- Impart and improve the design capability of the student.
- design the various elements of structures.
- analysis the entire elements of structures.
- Design problem can solve by using software.

STRATEGY :

This course conceives purely a design problem in any one of the disciplines of Civil Engineering such as Design of an RC structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to either an individual student or a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- attain knowledge in designing various design problems.
- attain knowledge in analysis various design problems.
- design calculations, specifications done by software.
- Design problems can be solved by manual or software.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	3	2	3	-	-	-	3	-	-	3	1	3
CO2	2	3	3	2	3	-	-	-	3	-	-	3	1	3
CO3	2	3	3	2	3	-	-	-	3	-	-	3	1	3
CO4	2	3	3	2	3	-	-	-	3	-	-	3	1	3

PROFESSIONAL ELECTIVE III

CE16351 POWER PLANT STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart knowledge in principle, layout and resources of power plant generation.
- gain knowledge in essential elements and structural requirements of hydroelectric power plant.
- understand planning, analysis of thermal power plant.
- gain knowledge in characteristics of nuclear power plant and its safety measures.
- understand miscellaneous power plant and its principle.

Prerequisite: Nil

UNIT I FUNDAMENTALS OF POWER PLANTS 9

Introduction – Classification of Power Plants, Principles of Power Plant, Lay out of Power Plant Building – Selection of type of generation – Resources for power generation – Machine foundation.

UNIT II HYDRO ELECTRIC POWER PLANTS 9

Elements of hydro-electric power plants – Advantages and disadvantages of water power – General and essential elements of Hydroelectric Power Plant – Structural requirements – Selection of site for hydroelectric plant – Penstocks and surge Tanks in Power Station.

UNIT III THERMAL POWER PLANTS 9

Planning, Analysis of thermal power plants – Layout – Ash handling – Dust collection – Induced draught and natural cooling towers – Air/water pollution by thermal power plants.

UNIT IV NUCLEAR POWER PLANTS 9

General characteristics of Nuclear Power Plants – Classification of reactors – Pressurized Water Reactor, Boiling Water Reactor, Fusion Power Reactor, Heavy Water Reactor – Selection criteria of materials for different systems – Containment structures – Nuclear power plant safety measures – Safety systems and support systems

UNIT V NON CONVENTIONAL POWER PLANTS 9

Types – Wind power plants – Selection of wind mill – Tidal power plants – Solar thermal power plants – Geothermal power plants – Principles and essential features.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the fundamentals of power plant
- understand structural requirements of hydropower plant
- plan and analyse the layout of thermal power plant
- select general criteria and safety measures of nuclear power plant
- design various power plant systems

TEXT BOOKS

1. S.C. Sharma and G.R. Nagpal, Power Plant Engineering, Khanna Publishers,2013
2. Raja A.K, AmitPrakashSrivastava and Manish Dwivedi, Power Plant Engineering, New Age International Publishers, 2006.

REFERENCES

1. Lewis.E.E. Nuclear Power Reactor Safety, Willey Inter Science, 1977.
2. Srinivasasulu.P and Vaidyanathan.C.V. Hand book on Machine Foundations, Tata McGraw Hill Publishing Co. Ltd., 2007.
3. Gilbert Gedeon.P.E., Planning and Design of Hydro Electric Power Plants, CECW-ED Engineer Manual, 1110-2-3001 Manual No.1110-2-3001, 1995.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	1	-	1	1	1	-	-	-	1	2	1	1
CO2	2	-	1	-	1	1	1	-	-	-	1	1	1	1
CO3	2	-	1	-	1	1	1	-	-	-	1	2	1	1
CO4	2	-	1	-	1	1	1	-	-	-	1	2	1	1
CO5	2	-	1	-	1	1	1	-	-	-	1	1	1	1

CE16352 BRIDGE STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- introduce the basic fundamentals of bridge design.
- familiarize with design of slab culverts, the beam and slab bridges
- explain the Principles of continuous bridges and composite bridges
- gain knowledge on fundamentals of bearings used in bridges.
- get exposure on the conceptual knowledge on bridge maintenance.

Prerequisite: Nil

UNIT I INTRODUCTION TO BRIDGE ENGINEERING 9

Historical background of bridges and types – Bridge aesthetics and proportioning – Design process – Review of applicable design codes – Loads on bridges and force distribution – Bridge geometry – Conceptual design – Classification of bridges – Bridge hydrology – Determination of design discharge, linear water way, economical Span, location of piers and abutments, afflux, scour depth.

UNIT II SLAB AND T- BEAM BRIDGES 9

Design of slab bridges – Skew slab culverts – Box culverts – T-beam bridges – Pigeaud curves – Courbon's theory – Hendry Jaegar method – analysis and design of T-beam bridges.

UNIT III LONG SPAN BRIDGES 9

Hollow girder bridges – Balanced cantilever bridges – Continuous girder bridges – Rigid frame bridges – Arch bridges – Bow string girder bridges – Pre-stressed concrete bridges – Composite pre-stressed concrete super structures – Erection of precast girders – Continuous construction – Recent trends.

UNIT IV BEARINGS AND SUBSTRUCTURE 9

Design of bearings for slab, girder, skew bridges – Design of piers – Abutments – Trestles, Joints – expansion joints. Materials for substructures – Bridge inspection – Caissons – Cofferdams – Spread and pile foundation.

UNIT V BRIDGE MAINTENANCE 9

Bridge failures – Case studies – Maintenance of bridges – Detailed inspection – Routine inspection – Posting of bridges – Rating of existing bridges – Rebuilding of bridges – Retrofitting and rehabilitation of bridges.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyse various design codes on bridges and execute reconnaissance of the bridge design.
- be proficient in Substructure of bridges.
- design Superstructure components of bridges.
- evaluate the types of bearings used in bridges.
- execute bridge maintenance and analyze case studies on bridges

TEXT BOOKS

1. KrishnaRaju.N, "Design of Bridges ", Oxford and IBH, 2009.
2. Ponnuswamy.S, "Bridge Engineering", Tata McGraw-Hill, 2008

REFERENCES

1. Jagadeesh T.R. and Jayaram M.A., "Design of Bridge Structures", Prentice Hall of India Pvt Ltd., 2013
2. Johnson Victor.D, "Essentials of Bridge Engineering", Oxford & IBH, 2007.
3. IRC:6-2010 Standard Specifications and Code of Practice for Road Bridges, Section II - Loads and Stresses (Fifth Revision).
4. IRC:24-2010 Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit State Method) (Third Revision).

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	1	2	1	-
CO2	2	3	2	2	2	-	-	-	-	-	1	2	2	2
CO3	2	3	2	2	2	-	-	-	-	-	1	2	2	2
CO4	2	3	2	2	2	-	-	-	-	-	1	2	2	2
CO5	3	-	-	-	-	-	-	-	-	-	1	2	1	-

CE16353 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the maintenance and repair strategies.
- identify an overview of quality assurance for concrete construction and explain the serviceability and durability properties of concrete under various exposure conditions.
- explain the repair materials and techniques used in the Construction Industry.
- identify the repair, rehabilitation and retrofitting techniques to overcome the structural damage due to various exposure conditions.
- explain the demolition techniques of broken-down structures.

Prerequisite : Nil

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 - Effects of cover thickness.

UNIT III SPECIAL CONCRETE 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 STRUCTURES 9

Strengthening of Structural elements - Repair of structures distressed due to corrosion, fire, leakage, and Earthquake demolition techniques - Engineered demolition methods - Case studies.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply knowledge about the quality of concrete.
- attain knowledge about the durability aspects of concrete.
- perceive the causes of deterioration of concrete structures..
- evaluate the assessment of distressed structures.
- attain knowledge about repairing of structures and demolition procedures.

TEXT BOOKS

1. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, PrenticeHall India Pvt Ltd 2014.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009
3. Santhakumar. A.R "Concrete Technology", Oxford Higher Education, 2006.

REFERENCES

1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008
2. Ravishankar.K.,Krishnamoorthy. T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004
3. DovKominetzky.M.S., - Design and Construction Failures, Galgotia Publications Pvt. Ltd., 2001
4. Hand Book on "Repair and Rehabilitation of RCC Buildings" – Director General works CPWD , Govt of India New Delhi – 2002

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	1	-	1	1	1	-
CO2	2	-	-	-	-	-	-	-	1	-	1	1	1	-
CO3	2	-	-	-	-	-	-	-	1	-	1	1	1	-
CO4	2	-	-	-	-	-	-	-	1	-	1	1	1	-
CO5	2	-	-	-	-	-	-	-	1	-	1	1	1	-

PROFESSIONAL ELECTIVE IV

CE16451 GROUND IMPROVEMENT TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- develop an awareness of problematic soils and selection of ground improvement techniques
- understand drainage and dewatering methods.
- know about the compaction and consolidation behaviour of the soils.
- study the concepts and applications of earth reinforcement.
- know about the suitable grouting techniques for various types of soils.

Prerequisite: Nil

UNIT I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 9

Role of ground improvement in foundation engineering – methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

UNIT II DEWATEREING 9

Dewatering Techniques – Well points – Vacuum and electro osmotic methods – Seepage analysis for two – dimensional flow for fully and partially penetrated slots in homogeneous deposits.

UNIT III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 9

In-situ densification of cohesionless soils and consolidation of cohesive soils – Dynamic compaction Vibro flotation, Sand compaction piles and deep compaction. Consolidation – Preloading with sand drains, and fabric drains, Stone columns and Lime piles-installation techniques – simple design – relative merits of above methods and their limitations.

UNIT IV EARTH REINFORCEMENT 9

Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – simple design – applications of reinforced earth – Role of Geotextiles in filtration, drainage, separation, road works and containment.

UNIT V GROUT TECHNIQUES 9

Types of grouts – Grouting equipment and machinery – injection methods – Grout monitoring – stabilization with cement, lime and chemicals – stabilization of expansive soil.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the problematic soil and select the suitable ground improvement techniques.
- determine the seepage analysis of the soil.
- get knowledge on in-situ treatment of cohesionless and cohesive soil.

- understand the concept of earth reinforcement and design of reinforced earth.
- gain knowledge about the various grouting techniques.

TEXT BOOKS

1. Purushothama Raj. P, "Ground Improvement Techniques", Firewall Media, 2005.
2. Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, 1994.
3. Mittal.S, "An Introduction to Ground Improvement Engineering", Medtech Publisher, 2013.

REFERENCES

1. Moseley, M.P., "Ground Improvement Blockie Academic and Professional", Chapman and Hall, Glasgow, 1998.
2. Jones J.E.P. "Earth Reinforcement and Soil Structure", Butterworths, London, 1985.
3. IS 13094: Selection of ground improvement techniques for foundation in weak soils – Guidelines -1992

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	1	1	-	-	-	-	2	1	-
CO2	2	-	-	-	-	1	1	-	-	-	-	2	1	-
CO3	2	-	-	-	-	1	1	-	-	-	-	2	1	-
CO4	2	-	-	-	-	1	1	-	-	-	-	2	1	-
CO5	2	-	-	-	3	1	1	-	-	-	-	2	1	-

CE16452 PREFABRICATED STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- impart the basic knowledge about prefabrication
- familiar with prefabricated components
- acquire the basic concepts design principles of prefabrication
- update their knowledge about joints in structural members
- design the prefabricated components for abnormal loads.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS 9

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

UNIT III DESIGN PRINCIPLES 9

Disuniting of structures – Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT IV JOINTS IN STRUCTURAL MEMBERS 9

Joints for different structural connections – Dimensions and detailing – Design of expansion joints.

UNIT V DESIGN FOR ABNORMAL LOADS 9

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

TOTAL PERIODS 45

COURSE OUTCOMES

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

- gather the basic knowledge about prefabrication
- familiarize with prefabricated components
- get the basic concepts design principles of prefabrication
- update their knowledge about joints in structural members
- design the prefabricated components for abnormal loads.

TEXT BOOKS

1. "Precast Concrete Structures", Second Edition by Kim S. Elliott, CRS Publishers, 2016
2. Gerostiza C.Z., Hendrikson C. and Rehat D.R., "Knowledge based process planning for construction and manufacturing", Academic Press Inc., 2012.
3. "Precast Concrete Structures", Second Edition by Kim S. Elliott, CRS Publishers, 2016

REFERENCES

1. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design", 8th Edition, Tata McGraw Hill Edition, 2011
2. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd Edition, USA 2010.
3. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	-	-	-	1	-	1	2	2	-
CO2	2	-	-	-	-	-	-	-	1	-	1	2	2	-
CO3	2	-	-	-	-	-	-	-	1	-	1	2	2	-
CO4	2	-	-	-	-	-	-	-	1	-	1	2	2	-
CO5	2	-	-	-	-	-	-	-	1	-	1	2	2	-

CE16453 INDUSTRIAL STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the planning and layout requirements, guidelines of factories act.
- gain knowledge on design of corbels, Nibs and Staircase.
- know about the various power plant structures.
- learn about the analysis and design of transmission line structures and chimneys.
- gain knowledge on various types of foundations.

Prerequisite: Nil

UNIT I PLANNING AND FUNCTIONAL REQUIREMENTS 9

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines of Factories Act.

UNIT II INDUSTRIAL BUILDINGS 9

Steel and RCC - Gantry Girder, Crane Girders - Design of Corbels and Nibs - Design of Staircase.

UNIT III POWER PLANT STRUCTURES 9

Types of power plants - Containment structures - Cooling Towers - Bunkers and Silos - Pipe Supporting structures.

UNIT IV TRANSMISSION LINE STRUCTURES AND CHIMNEYS 9

Analysis and design of steel monopoles, transmission line towers - Sag and Tension calculations, Methods of tower testing - Design of self-supporting and guyed chimney - Design of Chimney bases.

UNIT V FOUNDATION 9

Design of foundation for Towers - Chimneys and Cooling Towers - Machine Foundation - Design of Turbo Generator Foundation

TOTAL PERIODS 45

COURSE OUTCOMES

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

- classify the industries and plan the layout requirements based on the guidelines factory act.
- design the Gantry Girder, Crane Girders, Corbels, NIBS and Staircase.
- understand the various power plant structures.
- prepare the design for various chimneys.
- design the foundation for Chimneys, Cooling Towers, Machines and Turbo Generators.

TEXT BOOKS

1. Santhakumar A.R. and Murthy S.S., Transmission Line Structures, Tata McGraw Hill,1992
2. Srinivasulu P and Vaidyanathan.C, Handbook of Machine Foundations, Tata McGraw Hill, 2014.

REFERENCES

1. Jurgen Axel Adam, KatharriaHausmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004.
2. Manohar S.N, Tall Chimneys - Design and Construction, Tata McGraw Hill, 1985

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	1	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	1	-	-	-	-	-	-	-	2	-
CO3	2	3	3	3	1	-	-	-	-	-	-	-	2	3
CO4	2	1	-	-	1	-	-	-	-	-	-	-	2	-
CO5	2	1	-	-	1	-	-	-	-	-	-	-	2	-

CE16454 TALL STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- design and analyse the various methodologies of tall structures
- perform stability analysis of tall structures.
- impose the knowledge on the control of failures in structures.
- know the concepts behind the analysis and design of buildings.
- study on controlling the buckling of column.

Prerequisite: Nil

UNIT I DESIGN CRITERIA AND MATERIALS 9

Development of High Rise Structures – General Planning Considerations – Design philosophies Materials used for Construction – High Strength Concrete – High Performance Concrete – Self Compacting Concrete – Glass – High Strength Steel.

UNIT II LOADING 9

Gravity Loading – Dead Load – Live Load – Live load reduction technique – Impact Load Construction Load – Sequential Loading, Lateral Loading – Wind load – Earthquake Load – Combination of Loads.

UNIT III BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS 9

Factors affecting growth – Height and Structural form – High rise behaviour of various structural systems – Rigid frames – braced frames – Infilled frames – shear walls – coupled shear walls – wall frames – tubular structures – cores, Outrigger – Braced and hybrid mega systems.

UNIT IV ANALYSIS AND DESIGN 9

Modeling for approximate analysis –Accurate analysis and reduction techniques – Analysis of buildings as total structural system considering overall integrity and major subsystem interaction – Analysis for member forces, drift and twist, computerized general three dimensional analysis.

UNIT V STABILITY OF TALL STRUCTURES 9

Overall buckling analysis of frames, wall-frames – Approximate methods, second order effects of gravity of loading – Simultaneous first-order and P-Delta analysis – Translational, Torsional instability, out of Plumb effects – Stiffness of member in stability, effect of foundation rotation.

45

TOTAL PERIODS

COURSE OUTCOMES

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

- perceive the behaviour of tall buildings subjected to lateral building.
- design and evaluate tall building project alternatives on basis of chosen selection criteria
- attain knowledge about principles of designing tall buildings.
- aware with the effects and control of damaged structure.
- perform site specific response analysis to torsion stability

TEXT BOOKS

1. Taranath B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill, 2012
2. Bryan Stafford Smith, Alex coull, "Tall Building Structures, Analysis and Design", John Wiley and Sons, Inc.,2011

REFERENCES

1. Lin.T.Y, StotesBurry.D, "Structural Concepts and systems for Architects and Engineers" John Wiley, 2008
2. Lynn S.Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, Delhi, 2006.
3. Wolfgang Schueller, "High Rise Building Structures", John Wiley and Sons, New York 1997

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	1	-	-	-	-	-	-	2	2	1
CO2	2	2	2	2	1	-	-	-	-	-	-	2	2	1
CO3	2	2	2	2	1	-	-	-	-	-	-	2	2	1
CO4	2	2	2	2	1	-	-	-	-	-	-	2	2	1
CO5	2	2	2	1	1	-	-	-	-	-	-	2	2	1

CE16455 INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS **3 0 0 3**

COURSE OBJECTIVE

To enable the students to

- study about the theory of vibration.
- equip themselves familiar with wave and wave propagation.
- assess the dynamic properties of soil.
- get familiarized with the procedure used for machine foundation design.
- learn the concept of the vibration isolation and screening techniques.

Prerequisite: Nil

UNIT I THEORY OF VIBRATION **9**

Vibration of elementary systems – Vibratory motion – single degree freedom system – Free vibration with and without damping – Forced vibration with and without damping – Principles of vibration measuring instruments.

UNIT II WAVES AND WAVE PROPAGATION **9**

Wave propagation in an elastic homogeneous isotropic medium – Rayleigh, shear and compression waves – Waves in elastic half space (no theoretical treatment or derivation).

UNIT III DYNAMIC PROPERTIES OF SOILS **9**

Elastic properties of soils – Coefficient of elastic uniform and non-uniform compression and shear – Effect of vibration dissipative properties of soils – Determination of dynamic properties of soil – codal provisions – IS:5249- 1992.

UNIT IV DESIGN PROCEDURES FOR SIMPLE MACHINE FOUNDATION **9**

Design criteria – Dynamic – simple design procedures for foundations of reciprocating type machines (Treated single degree freedom only) – simple design procedures for foundations of impact type machines (Treated single degree freedom only).

UNIT V VIBRATION ISOLATION AND SCREENING **9**

Vibration isolation technique – Foundation isolation, isolation by location, Isolation by barriers active and passive isolation.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- evaluate the dynamic properties of soil.
- demonstrate various tests to find the soil properties.
- create the design of machine foundation based on the criteria.
- demonstrate the ability to design machine foundations.
- gather the various methods to reduce the isolation.

TEXT BOOKS

1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt.Ltd.2010.
2. Prakash.S, and Puri,V.K., "Foundation for Machines", McGraw Hill Publishing Company, Newyork, 1988.

REFERENCES

1. Kameswara Rao, "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003.
2. Kamaswara Rao, "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi, 1998.
3. Moore.P.J, "Analysis and Design of Foundation for Vibration", Oxford and IBH, 2005.
4. IS 5249 Code of Practice for "Method of test for determination of dynamic properties of soil" Bureau of Indian Standards, New Delhi.
5. IS 2974 Code (Part I to IV) of Practice for "Design and Construction of Machine Foundations", Bureau of Indian Standards, New Delhi.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	-	1	-	-	-	-	-	-	2	2	1
CO2	2	1	2	-	1	-	-	-	-	-	-	2	2	1
CO3	2	1	2	-	1	-	-	-	-	-	-	2	2	1
CO4	2	1	2	-	1	-	-	-	-	-	-	2	2	1
CO5	2	1	2	-	1	-	-	-	-	-	-	2	2	1

CE16801 **PROJECT WORK** **0 0 12 6**

COURSE OBJECTIVES

To enable the students to

- make use of the knowledge gained by the student at various semester.
- understand the various procedures for validation of the project and
- the degree course and formulate a real world problem and project's goals.
- analyse for the cost effectiveness.

STRATEGY:

The student works on a topic approved by the Head of the Department under the guidance of a faculty member and prepare 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 PERIODS 180

COURSE OUTCOMES

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

- formulate a real world problem.
- identify the requirement and develop the design solutions.
- test and validate through conformance of the developed prototype
- analysis the cost effectiveness.

CO PO Mapping

Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak														
Cos	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	1	1	2	-	1	-	3	-	2	1	3	2
CO2	3	1	1	1	2	-	1	-	3	-	2	1	3	2
CO3	3	1	1	1	2	-	1	-	3	-	2	1	3	2
CO4	3	1	1	1	2	-	1	-	3	-	2	1	3	2