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

<table>
<tr><td colspan="15">Mapping of course objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak</td></tr>
<tr><td rowspan="2">Cos</td><td colspan="14">Programme Outcomes (POs)</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td></tr>
<tr><td>CO1</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td><td>-</td></tr>
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<tr><td>CO4</td><td>2</td><td>2</td><td>-</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>-</td><td>-</td><td>2</td><td>2</td><td>2</td><td>-</td></tr>
<tr><td>CO5</td><td>-</td><td>-</td><td>2</td><td>2</td><td>-</td><td>2</td><td>2</td><td>2</td><td>2</td><td>-</td><td>2</td><td>2</td><td>2</td><td>-</td></tr>
</table>

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

Cos	Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak													
	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

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</table>

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   9
             DIFFUSION

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

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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.

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1. nptel.ac.in/courses/105104101/1

2. https://sites.google.com/a/mitr.iitm.ac.in/iitmcivil/ce2080

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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 acquire the 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

Cos	Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak
	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

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

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	Programme Outcomes (POs)													
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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

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   15
                EQUATIONS**

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

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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

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

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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
- understand the 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

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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

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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

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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

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</table>

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

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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

Cos	Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak													
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CO3	3	2	2	1	3	-	-	-	1	-	-	2	3	1
CO4	3	2	2	1	3	-	-	-	1	-	-	2	3	1

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

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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

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</table>

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

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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

UNIT I   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/

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</table>

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

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

CO PO Mapping

Cos	Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak													
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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

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

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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

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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

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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

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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

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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

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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   9 PLAN

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

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<tr><td colspan="15" align="center">Mapping of course objectives with Programme Outcomes:
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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

Cos	Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak													
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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

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</table>

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

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2. http://elearning.vtu.ac.in/06CV64.html

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CO4	2	1	1	1	-	-	-	-	-	-	-	2	1	1
CO5	2	1	1	1	-	-	-	-	-	-	-	2	1	1

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.

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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

| Cos | Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak | | | | | | | | | | | | |

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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

<table>
<tr><td colspan="16">Mapping of course objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak</td></tr>
<tr><td rowspan="2">Cos</td><td colspan="15">Programme Outcomes (POs)</td></tr>
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<tr><td>CO5</td><td>2</td><td>1</td><td>3</td><td>1</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>1</td><td>2</td></tr>
</table>

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

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</table>

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

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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

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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

Cos	Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak													
	Programme Outcomes (Pos)													
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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

Cos	Mapping of course objectives with Programme Outcomes: (1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak

	Programme Outcomes (POs)
Cos	**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

CE15701   CONCRETE STRUCTURES   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- impart the concepts of limit state design.
- acquire knowledge on various special structures.
- design earth retaining structures.
- design liquid retaining structures.
- gain the skills on ductile detailing of structures.

Prerequisite: Basic Structural Design II

UNIT I   INTRODUCTION   9

Limit state design - Strength and serviceability according to IS Codes - Calculation of deflection and crack width according to IS Code.

UNIT II   DESIGN OF SPECIAL STRUCTURES   9

Design of slender columns - Design of RC walls ; Strut and tie method of analysis for corbels and deep beams, Design of corbels, Deep-beams and grid floors.

UNIT III   EARTH RETAINING STRUCTURES   9

Concepts of active and passive earth pressure - Pressure distribution due to water table ; Surcharge - Cantilever and counterfort retaining walls - Stability requirements and design.

UNIT IV   LIQUID RETAINING STRUCTURES   9

Principles and design of liquid retaining structures -Properties of uncracked sections - Underground, surface, overhead tanks ; Design using IS 3370 - Square, rectangular and circular shapes with spherical domical roof -Design of circular base slab - Circular girder -Design of staging

UNIT V   DUCTILE DETAILING   9

Concept of Ductility -Detailing for ductility ; Design of beams, columns for ductility - Design of cast-in-situ joints in frames.

                                                    TOTAL PERIODS   45

COURSE OUTCOMES

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

- perceive the concepts of limit state design.
- design various special structures.
- express the design concepts of earth retaining structures.
- summarize the design concepts of liquid retaining structures.
- solve ductile detailing requirements in flexural members.

TEXT BOOKS

1. Varghese P C, "Limit State Design of Reinforced Concrete", Prentice Hall of India Ltd, New Delhi, 2013.

2. Sinha N C and Roy S K "Fundamentals of Reinforced concrete", S Chand & Co, Ltd., New Delhi, 2013.

3. Arthur H Nilson, David Darwin and Charles W Dolan, "Design of concrete Structures" Tata McGraw Hill, New Delhi, 2010.

REFERENCES

1. Krishna Raju N, "Advanced Reinforced Concrete Design", CBS Publishers & Distributors, New Delhi, 2016.

2. Gambhir.M. L., "Design of Reinforced Concrete Structures", Prentice Hall of India, 2012

3. Unnikrishna Pillai and Devdas Menon "Reinforced Concrete Design", Third Edition, Tata McGraw Hill Publishers Company Ltd., New Delhi, 2007.

4. IS 456: 2000 – Plain and Reinforced Concrete – Code of practice (Fourth Revision).

5. SP 16 – 1980 – Design Aids (for Reinforced Concrete) to IS456: 1978.

6. IS 3370 (Part I to IV): 2009 – Concrete Structures for Storage of Liquids – Code of Practice.

7. IS 13920: 1993 – Ductile Detailing of Reinforced Concrete Structures Subject to Seismic Forces.

WEBLINK

1. http://nptel.ac.in/downloads/105105104/

CO PO MAPPING:

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CO3	2	2	2	2	2	-	-	-	-	-	-	-	3	2
CO4	2	2	2	2	2	-	-	-	-	-	-	-	3	2
CO5	2	3	2	2	-	-	-	-	-	-	-	-	3	2

CE15702   ESTIMATION AND QUANTITY SURVEYING   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 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 etc.

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, syphon, fall.

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 ofquantities.
- attain the 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, 1998 & E–Tender
3. Arbitration and Conciliation Act, 1996

WEB LINKS

1. nptel.ac.in/courses/105103093
2. nptel.ac.in/courses/105103023

CO PO MAPPING:

<table>
<tr><th colspan="15">Mapping of course objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3- strong,2-Medium, 1-Weak</th></tr>
<tr><th rowspan="2">Cos</th><th colspan="14">Programme Outcomes (POs)</th></tr>
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</table>

CE15703   EARTHQUAKE RESISTANT STRUCTURES   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- understand the importance of engineering seismology and earthquake monitoring techniques.
- evaluate the effect of earthquake forces on structures as per Codal provisions.
- know about the basic principles of earthquake resistant design of masonry structures.
- familiarize lateral load analysis on earthquake resistant RC structures.
- acquire the knowledge on various vibration control techniques.

  Prerequisite: Nil

UNIT I   EARTHQUAKES AND GROUND MOTION   9

Engineering Seismology (Definitions, Introduction to Seismic hazard, Earthquake Phenomenon) -Seismotectonics and Seismic Zoning of India - Earthquake Monitoring and Seismic Instrumentation -Characteristics of Strong Earthquake Motion - Estimation of Earthquake Parameters.

UNIT II   EFFECTS OF EARTHQUAKE ON STRUCTURES   9

Dynamics of Structures (SDOFS/ MDOFS) - Response Spectra - Evaluation of Earthquake Forces as per codal provisions -Effect of Earthquake on Different Types of Structures - Lessons Learnt from Past Earthquakes.

UNIT III   EARTHQUAKE RESISTANT DESIGN OF MASONRY STRUCTURES   9

Structural Systems - Types of Buildings - Causes of damage - Planning Considerations - Philosophy and Principle of Earthquake Resistant Design - Guidelines for Earthquake Resistant Design - Earthquake Resistant Masonry Buildings - Design consideration - Guidelines.

UNIT IV   EARTHQUAKE RESISTANT DESIGN OF RC STRUCTURES   9

Earthquake Resistant Design of R.C.C. Buildings - Material properties - Lateral load analysis - Capacity based Design and detailing - Rigid Frames -Shear walls.

UNIT V   VIBRATION CONTROL TECHNIQUES   9

Vibration Control - Tuned Mass Dampers -Principles and application, Basic Concept of Seismic Base Isolation -Various Systems - Case Studies, Important structures.

TOTAL PERIODS   45

COURSE OUTCOMES

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

- perceive the basics of engineering seismology and seismotectonics behaviour of earth.
- evaluate the earthquake forces on structures as per Indian codes
- confess the importance of design philosophy and principle of earthquake resistant design.
- design earthquake resistant structures based on capacity-based design method.
- explain the various vibration control techniques in structures.

TEXT BOOKS

1. Damodarasamy S.R, Kavitha. S, "Basics of Structural Dynamics and Aseismic Design", PHI Learning Pvt. Ltd, 2009

2. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2009.

3. S K Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, 2007.

REFERENCES

1. Mohiuddin Ali Khan "Earthquake–Resistant Structures: Design, Build and Retrofit", Elsevier Science & Technology, 2012

2. C. A. Brebbia, "Earthquake Resistant Engineering Structures VIII", WIT Press, 2011

3. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2011.

4. Paulay,T and Priestley, M.J.N., "Seismic Design of Reinforced Concrete and Masonry buildings", John Wiley and Sons, 1992.

5. IS 1893 (Part 1): 2002 Indian Standard "Criteria for Earthquake Resistant Design of Structures"

6. IS 13920: 1993 – Ductile Detailing of Reinforced Concrete Structures Subject to Seismic Forces.

WEB LINKS

1. http://nptel.ac.in/courses/105101006/

2. http://freevideolectures.com/Course/3129/Structural–Dynamics#

3. http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291096–9845/issues

CO PO MAPPING:

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CO2	2	3	-	2	-	-	-	-	-	-	-	-	3	2
CO3	2	3	-	2	-	-	-	-	-	-	-	-	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	2

CE15704   **PRE-STRESSED CONCRETE STRUCTURES**   **3   0   0   3**

COURSE OBJECTIVES

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 Magnel"s 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 continuityin 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 the course, 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. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt Ltd., Second edition, 2014

2. Krishna Raju N., "Prestressed concrete", Tata McGraw Hill Company, Fifth Edition, 2012.

REFERENCES

1. Sinha.N.C. and Roy.S.K., "Fundamentals of Prestressed Concrete", S.Chand and Co. Ltd., 2011

2. Arthur H. Nilson, "Design of Prestressed Concrete", John Wiley and sons, 2nd Edition, 2011.

3. Lin T.Y. and Ned.H. Burns, "Design of prestressed Concrete Structures", John Wiley and Sons, 3rd Edition, 2010.

4. IS1343 – 1980 – 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.

WEB LINKS

1. http://nptel.ac.in/courses/105106118/

3. https://www.tmgglobals.com/prestressing

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CO2	3	2	3	-	-	-	-	-	-	-	-	-	1	1
CO3	3	2	3	-	-	-	-	-	-	-	-	-	1	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	-	1
CO5	2	2	3	-	-	-	-	-	-	-	-	-	1	2

PROGRAMME ELECTIVE III

MA 15153   OPERATIONS RESEARCH   **3   0   0   3**

COURSE OBJECTIVES

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.
- understand the techniques of optimality.
- develop an understanding and appreciation for the field of inventory and production management.
- provide the student with a rigorous framework with which to model and analyze queuing systems.

Prerequisite: Nil

UNIT I   LINEAR PROGRAMMING MODELS   **9**

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

UNIT II   TRANSPORTATION AND ASSIGNMENT MODELS   **9**

Mathematical formulation of transportation problem - Methods for finding initial basic feasible solution - optimum solution - degeneracy - Mathematical formulation of assignment models - Variants of the Assignment problem.

UNIT III   DYNAMIC PROGRAMMING   **9**

Dynamic programming - Principle of optimality - Forward and backward recursion - Applications of dynamic programming - Problem of dimensionality.

UNIT IV   INVENTORY MODELS AND NETWORKING MODELS   **9**

Inventory Models - EOQ and EBQ Models (With and without shortages), Quantity Discount Models - Networking Models - PERT & CPM.

UNIT V   QUEUEING MODELS   **9**

Characteristics of Queuing Models - Poisson Queues -(M / M / 1): (FIFO / ∞ /∞), (M / M / 1): (FIFO / N / ∞), (M / M / C): (FIFO / ∞ / ∞), (M / M / C): (FIFO / N / ∞) models.

                                                                TOTAL PERIODS   45

COURSE OUTCOMES

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

- perceive and apply linear, integer programming to solve operational problem with constraints…
- apply transportation and assignment models to find optimal solution in warehousing and Travelling.
- aware to use optimization concepts in real world problems.
- logistics majors will be able to apply inventory models and techniques to create and recommend appropriate stocking solutions in various business settings.
- 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. Operations Research by Kanthiswarup, P.K. Gupta, Manmohan 9th Revised Edition 2001, Reprint 2002. Sultan Chand & Sons, New Delhi

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 and Computational Methods", Springer, 2008.

4. Ravindran, Phillips, Solberg, "Operations Research: Principles and Practice", Second Edition, John Wiley & Sons, 2007.

WEB LINKS

1. https://www.youtube.com/watch?v=M8POtpPtQZc

2. https://www.youtube.com/watch?v=–YBlR1UF–UY

4. https://www.youtube.com/watch?v=ug7O1lSZyg0

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CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	1

CE15351   ADVANCED CONCRETE DESIGN   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- familiar with the limit state design of RCC beams and slabs in shear and torsion.
- design the Plain and Reinforced walls.
- design the flat slab as per Indian standard, and gain knowledge about yield line theory.
- analyse the special structures such as bunkers and silo.
- design the super structure of slab bridge and T beam bridge.

Prerequisite: Nil

UNIT I   DESIGN OF COMBINED BENDING, SHEAR AND TORSION   9

Behavior of RC beams and slabs in shear and torsion - Design of RC members for combined bending, shear and torsion.

UNIT II   DESIGN OF RC WALLS   9

Design of Plain and Reinforced Concrete walls - Shear wall.

UNIT III   DESIGN OF FLAT SLABS AND DESIGN OF SLABS USING YIELD LINE THEORY   9

Design of flat slabs - IS method - Design of slabs using yield line theory.

UNIT IV   BUNKERS AND SILOS   9

Design of Bunkers -Design of Silo - Detailing.

UNIT V   DESIGN OF BRIDGES   9

IRC loading, Design of slab bridge - T beam bridge. (Super structure only)

                                                                TOTAL PERIODS   45

COURSE OUTCOMES

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

- design the beams and slabs for combined bending, shear and torsion as per IS Code.
- design the Plain and Reinforced concrete walls.
- design the flat slab as per Indian standard and perceive knowledge on yield line theory.
- analyse the special structures.
- design the super structure of slab bridge and T beam bridge as per IRC loading.

TEXT BOOKS

1. Jagadeesh T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt Ltd., 2013
2. Varghese.P.C., "Advanced Reinforced concrete design", Prentice – Hall of India Private Ltd, New Delhi, 2010.
3. Krishna Raju, "Advanced reinforced concrete design – S.I units", C.B.S., New Delhi, 2010.

REFERENCES

1. Gambhir. M. L., "Design of Reinforced Concrete Structures", Prentice Hall of India, 2010.

2. N. Subramanian., "Design of Reinforced Concrete Structures", Oxford university press, 2010

3. IS 456–2000, "Indian standard code of practice for plain and reinforced concrete", Bureau of Indian standards, New Delhi, 2000.

4. Purushothaman, P, "Reinforced Concrete Structural Elements: Behaviour Analysis and Design", Tata McGraw Hill, 1986

WEB LINKS

1. https://onlinecourses.nptel.ac.in/noc17ce23

2. http://www.nptelvideos.in/2012/11/design–of–reinforced–concrete–structures.html.

3. http://nptel.ac.in/downloads/105105104/

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CO3	2	2	2	2	2	-	-	-	-	-	-	-	3	2
CO4	2	2	2	2	2	-	-	-	-	-	-	-	3	2
CO5	2	3	2	2	-	-	-	-	-	-	-	-	3	2

CE15352   INDUSTRIAL WASTE MANAGEMENT   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- provide basic knowledge on the management practices of solid and liquid waste.
- impart knowledge on the collection, transport and disposal of solid waste.
- emphasize the need for solid and liquid waste management.
- gain knowledge on removal of suspended and dissolved organic solids.
- study the industrial waste management and hazardous waste.

Prerequisite: Nil

UNIT I   INTRODUCTION   9

Types of industries and industrial pollution - Characteristics of industrial wastes - Population equivalent -Bioassay studies - Effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health - Environmental legislations related to prevention and control of industrial effluents.

UNIT II   CLEANER PRODUCTION   9

Waste management Approach - Waste Audit - Zero discharge -Volume and strength reduction - Material and process modifications - Recycle, reuse and by-product recovery - Applications.

UNIT III   POLLUTION FROM MAJOR INDUSTRIES   9

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Sugar, Paper, distilleries, Refineries, fertilizer, thermal power plants - Wastewater reclamation concepts.

UNIT IV   TREATMENT TECHNOLOGIES   9

Equalization - Neutralization - Removal of suspended and dissolved organic solids - Chemical oxidation - Adsorption -Removal of dissolved in-organics - Combined treatment of industrial and municipal wastes - Residue management - Dewatering - Disposal.

UNIT V   HAZARDOUS WASTE MANAGEMENT   9

Hazardous wastes -Physico chemical treatment - Solidification -Incineration - Secured landfills - Case study of industrial waste management in any two cities in Tamil Nadu and India with innovations in Engineering and Technology - Environmental legislations related to prevention and control of hazardous wastes.

TOTAL PERIODS   45

COURSE OUTCOMES

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

- execute plan on minimization of industrial wastes.
- design the facilities for the processing and reclamation of industrial waste water.
- evaluate the characteristics of solid and liquid waste from various industry.
- evaluate the methods of treatments and the disposal of various industrial effluent
- attain knowledge on hazardous waste management.

TEXT BOOKS

1. M.N.Rao & A.K.Dutta, "Wastewater Treatment", Oxford – IBH Publication, 2008.

2. Patwardhan. A.D., "Industrial Wastewater Treatment", Prentice Hall of India, New Delhi, 2008.

3. W.W. Eckenfelder Jr., "Industrial Water Pollution Control", McGraw Hill Book Company, New Delhi, 2000

REFERENCES

1. T.T. Shen, Industrial Pollution Prevention, Springer, 1999.

2. R.L. Stephenson and J.B. Blackburn, Jr., Industrial Wastewater Systems Hand book, Lewis Publisher, New Yark, 1998.

3. H.M. Freeman, Industrial Pollution Prevention Hand Book, McGraw–Hill Inc., New Delhi, 1995.

WEB LINKS

1. nptel.ac.in/courses/120108005/module1/lecture1.pdf

2. nptel.ac.in/courses/105106119/36

4. nptel.ac.in/courses/120108005/

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</table>

CE15353   TRAFFIC ENGINEERING AND MANAGEMENT   3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart the fundamentals related to the traffic flow
- acquire knowledge on traffic signals and its operation
- create awareness about the control measures for traffic flow and fundamentals of traffic engineering
- impart knowledge on accident risk and its management
- provide knowledge on traffic management measures.

Prerequisite: Nil

UNIT I   THEORY OF TRAFFIC FLOW   9

Scope - Definitions -Basic relationship ; Flow density - Capacity - Speed studies - Car following theory and its application to traffic engineering -probabilistic description of traffic flow ; Introduction to queuing theory- Traffic flow problems for steady state conditions - Simulation - Tools

UNIT II   TRAFFIC SIGNALS   9

Traffic signals - Types -Advantages - Optimal cycle time ; Signal setting for an intersection - Fixed time signals – Coordination of signals - Types - Area traffic control - Delay at signalized intersection.

UNIT III   TRAFFIC ENGINEERING AND CONTROL   9

Review of various traffic surveys - Traffic studies -Statistical methods - Traffic engineering and their applications - Distributions - Sampling theory - Significance testing - Regression and correlation -Intersection design - Principles - Various available alternatives - Rotary design -Roundabouts.

UNIT IV   ACCIDENT AND ROAD SAFETY   9

Accident -Causes - Reporting system - Types of accidents - Recording system - Analysis and preventive measures - Accident cost -Alternative methodologies for calculation ; Modeling - Collision diagram - Road safety -Road users -Awareness - Road users cost.

UNIT V   TRAFFIC SYSTEM MANAGEMENT   9

Traffic system management - Various measures - Scope - Relative merits and demerits ; Highway capacity - passenger car units (PCU) - Level of service - Factor affecting capacity -Level of service -;Influence of mixed traffic -Role of software in Traffic management system – Application of U Route in Traffic System Management

TOTAL PERIODS   45

COURSE OUTCOMES

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

- analyse the various types of traffic flow
- plan and design the traffic signal duration
- practice the traffic engineering and practice the control measures
- analyse the causes and report the accident
- manage the traffic congestion using the available management measures.

TEXT BOOKS

1. Dr. L.R.Kadiyali, "Traffic engineering and transport planning", Khanna Publishers, Delhi, 8th Edition, 2014
2. Subhash Saxena, "A Course in Traffic Engineering and Design", Dhanpat Rai & Sons, 2010.

REFERENCES

1. Wohl and Martin, "Traffic System Analysis for Engineering and Planners", McGraw Hill, 2007
2. G.J. Pingnataro, "Principles of Traffic Engineering", McGraw Hill, 2003

WEB LINKS

1. http://nptel.ac.in/downloads/105101008/

CO PO MAPPING:

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CO3	-	-	-	2	-	3	-	1	-	-	-	2	2	1
CO4	-	-	-	2	-	3	-	1	-	-	-	2	2	1
CO5	-	-	-	2	-	3	-	1	-	-	-	2	2	1

CE15354   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.

UNIT II   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 - 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 the course, students will be able to

- handle various smart materials and devices.
- perceive the basic principles and mechanisms of measuring techniques
- relate the engineering principles in smart sensors, actuators and transducer technology.
- perceive development of actuators and sensors and their integration into a smart structure.
- manage control strategies of smart structures.

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. Yoseph Bar Cohen, "Smart Structures and Materials", the International Society for Optical Engineering, 2009

2. J. W. Dally & W. F. Riley, "Experimental Stress Analysis", Tata McGraw–Hill, 2008.

3. L. S. Srinath, "Experimental Stress Analysis", Tata McGraw – Hill, 2005.

WEB LINKS

1. http://www.nptel.ac.in/syllabus/112104041/

2. https://www.iitk.ac.in/tkic/workshop/.../Smart%20Materials%20and%20Structures

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CO2	2	3	-	2	-	-	-	-	-	-	-	-	1	2
CO3	2	3	3	3	-	-	-	-	-	-	-	-	1	2
CO4	2	3	2	2	-	-	-	-	-	-	-	-	1	2
CO5	3	3	3	3	-	-	-	-	-	-	-	-	1	2

PROGRAMME ELECTIVE IV

CE15451   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 & 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. Aarne Vesilind, "Solid Waste Engineering", Cengage Learning, 2012
2. George Tchobanoglous and FrankKreith, "Handbook of Solid waste Management", McGraw Hill, 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.

WEB LINKS

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2. http;//nptel.ac.in/courses/downloads/120108005/

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CE15452   ENVIRONMENTAL MANAGEMENT   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- gain knowledge about the environmental management standards
- understand the preventive technologies of environmental management
- expand knowledge of the environmental management system
- discuss about the environmental audit
- study various applications of EMS

   Prerequisite: Nil

UNIT I   ENVIRONMENTAL MANAGEMENT STANDARDS   9

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Evolution of Environmental Stewardship - Environmental Management Principles ; National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection - Environmental quality objectives - Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking.

UNIT II   PREVENTIVE ENVIRONMENTAL MANAGEMENT   9

Pollution control Vs Pollution Prevention - Opportunities and Barriers -Cleaner production and Clean technology, closing the loops, zero discharge technologies - Four Stages and nine approaches of Pollution Prevention - Getting management commitment ; Analysis of Process Steps - Source reduction, raw material substitution, toxic use reduction and elimination, process modification - Material balance - Technical, economical and environmental feasibility evaluation of Pollution Prevention options in selected industries - Preventive Environmental Management over Product cycle.

UNIT III   ENVIRONMENTAL MANAGEMENT SYSTEM   9

EMAS, ISO 14000 - EMS as per ISO 14001 - benefits and barriers of EMS - Concept of continual improvement and pollution prevention - Environmental policy- Initial environmental review -Environmental aspect and impact analysis - Legal and other requirements;Objectives and targets - Environmental management programs - Structure and responsibility - Training awareness and competence ;Communication - Documentation and document control - Operational control - Monitoring and measurement - Management review.

UNIT IV   ENVIRONMENTAL AUDIT   9

Environmental management system audit as per ISO 19011 - Roles and qualifications of auditors - Environmental performance indicators and their evaluation ; Nonconformance -Corrective and preventive actions - Compliance audits - Waste audits and waste minimization planning - Environmental statement (form V) - Due diligence audit.

UNIT V   APPLICATIONS   9

Applications of EMS - Waste Audits and Pollution Prevention opportunities in Textile, Sugar, Pulp & Paper, Tanning industry, Dairy, Cement, Chemical industries, etc

                                                      TOTAL PERIODS   45

COURSE OUTCOMES

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

- confess about the environmental management standards
- attain the preventive technologies of environmental management
- conclude about the environmental management system
- express the various environmental audit
- apply the applications of EMS

TEXT BOOKS

1. Lennart Nilsson, Per Olof Persson Lars Rydén, Siarhei Darozhka and Audrone Zaliauskiene, "Cleaner Production – Technologies and Tools for Resource Efficient Production", Baltic University Press,Uppsala, 2007
2. Philipp Weir and Jörg Bentlage, "Environmental Management Systems and Certification", Baltic University Press, Uppsala 2006.

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1. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organization for Standardization, 2004.
2. Paul L Bishop „Pollution Prevention: Fundamentals and Practice", McGraw– Hill International, Boston, 2004.

WEB LINKS

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2. https://www.youtube.com/watch?v=8qqYlNOyLQ8

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CO3	-	-	-	1	-	1	1	1	-	-	2	2	-	2
CO4	-	-	-	2	-	1	1	1	-	-	2	2	-	2
CO5	-	-	-	2	3	1	1	2	-	-	-	1	-	2

CE15453   HOUSING PLANNING AND MANAGEMENT   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- impart the basic knowledge about housing and planning.
- familiar with housing programmes.
- acquire the basic concepts and ideas in planning and designing of housing projects.
- update their knowledge on new techniques in construction and cost–effective materials
- evaluate the housing projects and pricing that projects.

Prerequisite: Nil

UNIT I   INTRODUCTION TO HOUSING   9

Definition of Basic Terms - House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy - Principle of Sustainable Housing - Integrated approach on arriving holding capacity and density norms -All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

UNIT II   HOUSING PROGRAMME   9

Basic Concepts, Contents and Standards for Housing Programmes -Sites and Services, Neighborhoods - Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes -Slum improvement - Slum redevelopment and Relocation - Use of GIS and MIS in Slum Housing Projects, Role of Public housing agencies, and Private sector in supply -Quality, infrastructure and pricing - Role of Non-Government Organizations in slum housing.

UNIT III   PLANNING AND DESIGN OF HOUSING PROJECTS   9

Formulation of Housing Projects - Land Use and Soil suitability analysis - Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Design Problems) - Housing Project Formulation.

UNIT IV   CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS   9

New Constructions Techniques - Cost Effective Modern Materials and methods of Construction Green building concept - Building Centers - Concept, Functions and Performance Evaluation.

UNIT V   HOUSING FINANCE AND PROJECT APPRAISAL   9

Evaluation of Housing Projects for sustainable principles - Housing Finance, Cost Recovery - Cash Flow Analysis, Subsidy and Cross Subsidy - Public Private Partnership Projects - Viability Gap Funding -Pricing of Housing Units (Problems).

TOTAL PERIODS   45

COURSE OUTCOMES

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

- gather knowledge on basic concepts of housing.
- familiarize with different housing programmes.
- attain the basic concepts and ideas in planning and designing of housing projects.
- upgrade their knowledge on new techniques in construction and cost–effective materials.
- evaluate the housing projects and pricing that projects.

TEXT BOOKS

1. "Housing planning and management" by K. Chandrasekar and N. Karthikeyan, CGS Publishers, 2016.

2. "Building construction" by Dr. B.C.Punmia, Er. Ashok kumar Jain, Dr .Arunkumarjain ,Lakshmi Publications ,2016.

REFERENCES

1. Wiley– Blackwell, "Neufert Architects" Data, 4th Edition, Blackwell Publishing Ltd, 2012.

2. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design", 8th Edition, Tata McGraw Hill Edition, 2011

3. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd Edition, USA2010.

WEB LINKS

1. http://nptel.ac.in/courses/124107001/

2. http://mohua.gov.in/cms/policies.php

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CO1	-	-	1	-	-	-	-	2	-	2	-	-	2	3
CO2	-	-	1	-	-	-	-	2	-	2	-	-	2	3
CO3	-	-	2	-	-	-	-	2	-	3	3	-	2	3
CO4	-	-	2	-	-	-	-	2	-	2	3	-	2	3
CO5	-	-	2	-	-	-	-	2	-	3	-	-	2	3

CE15454   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 procedures 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. Tripathi Private 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", Grand Publications, Noida, 2009

WEB LINKS

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

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PROGRAMME ELECTIVE IV

CE15451   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 & 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. Aarne Vesilind, "Solid Waste Engineering", Cengage Learning, 2012

2. George Tchobanoglous and FrankKreith, "Handbook of Solid waste Management", McGraw Hill, New York. 2002.

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1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization", Government of India, New Delhi, 2014.

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CE15452   ENVIRONMENTAL MANAGEMENT   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- gain knowledge about the environmental management standards
- understand the preventive technologies of environmental management
- expand knowledge of the environmental management system
- discuss about the environmental audit
- study various applications of EMS

   Prerequisite: Nil

UNIT I   ENVIRONMENTAL MANAGEMENT STANDARDS   9

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Evolution of Environmental Stewardship - Environmental Management Principles ; National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection - Environmental quality objectives - Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking.

UNIT II   PREVENTIVE ENVIRONMENTAL MANAGEMENT   9

Pollution control Vs Pollution Prevention - Opportunities and Barriers -Cleaner production and Clean technology, closing the loops, zero discharge technologies - Four Stages and nine approaches of Pollution Prevention - Getting management commitment ; Analysis of Process Steps - Source reduction, raw material substitution, toxic use reduction and elimination, process modification - Material balance - Technical, economical and environmental feasibility evaluation of Pollution Prevention options in selected industries - Preventive Environmental Management over Product cycle.

UNIT III   ENVIRONMENTAL MANAGEMENT SYSTEM   9

EMAS, ISO 14000 - EMS as per ISO 14001 - benefits and barriers of EMS - Concept of continual improvement and pollution prevention - Environmental policy- Initial environmental review -Environmental aspect and impact analysis - Legal and other requirements;Objectives and targets - Environmental management programs - Structure and responsibility - Training awareness and competence ;Communication - Documentation and document control - Operational control - Monitoring and measurement - Management review.

UNIT IV   ENVIRONMENTAL AUDIT   9

Environmental management system audit as per ISO 19011 - Roles and qualifications of auditors - Environmental performance indicators and their evaluation ; Nonconformance -Corrective and preventive actions - Compliance audits - Waste audits and waste minimization planning - Environmental statement (form V) - Due diligence audit.

UNIT V   APPLICATIONS   9

Applications of EMS - Waste Audits and Pollution Prevention opportunities in Textile, Sugar, Pulp & Paper, Tanning industry, Dairy, Cement, Chemical industries, etc

                                                                     TOTAL PERIODS   45

COURSE OUTCOMES

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

- confess about the environmental management standards

- attain the preventive technologies of environmental management

- conclude about the environmental management system

- express the various environmental audit

- apply the applications of EMS

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CE15453   HOUSING PLANNING AND MANAGEMENT   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- impart the basic knowledge about housing and planning.
- familiar with housing programmes.
- acquire the basic concepts and ideas in planning and designing of housing projects.
- update their knowledge on new techniques in construction and cost–effective materials
- evaluate the housing projects and pricing that projects.

Prerequisite: Nil

UNIT I   INTRODUCTION TO HOUSING   9

Definition of Basic Terms - House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy - Principle of Sustainable Housing - Integrated approach on arriving holding capacity and density norms -All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

UNIT II   HOUSING PROGRAMME   9

Basic Concepts, Contents and Standards for Housing Programmes -Sites and Services, Neighborhoods - Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes -Slum improvement - Slum redevelopment and Relocation - Use of GIS and MIS in Slum Housing Projects, Role of Public housing agencies, and Private sector in supply -Quality, infrastructure and pricing - Role of Non-Government Organizations in slum housing.

UNIT III   PLANNING AND DESIGN OF HOUSING PROJECTS   9

Formulation of Housing Projects - Land Use and Soil suitability analysis - Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Design Problems) - Housing Project Formulation.

UNIT IV   CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS   9

New Constructions Techniques - Cost Effective Modern Materials and methods of Construction Green building concept - Building Centers - Concept, Functions and Performance Evaluation.

UNIT V   HOUSING FINANCE AND PROJECT APPRAISAL   9

Evaluation of Housing Projects for sustainable principles - Housing Finance, Cost Recovery - Cash Flow Analysis, Subsidy and Cross Subsidy - Public Private Partnership Projects - Viability Gap Funding -Pricing of Housing Units (Problems).

TOTAL PERIODS   45

COURSE OUTCOMES

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

- gather knowledge on basic concepts of housing.
- familiarize with different housing programmes.
- attain the basic concepts and ideas in planning and designing of housing projects.
- upgrade their knowledge on new techniques in construction and cost–effective materials.
- evaluate the housing projects and pricing that projects.

TEXT BOOKS

1. "Housing planning and management" by K. Chandrasekar and N. Karthikeyan, CGS Publishers, 2016.

2. "Building construction" by Dr. B.C.Punmia, Er. Ashok kumar Jain, Dr .Arunkumarjain ,Lakshmi Publications ,2016.

REFERENCES

1. Wiley– Blackwell, "Neufert Architects" Data, 4th Edition, Blackwell Publishing Ltd, 2012.

2. Donald Watson and Michael J.Crosbie, "Time Saver Standards for Architectural Design", 8th Edition, Tata McGraw Hill Edition, 2011

3. Walter Martin Hosack, "Land Development Calculations", McGraw Hill 2nd Edition, USA2010.

WEB LINKS

1. http://nptel.ac.in/courses/124107001/

2. http://mohua.gov.in/cms/policies.php

CO PO MAPPING:

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CE15454   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 procedures 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. Tripathi Private 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", Grand Publications, Noida, 2009

WEB LINKS

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

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CO4	-	-	-	-	-	2	-	2	3	2	-	1	2	-
CO5	-	-	-	-	-	2	-	2	3	2	-	1	2	-

CE15455   BRIDGE ENGINEERING   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- introduce the basic fundamentals of bridge design.
- explore the design methodologies of superstructure of bridges.
- familiarize with substructure components of 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   SUPERSTRUCTURE OF BRIDGES   9

Pigeaud‟s method of computation of slab moments - Courbon‟s method of computation of moments in girders - Design of simply supported T-beam bridge.

UNIT III   SUBSTRUCTURE FOR BRIDGES   9

Piers - Abutments - Wing walls - Setting out for piers and abutments - Materials for substructures – Bridge inspection - Caissons - Cofferdams - Spread and pile foundation.

UNIT IV   BEARINGS   9

Purposes of bearings - Importance of bearings - Free and fixed bearings - Types of bearings - Bed blocks - Maintenance of bearings

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 the course, students will be able to

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

TEXT BOOKS

1. Krishna Raju.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).

WEB LINKS

1. http://www.enggprog.com/Downloads/Lectures/BridgeEngg/
2. http://coepalumni.net/article pdf/article pdf1491489284.pdf

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CE15705   DESIGN AND DRAWING LABORATORY   0   0   2   1

COURSE OBJECTIVES

To enable the students to

- design manually the retaining wall, water tank
- enhance the 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

Prerequisite: Concrete Structures

LIST OF EXPERIMENTS

(Manual Design & 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 Girder
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

TEXTBOOKS

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

REFERENCES

1. Krishnamurthy, D., "Structural Design & Drawing – Vol. II and III, CBS Publishers, 2010.

2. B.C., Punmia, Ashok Kumar Jain & Arun Kumar Jain, "Comprehensive Design of Steel Structures", Laxmi Publications Pvt. Ltd., 2003

3. Shah V L and Veena Gore, "Limit State Design of Steel Structures", IS800–2007, Structures Publications, 2009.

WEB LINKS

1. nptel.ac.in/courses/105105105
2. nptel.ac.in/courses/105105162

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CO3	-	-	3	-	2	-	-	-	-	-	-	-	3	2
CO4	-	-	2	-	2	2	-	-	-	-	-	-	3	2

CE15706   DESIGN PROJECT   0   0   4   2

COURSE OBJECTIVES

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.

                                                                TOTAL PERIODS   60

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks   : 20 marks

(Decided by conducting 3 reviews by the guide appointed by the Institution)

2. Evaluation of Project Report   : 30 marks

(Evaluated by the external examiner appointed the University).

Every student belonging to the same group gets the same mark

3. Viva voce examination: 50 marks

(Evaluated by the internal examiner appointed by the HOD with the approval of HOI,

external examiner appointed by the University and Guide of the course – with equal Weightage)

COURSE OUTCOMES

Upon the course, 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.

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CO4	2	3	2	-	2	-	-	-	-	-	-	-	-	2

PROGRAMME ELECTIVE – V

CE15551   **FINITE ELEMENT METHOD**   **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.

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

Upon the completion of the course, 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

WEB LINKS

1. http://www.colorado.edu/engineering/CAS/courses.d/IFEM.d/Home.html
2. http://nptel.ac.in/courses/112104116/

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CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	2

CE15552   PROJECT FORMULATION AND APPRAISAL   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- understand the concepts of Project formulation

- know about the costing of construction projects

- learn the various techniques used in project appraisal and identify the risk analysis in practice

- acquire knowledge in project financing and special schemes

- study the present scenario in infrastructure development of the projects

Prerequisite: Nil

UNIT I   PROJECT FORMULATION   9

Project - Concepts - Capital investments - Generation and Screening of Project Ideas - Project identification - Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report - Different Project Clearances required.

UNIT II   PROJECT COSTING   9

Project Cash Flows - Time Value of Money - Cost of Capital - Project cost management - Resource planning - Cost estimating - Cost budgeting - Cost control.

UNIT III   PROJECT APPRAISAL   9

NPV - BCR - IRR - ARR – Urgency- Pay Back Period - Assessment of Various Methods - Indian Practice of Investment Appraisal - International Practice of Appraisal - Analysis of Risk - Different Methods - Selection ofa Project and Risk Analysis in Practice.

UNIT IV   PROJECT FINANCING   9

Project Financing - Means of Finance - Financial Institutions - Special Schemes - Key Financial Indicators - Ratios.

UNIT V   PRIVATE SECTOR PARTICIPATION   9

Private sector participation in Infrastructure Development Projects -BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.

TOTAL PERIODS   45

COURSE OUTCOMES

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

- confess the concepts of project formulation.

- apply the modern techniques in the costing of construction projects.

- utilize new techniques in project appraisal and risk analysis.

- get exposure in project financing and identify the key factors in financing.

- perceive about the Private sector participation in Infrastructure Development Projects.

TEXT BOOKS

1. Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation Review", McGraw Hill Publishing Company Ltd., New Delhi. 8th Edition 2014.
2. "United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies", (IDBI Reproduction) Bombay, 1987.

REFERENCES

1. Joy P.K., "Total Project Management – The Indian Context", New Delhi, Macmillan India Ltd., 2010
2. Barcus, S.W. and Wilkinson.J.W., "Hand Book of Management Consulting Services", McGraw Hill, New York,1995.

WEB LINKS

1. nptel.ac.in/courses/112102106/4
2. www.nptelvideos.in/2012/12/project–and–production–management.html

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CE15553   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; 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", Prentice Hall India Pvt Ltd 2014.

2. B.Vidivelli, "Rehabilitation of Concrete Structures" Standard Publishers Distributors.1st edition 2009

3. Santhakumar. A.R "Concrete Technology", Oxford Higher Education, 2006.

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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

WEB LINKS

1. http://nptel.ac.in/courses/114106035/38

2. http;//nptel.ac.in/courses/120108005/

CO PO MAPPING:

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CE15554   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.
- apply the principles of electrical and air conditioning facilities.
- apply the fire safety installation in various types of building.
- attain 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.

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CO1	-	-	-	-	-	-	1	-	-	-	-	-	3	2
CO2	-	-	-	2	2	-	-	-	-	-	-	-	3	2
CO3	-	-	-	3	2	-	-	-	-	-	-	-	3	2
CO4	-	-	-	2	2	2	-	-	-	-	-	-	3	2
CO5	-	-	-	3	-	2	-	-	-	-	-	-	3	2

CE15555   STRUCTURAL DYNAMICS   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- understand the principles of vibration, response of structural systems to dynamic loads and displacements.
- learn the behavior and response of structures subjected to harmonic and periodic loading.
- study the behavior and response of SDOF structures with Step and pulse dynamic loading.
- impart knowledge on SDOF earthquake response of linear systems.
- study the behavior and response of MDOF structures with various dynamic loading.

Prerequisite: Nil

UNIT I   INTRODUCTION   9

Vibration and its importance to structural engineering problems - Problem Statement - Basic concepts of structural dynamics- single degree of freedom system - Solution Methods of Single Degree of Freedom Systems (SDOF); Force displacement relationship - Damping force; Equation of motion – Mass- Spring - Damper system - Methods ofsolution of differential equation. Free Vibration (SDOF); Undamped free vibration viscously damped free vibration.

UNIT II   RESPONSE TO HARMONIC AND PERIODIC EXCITATIONS (SDOF)   9

Harmonic vibration of undamped systems - Harmonic vibration with viscous damping - Response to vibration generator - Natural frequency and damping from harmonic test - Force transmission and vibration isolation - Vibration measuring instruments - Response to periodic force.

UNIT III   RESPONSE TO ARBITRARY, STEP AND PULSE EXCITATIONS (SDOF)   9

Response to unit impulse - Response to arbitrary force - Step force - Ramp force - Response to pulse excitations - Solution methods - Effects of viscous damping; Numerical Evaluation of Dynamic Response (SDOF); Time step methods - Methods based on interpolation of excitation - Central difference method - Newmark‟s method - Analysis of nonlinear response by Newmark‟s method.

UNIT IV   EARTHQUAKE RESPONSE TO LINEAR SYSTEMS (SDOF)   9

Earthquake excitation; Equation of motion - Response quantities - Response history - Response spectrum concept - Response from the response spectrum -Response spectrum characteristics; Generalized Single Degree of Freedom Systems; Generalized single degree of freedom system - System with distributed mass and elasticity - Lumped mass system - Shear building - Natural vibration frequency by Rayleigh‟s method.

UNIT V   MULTI –DEGREE OF FREEDOM SYSTEMS (MDOF)   9

Equation of motions - Simple system two storey shear building - General approach for linear systems - Static condensation; Free Vibration- Natural frequencies and modes - Modal and spectral matrices - Orthogonality of modes - Normalization of modes - Solution of undamped free vibration systems - Solution methods for Eigen value problem.

TOTAL PERIODS   45

COURSE OUTCOMES

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

- perceive the response of structural systems to dynamic loads and displacements.
- realize the behavior and response of structures subjected to harmonic and periodic loading.
- predict the response of SDOF structures with Step and pulse dynamic loading.
- analyze the earthquake response of SDOF linear systems.
- analyze the structures with MDOF system under dynamic loading.

TEXT BOOKS

1. Madhujit Mukhopadhyay, "Structural Dynamics Vibrations and Systems", ANE Books India Publishers, 2010.
2. Manickaselvam, V.K., "Elementary Structural Dynamics", Dhanpat Rai & Sons, 2001.

REFERENCES

1. Clough R W and Penzien J, "Dynamics of Structures", McGraw Hill, INC, 2015
2. Anil K.Chopra, "Dynamics of Structures", Pearson Education Ltd., 2014.
3. Roy R.Craig, Jr, Andrew J. Kurdila, Fundamentals of Structural Dynamics, John Wiley & Sons, 2011.
4. Leonard Meirovitch, "Elements of Vibration Analysis", McGraw Hill, 1986, IOS Press, 2006.
5. Mario Paz, Structural Dynamics, "Theory and Computation", Kluwer Academic Publication, 2004.

WEB LINKS

1. http://nptel.ac.in/courses/105101006/
2. http://freevideolectures.com/courses/3129/Structural–Dynamics#

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CO4	2	2	3	-	-	-	-	-	-	-	-	1	2	3
CO5	2	2	3	-	-	-	-	-	-	-	-	1	2	3

PROGRAMME ELECTIVE –VI

CE15651   GROUND IMPROVEMENT TECHNIQUES   3   0   0   3

COURSE OBJECTIVES

To enable the students to

- understand the principles and design procedures for various ground improvement techniques.
- gain competence in properly evaluating alternative solutions and the effectiveness before, during and after using ground improvement.
- understand the in–situ treatment of cohesion less and cohesive soils.
- bring out concepts of reinforced earth.
- understand the grouting techniques for stabilization of expansive soil.

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   DEWATERING   9

Dewatering Techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two dimensional flows for fully and partially penetrated slots in homogeneous deposits - Design for simple cases.

UNIT III   INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS   9

In-situ densification of cohesion less soils - Dynamic compaction - Vibro flotation, Sand compaction piles and deep compaction; Consolidation of cohesion less soils - Preloading with sand drains, and fabric drains; Stabilization of soft clay ground using 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; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

UNIT V   GROUTING TECHNIQUES   9

Types of grouts - Grouting equipment"s 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 the course, students will be able to

- perceive the need for ground improvement and various ground improvement techniques
- suggest dewatering and drainage techniques for different types of soil.
- obtain knowledge on earth reinforcement techniques
- utilize geotextiles for soil stabilization.
- implement grouting techniques for stabilization of expansive soil.

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, 2000.

REFERENCES

1. Moseley, M.P., "Ground Improvement Blockie Academic and Professional", Chapman and Hall, Glasgow, 2004.
2. Moseley, M.P and Kirsch. K., "Ground Improvement mediation", Sponress, Taylor and Francis Group, London, 2004.
3. Jones C.J.F.P. "Earth Reinforcement and Soil Structure", Thomas Telford Publising, 2006.
4. Winterkorn, H.F. and Fang, H.Y. "Foundation Engineering Hand Book". Van Nostrand Reinhold, 2011.

WEB LINKS

1. nptel.ac.in/courses/105108075/
2. www.cdeep.iitb.ac.in/webpage_data/nptel/.../Foundation.../Course_home36.1.html

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CE15652   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

Behaviour 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 the course, 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.

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.

WEB LINKS

1. http://www.cipremier.com/e107_files/downloads/Papers/100/27/100027054..pdf

2. http://cbri.res.in/rd/rd–programs/mass–housing–project/

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CO4	1	2	3	2	-	-	-	-	-	-	-	-	2	3
CO5	1	2	3	2	-	-	-	-	-	-	-	-	2	3

CE15653   MACHINE FOUNDATIONS   **3   0   0   3**

COURSE OBJECTIVES

To enable the students to

- familiarize with the dynamic properties of soil.
- understand the field and laboratory tests to find the soil properties.
- understand the design criteria and analysis under different modes of vibration.
- create an understanding about the importance of designing machine foundation for reciprocating and impact machines.
- know about the isolation methods to reduce the vibrations.

Prerequisite: Nil

UNIT I   THEORY OF VIBRATIONS   9

Basic definitions - Free and Forced vibrations with and without damping for Single degree freedom system - Resonance and its effect - Magnification - Logarithmic decrement - Transmissibility; Natural frequency of foundation soil system - Barkan‟s and IS methods - Pressure bulb concept - Pauw‟s Analogy.

UNIT II   WAVE PROPAGATION AND DYNAMIC SOIL PROPERTIES   9

Elastic waves in Rods - Waves in elastic Half space, Field and Laboratory methods of determination - Up hole, Down hole and Cross hole methods - Cyclic plate load test - Block vibration test - Determination of Damping factor.

UNIT III   MACHINE FOUNDATIONS   9

Types, Design criteria, Permissible amplitudes and Bearing pressure, Degrees of freedom; Analysis under different modes of vibration of block foundation.

UNIT IV   DESIGN OF FOUNDATIONS FOR RECIPROCATING AND IMPACT MACHINES   9

Analysis of Two Degree freedom systems under free and forced vibrations - Principles of Design of Foundations for reciprocating and impact machines as per IS code.

UNIT V   VIBRATION ISOLATION   9

Concept -Types and methods - Isolating materials and their properties; Vibration generation mechanism - Passive and active vibration control - Vibration measurements.

TOTAL PERIODS   45

COURSE OUTCOMES

Upon the completion of the course, 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. Shamsher Prakash, "Soil Dynamics", 3rd Edition, John Wiley, 2000

2. Swami Saran, "Soil Dynamics and Machine Foundations" 2nd Edition , Galgota Publishing Pvt Ltd, 1999

REFERENCES

1. P.Srinivasulu and G.V.Vaidyanathan, "Handbook of Machine Foundations", 2nd Edition, Tata McGraw Hill, 2017

2. Prasad.B.B., "Advance Soil Dynamics and Earthquake Engineering", 2nd Edition, Prentice Hall, 2013

3. Richart, Hall and Woods, "Vibration of Soils and Foundations", Prentice Hall, 1981.

WEB LINKS

1. nptel.ac.in/courses/105107120/23

2. nptel.ac.in/downloads/105101005

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CE15654   TALL BUILDINGS   **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- design and analyse the various methodologies of tall buildings.
- perform stability analysis of tall buildings.
- 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 BUILDINGS   9

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

TOTAL PERIODS   45

COURSE OUTCOMES

Upon the completion of the course, 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.

WEB LINKS

1. http://nptel.ac.in/courses/105106050/
2. http://nptel.ac.in/courses/105106113/
3. http://nptel.ac.in/courses/105102012/

CO PO MAPPING:

<table>
<tr><td colspan="15" align="center">Mapping of course objectives with Programme Outcomes:
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</table>

CE15655   **DISASTER RESISTANT STRUCTURES**   **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- get an exposure on behaviour of Life-line structures.
- understand the community structures.
- gain a preliminary understanding on classification of structures for safety point of view.
- enhance awareness of use of modern materials and their impact on disaster reduction.
- gain knowledge on different types of foundation and its impact on safety and Ground improvement techniques.

Prerequisite: Nil

UNIT I   BEHAVIOUR OF LIFE-LINE STRUCTURES   9

Philosophy for design to resist earthquake, cyclone and flood, Tsunami, National and International codes of practice, By-Law of urban and semi-urban areas - Traditional and modern structures.

UNIT II   COMMUNITY STRUCTURES   9

Response of dams, bridges, buildings - Strengthening measures, Safety analysis and rating - Reliability assessment.

UNIT III   REHABILITATION AND RETROFITTING   9

Testing and evaluation - Classification of structures for safety point of view - Methods of strengthening for different disasters - Qualification test.

UNIT IV   CONSTRUCTION TECHNIQUES WITH MODERN MATERIALS   9

Use of modern materials and their impact on disaster reduction - Use of modern analysis, design and construction techniques.

UNIT V   DAMAGE ASSESSMENT OF STRUCTURES   9

Damage surveys - Maintenance and modifications to improve hazard resistance - Different types of foundation and its impact on safety - Ground improvement techniques.

TOTAL PERIODS   45

COURSE OUTCOMES

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

- differentiate the behaviour of Life-line structures.
- assess reliability and safety analysis on community structures.
- assess various methods of strengthening for different disasters.
- utilize modern analysis, design and construction techniques optimization of structures for better performance.
- assess maintenance and modifications to improve hazard resistance structures

TEXT BOOKS

1. R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, U.K 2013.
2. V.Moskvin, "Concrete and Reinforced Concrete – Deterioration and Protection" Mir Publishers – Moscow 1983.

REFERENCES

1. Santhakumar A.R "Concrete Technology", Oxford Higher Education, 23 Oct 2006
2. Raiker R.N. "Learning from failures Deficiencies in Design, Construction and Service", R & D Center (SDCPL) Raiker Bhavan, Bombay, 1987.

WEB LINKS

1. nptel.ac.in/courses/105105104/pdf/m16l39.pdf
2. nptel.ac.in/courses/105101004/
3. nptel.ac.in/syllabus/syllabus_pdf/105101004.pdf

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CE15801   PROJECT WORK   **0   0   12   6**

COURSE OBJECTIVES

To enable 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 prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL PERIODS   180

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks   : 20 marks

(Decided by conducting 3 reviews by the guide appointed by the Institution)

2. Evaluation of Project Report   : 30 marks

(Evaluated by the external examiner appointed the University).

Every student belonging to the same group gets the same mark

3. Viva voce examination: 50 marks

(Evaluated by the internal examiner appointed by the HOD with the approval of HOI,

external examiner appointed by the University and Guide of the course – with equal Weightage)

COURSE OUTCOMES

Upon the completion of the course, 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:

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CO2	1	3	2	2	-	-	-	-	-	-	-	-	3	2
CO3	1	3	2	2	-	-	-	-	-	-	-	-	3	2
CO4	1	3	2	2	-	-	-	-	-	-	-	-	3	2