Environmental Engineering II

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-1-0, (4)	Program Core	CV107101CV

[Pre-requisites: Environmental Engineering-I]

Course Objectives

1. To estimate the quantity of wastewater and design collection system, transport system, and various units of the wastewater treatment plant.
2. To identify the suitable methods for recycle, reuse, and disposal of treated wastewater and sludge.
3. To learn the various techniques for treating industrial wastewater and solid waste management.

Course Content

Unit 1: Sanitation and Wasterwater

Sanitation: Need, types of sanitation systems.

Wastewater: Estimation of quantity and collection system. Sources, estimation of wastewater flow and its variations, estimation of storm water run-off, Wastewater collection systems, patterns of collection system.

Design of sewers. Sewer appurtenances.

Unit 2: Wastewater characteristics and treatment

Characteristics of wastewater-physical, chemical, and biological characteristics, Sustainable management of wastewater – Centralized and decentralized/onsite management, Fundamentals of unit operations & processes in wastewater treatment. Types of reactors, Sewage treatment-preliminary treatment systems - racks and screens, comminutors, grit chambers, Primary treatment systems- Plain sedimentation. Primary settling tank, clarifloculators.

Unit 3: Biological treatment of wastewater

Aerobic treatment processes: Suspended growth processes, activated sludge process and its variations. Attached growth processes: trickling filter, MBBR technique.

Unit 4: Anaerobic treatment process, sludge management, and disposal

Anaerobic treatment process: anaerobic reactors, Sludge: Collection, management, treatment and disposal, Onsite waste water treatment- septic tank, Imhoff tank, oxidation pond.

Stabilization Ponds / Lagoons: aerobic, anaerobic and facultative lagoon, Sewage disposal: disposal by dilution, self-purification of polluted streams, factors affecting self-purification, Sag curve, disposal on land surfaces.

Reuse, recycling of treated wastewater.

Unit 5: Industrial waste treatment and solid waste management

Industrial Waste Management- Principles of waste management. Industrial wastes, origin, character, and management.

Sustainable solid waste management: sources and characteristics, collection, transportation, processing, and disposal of solid waste.

Course Materials

Required Text: Text books

1. Peavy, H. S., Rowe D.R., and Tchobanoglous G., Environmental Engineering, McGraw Hill, New York (1985).
2. Metcalf and Eddy Inc, Wastewater Engineering- Treatment and Reuse, Tata McGraw Hill (1995)

Optional Materials: Reference Books

1. CPHEEO Manual on Sewerage and Sewage Treatment Systems, Ministry of Urban Development (2013). http://cpheeo.gov.in/cms/manual-on-sewerage-and-sewage-treatment.php
2. CPHEEO Manual on Solid Waste Management (2016). http://cpheeo.gov.in/cms/manual-on-municipal-solid-waste-management-2016.php
3. Mackenzie L. Davis, Water and Wastewater Engineering. McGrawHill)

Irrigation & Hydraulic Structures

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107201CV

[Pre-requisites: None]

Course Objectives

1. To understand various types of irrigation and hydraulic structures.
2. Applying the basic knowledge of hydrology, open channel flow and soil mechanics.
3. To design structures using relevant standards codes

Course Content

Unit 1 : Canal Irrigation

Classification of canal, parts of canal irrigation system, canal alignment, lay-out of canal system, typical canal cross section, command areas, losses in irrigation systems; Water logging and its control.

Unit 2: Canal Design & Regulations works

Design an unlined canal and lined canal; Canal Regulation works: Canal drops and falls, cross regulators, distributaries head regulators, canal escapes.

Unit 3: Reservoir Planning and Dams

Reservoir Planning

Type of reservoirs, storage zones of a reservoir, mass curve and demand curve, determination of reservoir capacity, safe yield.

Dams:

Types of Dam; Suitability of Dams; Gravity Dam: Elementary profile of a gravity dam, High and low gravity dams; Earth Dam: Types of Earth fill dams, Causes of failures, Control of Seepage, Stability of slopes.

Unit 4: Spillway and Energy Dissipaters and Diversion Headworks

Spillway and Energy Dissipaters:

Types of spillway; essential requirements of spillway; Design of Ogee Spillway; Energy Dissipation below spillways; Types of Energy dissipater; Hydraulic jump; stilling basins.

Diversion Headworks:

Types of diversion works; location and components; Weir and Barrage; Causes of failures of Weirs; Design of Weirs on permeable foundations.

Unit 5: Cross Drainage Works

Cross Drainage Works:

Types of cross drainage works: Aqueduct, Syphon Aqueduct, Super Passage, Syphon, level crossing, inlets and outlets; Channel Transition; Design of Cross Drainage works.

Course Materials

Required Text: Text books

1. Theory and Design of Irrigation Structures (Volume - I & II) - Varshney (Nem Chand Bros.)
2. Irrigation Engineering - B.C. Punmia (Laxmi Publications)

Optional Materials: Reference Books

1. Irrigation, Water Resources and Water Power Engineering - Dr. P.N. Modi (Standard Book House)
2. Irrigation Engineering - Asawa G.L. (New Age International Publications)
3. Fundamentals of Irrigation Engineering - Bharat Singh (Nem Chand & Bros.)
4. Irrigation Engineering and Hydraulic Structures - S.K. Garg (Khanna Publications)

Seismic Design of Buildings

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107202CV

[Pre-requisites: Structural Analysis-I]

Course Objectives

1. To cultivate the basic knowledge related to the seismic analysis and design of structures and various fundamental aspects of Earthquake Engineering.
2. To provide the basic concepts of ductile detailing and seismic control of structures.
3. To develop the skills of students for becoming a design professional in seismic designing concepts of structures and serve the society of seismic region

Course Content

Unit 1: Engineering seismology and Theory of Vibrations

Causes of earthquakes; seismic waves; magnitude, intensity and energy release, characteristics of strong earthquake ground motions, Introduction to theory of vibrations - Flexibility of long and short period structures, concept of response spectrum, Seismic zones.

Unit 2: Seismic design concepts

Desirable features of earthquake resistant buildings, Building forms for earthquake resistance, Seismic design philosophy, Performance of buildings in past earthquakes, Lessons from structural damage during past earthquakes, Equivalent static lateral earthquake force, Study of codal provisions IS 1893: (Part 2).

Unit 3: Masonry buildings

Basic terminologies in structural masonry, Basics of design of load bearing masonry, Failures of masonry structures, Lessons from structural damage during past earthquakes, Concepts for reinforced masonry and earthquake resistant masonry, Study of Codal provisions IS 4326: 2014, IS 1905:2002, Concepts of Seismic design of masonry buildings, Box action of masonry buildings, Seismic Bands in masonry buildings, and detailing of masonry buildings.

Unit 4: RCC buildings

Introduction –Behavior of RCC Buildings, Lessons from structural damage during past earthquakes, Methods of analysis, Equivalent Static Method of Analysis , Static and Dynamic methods of analysis , Concept of modal analysis, Seismic Design of RCC Buildings, Ductile detailing of RCC buildings and IS13920codal provisions, Introduction to seismic control of structures.

Unit 5: Steel Buildings

Introduction, Behavior of steel buildings, Design philosophy of steel buildings, Lessons from structural damage during past earthquakes, Types of failures in steel buildings, Concept of seismic design of steel buildings, Bracing systems.

Course Materials

Required Text: Text books

1. Murty C. V. R., (2005), Earthquake Tips, Learning Earthquake Design and Construction, IIT Kanpur.
2. Pankaj Agarwal and Manish Shrikhande, (2006), Earthquake Resistant Design of Structures, Prentice-Hall of India Pvt. Limited, New Delhi

Optional Materials: Reference Books

1. Design of Earthquake Resistant Buildings – Minoru Wakabayashi (McGraw Hill Publication)
2. Dynamics of Structures: Theory and Application to Earthquake Engineering (2nd edition) – Anil K Chopra (Pearson Education Publication).
3. Seismic Analysis of Structures – T. K. Datta (Wiley Publication)

Probablistic Approaches in Civil Engineering

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107203CV

Course Objectives

1. To identify topics where probability and statistics have been or should be applied in Civil engineering.
2. To Choose appropriate probabilistic models for a given problem, using information from observed data and knowledge of the physical system being studied.
3. To use probability tools to perform Civil engineering calculations.

Course Content

Unit 1: Introduction to Statistics

Role of statistics in engineering, Mean, Mode and Median, Standard Deviation and Skewness Coefficient.

Unit 2: Introduction to Probability

Probability, Sample Space, Events, Venn diagram, Combinations of Events, Operational Rules, De Morgan's Rule, Probabilities Multiplication Rule, Theorem of Total Probability, Conditional Probabilities, Marginal Probability Independent Event, Bayes' Theorem

Unit 3: Random Variables

Random Variables, types of random variables, Multiple Random Variables, Joint Distributions, Conditional PDF and PMF, Marginal PDF and PMF, Covariance and Correlation, Multivariate Distributions

Unit 4: Probability Distribution Function

Both discrete (binomial distribution, poisson's distribution) and continuous distribution functions (normal, lognormal, exponential distribution, gamma distribution).

Unit 5: Testing of Hypotheses:

Null and alternative hypotheses, the critical and 8 acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications, problems.

Course Materials

Required Text: Text books

1. Probability, Reliability and Statistical Methods in Engineering Design. Achintya Haldar Sankaran Mahadevan
2. Structural Reliability Analysis and Optimization: Use of Approximations. Ramana V. Grandhi and Liping Wang.

Optional Materials: Reference Books

1. Probabilistic Methods in Geotechnical Engineering. Gordon A. Fenton
2. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross

Advanced Design of Reinforced Concrete Structures

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-II	CV107251CV

[Pre-requisites: Design of Reinforced Concrete Structures]

Course Objectives

1. Able to do the design and detailing of different types of footing.
2. Able to do the design and detailing of different types of retaining walls.
3. Able to do the design and detailing of different types of water tank and bridges.

Course Content

Unit 1: Combined Footing

Concepts of Combined Footings, Design of rectangular, trapezoidal, and strap beam combined footings

Unit 2: Retaining walls

Design of Cantilever and Counter fort retaining walls

Unit 3: RCC Water Tanks

Concepts of water tank design, IS Code provisions, Design of underground circular water tank, Design of overhead rectangular water tank.

Unit 4: Over head water tank

Design of RCC circular double dome tank and Intze tank.

Unit 5: RCC Bridges

Introduction to Relevant IRC codes for bridge design, Design of solid slab & T-beam bridge deck.

Course Materials

Required Text: Text books

1. RCC Structures – B.C. Punmia (Laxmi Publications)
2. Design of RCC Structures -Subramainin
3. RCC Design – Sinha & Roy (S. Chand & Co.)
4. Design of RCC Structures- M.L Gambir
5. Bridge Superstructure N. Rajagopalan (Narosa Publishing House)
6. Relevant Bureau of Indian Standard Codes and Indian Road Congress codes

Optional Materials: Reference Books

1. RCC Structures (Vol. – I & II) – O.P. Jain and Jaikrishna (Nem Chand Publications)

2. Bridge Engineering – R.K. Raina

Intelligent Transportation Systems

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective -II	CV107252CV

[Pre-requisites: Highway and Railway Engineering]

Course Objectives

1. To understand various components of Intelligent Transportation Systems (ITS) and supporting technologies.
2. To understand significance of ITS and its applications for improving the performance of the transportation system
3. To learn and Construct ITS related strategies for varying roadway and traffic conditions using design and control parameters

Course Content

Unit 1: Introduction to ITS

Definition Objectives, Historical Background, Benefits of ITS –Introduction to Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), Traffic control and monitoring aspects, components of ITS**.**

Unit 2: Advanced Traveler Information Systems (ATIS)

Trip Planner and its impact, Traffic density measurement, Variable message signs, Parking guidance, Weather information and variable speed limits, Impacts of ATIS.

Unit 3: Advance vehicle monitoring systems & commercial vehicle operations (CVO)

Security CCTV systems, Wireless Sensor Network and RFID, Blue-tooth and Wi-Fi sensors, inductive loop detectors and image processing techniques, Impacts of AVMS. Emergency vehicle notification systems, Automatic road enforcement, Variable speed limits, Collision avoidance systems, Dynamic Traffic Light Sequence, Cooperative systems on the road, Automatic number plate recognition by Image processing, Impacts of CVO

Unit 4: ITS applications & ITS programs in the world

Advanced Traffic Management Systems (ATMS) Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS), Automated Highway Systems, and Framework for evaluating ITS related strategies.

Overview of ITS implementations in developed countries, ITS in developing countries, Potential applications of offline and online real time measurement of traffic flow characteristics.

Unit 5: Intelligent Supporting Technologies

Wireless communications, Standards and Cellular Technology, ITS Data acquisition and processing, Hardware and Software--Micro-Controllers, PLC, Embedded systems, Ubiquitous Computing, Sensing Technologies, Detectors/Detection Techniques—Triangulation Technique, Inductive loop detection, Video vehicle detection, Microwave detection, etc. Global Positioning System (GPS). Case studies.

Course Materials

Required Text: Text books

1. S Ghosh and T Lee, Intelligent Transportation Systems, CRC Press, Boca Raton, 2010.
2. C Drane and C R Drane, Positioning Systems in Intelligent Transportation Systems, Artech House Publishers, London, 1997

Optional Materials: Reference Books

1. JMC Queen and B McQueen, Intelligent Transportation System and Architecture, Artech House Publishers, Artech House, London, 1999.
2. A J Khattak, Intelligent Transportation Systems: Planning, Operations, and Evaluation, CRC Press, United Sates, 2014.
3. M A Chowdhury and A Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, London, 2010.

Rock Engineering

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Program Elective-I	CV107253CV

[Pre-requisites: None]

Course Objectives

1. To understand of the mechanical behavior of rock materials, rock discontinuities and rock masses.
2. To be able to analyze and to determine mechanical and engineering properties of rocks for engineering applications.
3. To be able to determine the design data for the design of various structure in rock and rock masses

Course Content

Unit 1: Introduction
Definition, Importance, History of Rock Mechanics, Types of Rocks, Drilling, Blasting and underground open excavation, Mining and other Engineering applications, Modes of failure – Rotational, Plane and wedge failures.

Unit 2: Laboratory testing on rocks
Tests for Physical Properties, Compressive strength, Tensile strength, Direct shear, Triaxial Shear, Slake Durability, Schmidt Rebound Hardness.

Unit 3: Strength, Modulus and stress strain behavior of rocks
Factors influencing rock behavior, Strength criteria for Isotropic Intact Rocks, Modulus of Isotropic Intact Rocks, Compressive strength and modulus from SPT, Stress Strain models – Elastic model, Elasto plastic model, Visco-elastic model.

Unit 4: Engineering classification of rocks and rock masses
RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMRS and RSR System. Classification based on strength and modulus, Classification based on strength and failure strain, rock discontinuity qualitative description.

Unit-5: Rock foundation and field-test on rocks
Estimation of Bearing Capacity – Intact, Fractured rocks, Stress distribution in rocks, Settlement in rocks, Bearing capacity of piles in rock. Geophysical methods, Seismc Refraction method, Deformability tests– Plate Jack Test, Goodman Jack Test, Field Permeability Test –Packers Test.

Course Materials

Required Text: Text books

Engineering in Rocks by Rammaruthum, Prantice Hall of India Private Limited, New Delhi

Optional Materials: Reference Books

1. Introduction to Rock Mechanics by R.E.Goodman, John Wiley & Sons
2. Fundamentals of Rock Mechanics, Fourth Edition, by Jaeger, Cook and Zimmerman, Blackwell Publishing.

Environmental Impact Assessment & Environmental Management

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective -I	CV107301CV

[Pre-requisites: Environmental Engineering-I]

Course Objectives

1. Appreciation of the need to assess and evaluate the impact on environment. Understanding of major principles of environmental impact assessment and various environmental attributes to be considered for the EIA study.
2. Understand the different steps within environmental impact assessment, identify the suitable methodology and prepare EIA.
3. Indentify and incorporate mitigation measures

Course Content

Unit 1: Introduction

Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Public Participation in EIA. EIA process – screening– scoping - setting – analysis – mitigation

Unit 2: Components and Methods for EIA

Matrices – Networks – Checklists – Connections and combinations of processes – Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modeling for impact prediction Assessment of impacts – air – water – soil – noise – biological –– Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation. EIA methods in other countries.

Unit 3: Socio-Economic Impact Assessment

Definition of social impact assessment. Social impact assessment model and the planning process. Rationale and measurement for SIA variables. Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition - neighborhood and community impacts. Selecting, testing and understanding significant social impacts. Mitigation and enhancement in social assessment. Environmental costing of projects.

Unit 4: Environmental Management Plan

Environmental Management Plan - preparation, implementation and review Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

Unit 5: Life Cycle Assessment

Life cycle assessment and its purpose. Evolution of Life Cycle Assessment. Stages in LCA of a Product. Code of Good Conduct for LCA. Procedures for LCA. Defining the goal and scope. Analyzing the inventory. Assessing environmental impact. Evaluating environmental profiles. Different Applications of LCA. Private sector applications. Governmental applications

Course Materials

Required Text: Text books

1. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science London. 1999
2. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996
3. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey. 2003

Optional Materials: Reference Books

1. World Bank –Source book on EIA
2. Glynn, J. and Gary, W. H. K. -Environmental Science and Engineering, Prentice Hall Publishers.
3. Wathern, P. –Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.
4. A Chadwick, Introduction to Environmental Impact Assessment, Taylor & Francis , 2007
5. R.Therirvel, E. Wilson, S. Hompson, D. Heaney, D.Pritchard, Strategic Environmental Assessment, Earthscan, London , 1992
6. Paul, A Erickson, A Practical Guide to Environmental Impact Assessment, Academic Press , 1994

Finite Element Methods

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV107302CV

[Pre-requisites: None]

Course Objectives

1. The students should understand the mathematical and physical principles underlying the FEA.
2. Be able to identify and solve relatively complex engineering problems using FEA.
3. To provide students with basic skills of FEA programming using Matlab.

Course Content

Unit 1: Introduction to Finite Element Analysis

Overview of Engineering systems: Continuous and discrete systems (discussion on differential equations, matrix algebra), Basic Concepts of Finite Element Analysis, Introduction to Elasticity, Plane Stress, Plane Strain.

Unit 2: Finite Element Formulation Techniques

Weighted residual techniques (least square method, collocation, sub-domain collocation, Galerkin method), Rayleigh-Ritz Formulation, Energy methods and Variational principles.

Unit 3: FEM for One Dimensional Analysis

Development of bar and beam element, Derivation of element shape functions (Lagrangian and Hermite) in physical coordinates, Derive bar and beam element equations using energy approach and Galerkin Method. Application to truss and frames.

Unit 4: FEM for Two Dimensional Analysis

Discretization concepts, choice of elements: Triangular elements (CST and LST), Rectangular elements, Lagrange and Serendipity elements, Analyze plane stress problems using energy approach, Higher order elements.

Unit 5: FEM for Three Dimensional Analysis and Isoparametric Elements

Axisymmetric elements, Solid elements, Iso-parameteric eormulation, Numerical integration, Practical considerations in FE modeling and Interpreting results, Computer implementation.

Course Materials

Required Text: Text books

Daryl Logan, A First Course in the Finite Element Method, Cengage Learning

Optional Materials: Reference Books

1. C.S.Krishnamoorty, Finite Element Analysis, Tata McGraw-Hill
2. J. Fish and T. Belytschko, A First Course in Finite Elements, Wiley, USA
3. K. J.Bathe, Finite Element Procedures, Prentice-Hall of India, New Delhi, India
4. R D Cook, D A Malkus, M E Plesha, RJ Witt, Concepts and Applications of Finite Element Analysis, John Wiley & Sons
5. O.C. Zienkiewicz, R.L. Taylor, J.Z. Zhu, The Finite Element Method: Its Basis and Fundamentals, Butterworth-Heinemann

Urban Hydrology

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	3-0-0, (3)	Open Elective-I	CV107303CV

[Pre-requisites: None]

Course Objectives

1. Compare and contrast natural versus urban water cycle.
2. Understand the natural and human factors that regulate hydrologic processes in urban areas.
3. Explain the spatial and temporal variability of the water cycle.

Course Content

Unit-1

Review of basic hydrology, hydrometeorology, infiltration, evapotranspiration, runoff and hydrograph analysis.

Unit-2

Strom water runoff generation; Return period; Hydrologic risk, commonly used probability distributions in hydrology.

Unit-3

Fitting probability distributions to hydrologic data. Probability plotting and frequency analysis, IDF relationships; Design storm

Unit-4

Open channel flow in urban watersheds; Interception storage, Infiltration, Depression storage; Combined loss models; Estimation of runoff rates from urban watersheds.

Unit-5

Flow routing; Storm water drainage structures; storm water detention; structural and non-structural control measures, Source control techniques; urban storm water models; introduction to urban groundwater systems.

Course Materials

Required Text: Text books

Hall, M.J. Urban Hydrology. Elsevier, 1984

Optional Materials: Reference Books

1. Butler, D. & Davies, J.W. Urban Drainage, Spon Press, 2nd Edn., 2004.
2. Akan A.O and Hioughtalen R.J. Urban Hydrology, Hydraulics and Storm water Quality " Engineering Applications and Computer Modeling, John Wiley & Sons 2003.
3. Hall, M.J. Urban Hydrology. Elsevier, 1984.
4. Shaw, E.M. Hydrology in Practice. 3rd Edn., Chapman & Hall, 1994

Structural Engineering Drawing Lab

[VIIth Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Civil Engineering	0-0-2, (1)	Lab	CV107401CV

Course Objectives

To learn the detail drawing of different elements of RCC Structures and Steel Structures

Course Content

List of Experiments

1. RCC detailing of variation structural elements such as Footing(Isolated & combined), columns, beams and slabs
2. RCC detailing of Water Tank (tank Resting on ground & overhead water tank)
3. RCC detailing of Retaining Walls (cantilever & counter fort)
4. Detailing of Steel Connections
5. Detailing of Built up sections(Beams & connections)
6. Detailing of Steel Truss.

Course Materials

Required Text: Text books

Relevant Bureau of Indian Standard (BIS) codes and guidelines

Optional Materials: Reference Books

Structural Design And Drawing - Dr. D Krishnamurthy (CBS Publisher)