Specialization Courses

Course Description

Title: Sustainable Construction **Code: CE351**
L-T-P scheme:3-0-0 **Credits: 3**

Prerequisite: Building Materials and Construction

Objective:
The objective of this course is to introduce the fundamentals of sustainable construction and relate it to field problems.

Learning Outcomes:

Sustainable Construction	
CO1	**Outline** the concepts of Sustainable Construction.
CO2	**Identify** the Process Design and Development- Sustainability .
CO3	**Analyze** the Socio-economic feasibility of sustainable construction for a given problem.
CO4	**Describe** the Life Cycle Assessment and Costing.
CO5	**Determine** the feasibility of chemicals/admixtures for a given real time problem.
CO6	**Apply** the concepts of advanced sustainable materials in practical situations..

Course Content:
Unit 1: Fundamentals of Sustainable Construction Engineering- Sustainability and resources, need, present practices at national and international level,

Unit 2: The Sustainability Quadrant- challenges & Issues, Government initiatives. Construction Product, Process Design and Development- Sustainability of construction resources, process modifications, product performance evaluation.

Unit 3: Sustainability assessment using standard approaches- LEED/GRIHA rating evaluation process. Socio-economic feasibility of sustainable construction products- Innovative & customized sustainable product design based on social constraints, tools & aids available for sustainable construction products.

Unit 4: Life Cycle Assessment and Costing-Various aspects related to construction cost, present value analysis, life cycle stages, cost calculation & measures, evaluation criteria, uncertainty assessment, sensitivity analysis, break even analysis.
Unit 5: Various construction chemicals/admixtures , Fly ash and its use in concrete ,Silica fume concrete ,Self compacting concrete, Fiber Reinforced plastics and concrete ,Light weight concrete.

Unit 6: Crumb modified bitumen Rubber, Glenium Concrete Materials used in nuclear-containment structures. High performance concrete, Nano technology in cement concrete, Ferrocement Technology

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizzes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1,
Test-2	25 Marks	Based on Unit-2 & Unit-3and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Construction equipments (will be added from time to time): Digital copy will be available on the JUET server.

Textbooks:

1. Sustainable Engineering Practice ASCE Publication 2010.
2. Hagger Sustainable Industrial Design and Waste Management, Techniz Book 2010.

Reference Books:

1. Concrete Technology by M.S.Shetty, S.Chand Publ.
2. Building Materials by M L Gambhir, Neha Jamwal, Tata McGraw Hill Publ.
3. Helmut Rechberger, Practical handbook of Material Flow Analysis, Taylor & Francis. 2010.
4. Michael Z. Hou, HepingXie, Jeoungseok Yoon Underground Storage of CO2 and Energy Taylor & Francis, 2010.

Course Description

Title: Construction Planning and Control **Code: CE352**
L-T-P scheme:3-0-0 **Credits: 3**

Prerequisite: Nil

Objective:
To learn how to use the knowledge of planning and control in understanding the behavior of construction project management. This course serves as an introduction toConstruction Planning and Control applied for Civil Engineering project management..
Learning Outcomes:
Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the construction planning &control in scheduling
CO2	**Identify** planning and control in building plan, elements of network
CO3	**Analyze** preconstruction, construction, and procurement activities.
CO4	**Describe** Bar Charts and Critical Path Method Networks
CO5	**Determine** resource requirements of a project
CO6	**Apply** Earned Value Analysis and other progress metrics for cost control.

Course Content:
Unit 1 - Construction Planning & Control Conversion of a Scope of Work into scheduling activities.
Unit 2 - Developing a building plan including preconstruction, construction, and procurement activities.
Unit 3 -Preparing, analyzing, and updating Bar Charts and Critical Path Method Networks; prepare and presenting schedule information.

Unit 4 - Assigning and analyzing resource requirements of a project; performing time/cost trade-off analyses.
Unit 5 - Justifying claims for additional time; processing schedule information in a computerized scheduling package
Unit 6 - Controlling cost by applying the Earned Value Analysis and other progress metrics.
Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.

- There will be assignments, quizzes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 and Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Construction Planning & Control (will be added from time to time): Digital copy will be available on the JUET server.

Text books:

1. Calin M. Popescu, Chotchai Charoenngam, "Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications", Wiley, New York, 1995.
2. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", McGraw-Hill Publishing Company, New Delhi, 1998.
3. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamental Concepts for Owners, Engineers", Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Halpin, D. W., "Financial and Cost Concepts for Construction Management", John Wiley & Sons, New York, 1985.
5. Willis, E. M., "Scheduling Construction Projects", John Wiley & Sons, 1986.

Course Description

Title: Construction Safety and Health **Code: CE353**
L-T-P scheme:3-0-0 **Credit: 3**

Prerequisites: None

Objective:

The objective of this course is that students will learn about minimum safety and health requirements related to construction activities.

Learning Outcomes:

CO1	**Outline** the concepts of safety, factors affecting safety
CO2	**Identify** and plan for safety provisions and techniques for construction safety management,
CO3	**Analyze** the need for demolition and management of accidents and injuries.
CO4	**Describe** the roles of organizations and personnel involved in major construction projects and explain how each affects site safety.
CO5	**Demonstrate** construction safety in an increasingly challenging and changing environment
CO6	**Explain** the legal aspects including liability and regulatory requirements of construction safety.

COURSE OUTLINE:

Unit-1: Concept of safety, factors affecting safety: psychological and technological,
Unit-2: Planning for safety provisions, techniques for construction safety management, safety considerations during construction,
Unit-3: Demolition and use of equipment; management of accidents/injuries, site management with regard to safety recommendations, training for safety awareness, implementation of health & safety plans, construction hazards & solutions, formulation of safety manuals, safety legislation, standards/codes with regard to construction safety, case studies,
Unit-4: Construction safety management – fundamentals, measuring performance & recording information, health hazard in construction, personal protective and lifesaving equipment, the safety policy; assessing the risks, control strategies for construction work; fire safety, the health and safety plan,
Unit-5: Training; meetings, understanding people, access to information, environment, health and safety issues - construction and the environment, construction health and safety law

Teaching Methodology:

- At the start, of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The lecture may be conducted with the aid of a multi-media projector, whiteboard, OHP, etc.
- Attendance is compulsory in lectures that carry marks.

- At regular intervals, assignments will be given. Students should submit all assignments during the given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carry marks.
- There will be assignments and quizzes at regular intervals. Students can build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1,
Test-2	25 Marks	Based on Unit-2, Unit-3, and Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5,around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:
Tutorials and lecture slides on the Theory of structures (will be added from time to time):
Digital copy will be available on the JUET server.

Text Book:
1. Safety, Occupational Health and Environmental Management in Construction by S C Sharma &Vineet Kumar

TEXT BOOKS / REFERENCES:

Hill, Darryl C. (2004) Construction Safety Management and Engineering. American Society of Safety Engineers, Des Plaines, Illinois.

Course Description

Title: Advances in Construction materials **Code: CE354**
L-T-P scheme:3-0-0 **Credit: 3**

Prerequisite: Building materials and construction

Objective:
To introduce the advanced building materials used in the construction industry or being studied at the research level.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the various properties and uses of construction materials.
CO2	**Describe** the behavior of materials.
CO3	**Develop** the concepts of construction materials for appropriate field applications as per IS code requirements.
CO4	**Identify** the requirements of construction materials as per IS codes.
CO5	**Demonstrate** the structural aspects of different materials and the technicalities involved in construction methods.
CO6	**Apply** the concepts developed for the planning and construction of buildings.

Course Content:
Unit-1: Foams and lightweight materials, fiber reinforced concrete. Types of fibers, workability, mechanical and physical properties of fiber reinforced concrete,
Unit-2: Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete.
Unit-3: Concrete at high temperature, High strength concrete, changes in concrete with time, corrosion of concrete in various environments, corrosion of reinforcing steel, electrochemical process, measures of protection, Ferro-cement Architectural use, and aesthetics of composites.
Unit-4: materials and properties polymers Civil Engineering Polymers, fibers and composites, fiber-reinforced plastic in sandwich panicles, modeling.
Unit-5: Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers,
Unit-6: polymer foams and polymers in building physics, Polymer concrete composites.

Teaching Methodology:

- At the start, of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The lecture may be conducted with the aid of a multi-media projector, whiteboard, OHP, etc.

- Attendance is compulsory in lectures that carry marks.
- At regular intervals, assignments will be given. Students should submit all assignments during the given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carry marks.
- There will be assignments and quizzes at regular intervals. Students can build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1, Unit-2
Test-2	25 Marks	Based on Unit-2 & Unit-3and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slide on Recent advances in Construction materials (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:

1. Interscience Publication by Broutman. A Wiley John Wiley & sons New York, 1996.
2 Engineering Materials by Rangwala S C Charotar Publishing house, Anand, 1985.
3. Weather Head R G “FRP Technology” Applied Science Publishers Ltd., London ,1998.
4. Civil Engineering Materials by Raina K B Tata McGraw- Hill Publishing Company Ltd, New Delhi, 1999.
5. Engineering Materials by Budinski KG, Prentice Hall of India, New Delhi, 1985.

Reference Books/Material:

1. Concrete, Prentice-Hall, by P. K. Mehta, P J M Monteiro, New Jersey
2 Handbook of Concrete Mixes, Special Publications No 24 BIS New Delhi
3. EFNAARC Guidelines on SCC
4. ACI Special Publications
5. IS Specifications

Course Description

Title: Value Engineering **Code: CE355**
L-T-P scheme:3-0-0 **Credits: 3**

Prerequisite: None

Objective: This course is designed to explain the value concept of methods, objects and planning.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** general techniques of Value Engineering in a business organization.
CO2	**Identify** special techniques in Value Engineering.
CO3	**Analyze** analytical and decision-making skills in the Value Engineering job.
CO4	**Describe** structured phases of Value Engineering and build teams.
CO5	**Determine** strategy for formulating Value Engineering Study Team, Value Engineering Study Procedure and the workshop approach to achieving value.
CO6	**Apply** Target setting, Time management, Assessment of Value Engineering Results and case study discussions.

Course Content:

Unit 1 - Concepts: Introduction, History of value engineering, Value, Function, Cost, Worth, Case Study Discussions.

Unit 2 - General Techniques in Value Engineering: The Gordon Technique, Feasibility Ranking, The Morphological Analysis Technique, ABC Analysis, Probabilistic Approach, Case Study Discussions.
Unit 3 - Special Techniques in Value Engineering: Function – Cost – Worth Analysis, Function Analysis
Unit 4 - System Technique - Technically oriented FAST and Customer-oriented FAST, Weighted Evaluation Method, Quantitative Method, Evaluation Matrix, Life Cycle Cost (LCC), Case Study Discussions.
Unit 5 - Applications of Value Engineering: Guidelines for formulating Value Engineering Study Team, Value Engineering Study Procedure, the workshop approach to achieving value.

Unit 6 - Target setting, Time management, Assessment of Value Engineering Results, Case Study Discussions.

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1 & Unit-2
Test-2	25 Marks	Based on Unit-3 and Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Value Engineering (will be added from time to time): Digital copy will be available on the JUET server.

Text books:

1. Anil Kumar Mukhopadhyaya, Value Engineering Concepts, Techniques and Applications, Response Books, 2013.
2. Anil Kumar Mukhopadhyaya, Value Engineering Mastermind from Concept to Value Engineering Certification, Response Books, 2009.
3. Lawrence D. Miles, Techniques of Value Analysis and Engineering, McGraw-Hill Book Company, 2009.
4. M.R.S. Murthy, Cost Analysis for Management Decisions, Tata McGraw-Hill Publishing Company Ltd., 1988.
5. IS 1180: 2003 Indian Standard “Guidelines to establish a Value Engineering Activity” (First Revision)

Course Description

Title: Construction Financial Management **Code: CE356**
L-T-P scheme:3-0-0 **Credits: 3**

Prerequisite:

Objective:
The Construction Financial Management course teaches an all-important skill when it comes to construction and development. In this course, students will learn to control costs and monitor project cash flow.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** various types of construction, estimating, pricing and management.
CO2	**Identify** building estimates and cost control methods.
CO3	**Analyze** project cash flow and tenders in cost estimating.
CO4	**Describe** the real estate finance and mathematics of money.
CO5	**Determine** the financial plans for real estate projects.
CO6	**Apply** risk in project and construction finance.

Course Content:
Unit-1: understanding design in the construction industry, Overview of the types of cost estimates, Understanding structural steel and estimating equipment costs, Understanding cost indices, learning about concrete and reinforcing steel.

Unit-2: Estimate classification, methods and formats, Building and finalizing the estimate, Checks and due diligence, Bids and procurement, Cost reporting, Change orders and communication, Methods of cost control, Defining EVM, Closing out a project, Cost estimation, The role and responsibilities of a cost managers.

Unit-3: Cash flow methods, Charting cash flow, Calculating billing, The payment cycle, Accelerating revenue, Program cost control, Defining the cost of a capital program, Estimating software in action, Workflows.Computing interest calculations, The present and future value of money.

Unit-4: Introduction to financing development projects, Development costs, Introduction to financial plans for development projects, Debt financing of real estate projects, Net comprehensive cash flows for sponsor and lender, DCF project evaluation for sponsor and lender.

Unit-5: Introduction to decision tree analysis, Global project finance overview, Stakeholders in project finance, Principles of project financing, Risk and risk allocation, Contracts and agreements, Money and estimate in capital project delivery, Benchmarking and normalization process, Mitigating risk through lean project delivery systems.

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on & Unit-2, & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Applied Mechanics (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:

1. Construction Accounting & Financial Management: Pearson New International Edition by Stephen Peterson.

2. Financial Management and Accounting Fundamentals for Construction Book by Bolivar A. Senior and Daniel W Halpin, 2 September 2009.

3. Cost Accounting and Financial Management for Construction Project Managers Textbook by Len Holm, 2 August 2018.

4. Financial Management in Construction Contracting Book by Andrew Ross and Peter Williams, 30 November 2012.

Reference Books:

1. Risk and Financial Management in Construction Book by Simon Burtonshaw-Gunn, (2009).

2. Accounting and Financial Management for Residential Book by Emma S. Shinn, (2002).

3. The Handbook of Construction Accounting and Financial Management, Book by William E. Coombs and William J. Palmer, (1984).

Course Description

Title: Concrete Technology **Code: CE361**
L-T-P scheme: 3-0-0 **Credits: 3**

Prerequisite: Building Materials and Construction

Objective: The objective of this course is to acquaint the student with knowledge about various ingredients used in concrete.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the properties of various ingredients of concrete.
CO2	**Identify** suitable concreting ingredients.
CO3	**Analyze** the suitability of admixtures in concrete.
CO4	**Describe** the behavior of concrete at micro and macro level.
CO5	**Determine** the mix design suitable for a given condition.
CO6	**Apply** the concepts of concrete technology.

Course Content:

Unit- I: Introduction to concrete, its components and use, Hydraulic cements: Manufacturing, emissions, composition, types, hydration and microstructural development of Portland cements; Special hydraulic cements

Unit-II: Aggregates: Properties, types of aggregates, classification of aggregates, testing of aggregates, effects of aggregates on concrete properties, lightweight aggregates, recycled aggregates, quality control of water.

Unit-III: Admixtures: Chemical admixtures: Water reducers, superplasticizers, accelerators, retarders, air entraining admixtures, Mineral additives: Slags, fly ashes, rice husk ash, metakaolin, calcined clays, silica fume, limestone powder

Unit IV: Mix design of concrete: Concept of Mix design, variables in proportioning, various methods of mix design, roles of water to cement ratio, chemical admixtures, mineral additives, concrete mix design through IS:10262-2019, self compacting concrete, high strength and high performance concrete.

Unit V: Testing of concrete: Properties of fresh concrete: Workability, rheology, shrinkage, bleeding, test methods, Properties of hardened concrete, Non-destructive testing and repair of concrete, Quality in practice: provisions of IS456

Unit VI: Durability of concrete: Mass transport in concrete, carbonation, chloride ingress, sulphate attack, salt attack, frost, salt scaling, alkali silica reaction, repair, Cracking: Chemical shrinkage, autogenous shrinkage, drying shrinkage, plastic shrinkage, thermal cracking.

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on & Unit-2, & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Concrete Technology (will be added from time to time):
Digital copy will be available on the JUET server.

Text Books:

1. HFW Taylor, Cement Chemistry, Thomas Telford, 1997
2. Bensted J. and Barnes P. (Ed.), "Structure and Performance of Cements", Second Edition, Spon Press, 2002

Reference Books:

1. P.K. Mehta and P.J.M. Monteiro, "Concrete Microstructure, Properties and Materials", Third Edition, Tata McGraw Hill 2006
2. A.M. Neville and J.J. Brooks, “Concrete Technology”, Pearson Education Ltd. 1987.

3. Jahren P. and Tongbo S., Concrete and Sustainability, CRC Press, 2014
4. Sarja A. and Vesikari, E., Durability Design of Concrete Structures E & FN Spon. 1996.
5. Brandt, A. M., Cement-Based Composites: Materials, Mechanical Properties and Performance, E & FN SPON. 1995
6. Bentur, A. and Mindes, S., Fibre Reinforced Cementitious Composites, E & FN Spon 1990

Course Description

Title: Concrete Technology Lab **Code: CE402**
L-T-P scheme: 0-0-2 **Credits: 1**

Prerequisite: Concrete Technology

Objective: To understand the effect of ingredients of concrete in its structural behavior.
Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the fundamental effects of ingredients of concrete in its behavior.
CO2	**Identify** the various factors affecting the strength of concrete.
CO3	**Analyze** the results of various tests in concrete.
CO4	**Describe** the significance of tests of fresh and hardened concrete.
CO5	**Enumerate** the step-by-step procedure of different tests as per Indian standard codes.
CO6	**Apply** the concepts of codal provisions to the mix design.

Course Content:

Unit-1: Specific surface area of Cement by Blaine's Apparatus
Unit-2: Soundness test of cement by Autoclave method
Unit-3: Soundness test of coarse aggregates
Unit-4: Lime reactivity test
Unit-5: Marsh cone test and drying shrinkage by length comparator
Unit-6: Workability test of self compacting concrete
Unit-7: Modulus of Elasticity of Concrete
Unit-8: Concepts of Mix Design of concrete
Unit-9: Split and Flexural strength of concrete
Unit-10: Permeability of concrete
Unit-11: Sorptivity test of concrete

Teaching Methodology:

This course is introduced to help students to know about the fundamental knowledge of testing of concrete and its ingredients. This course has been divided into ten units and each section includes theory and practical exercises to help a student gain more experience in concrete technology. This theory course is well complemented by a theory course under the name ‘concrete technology’ in the same semester that helps a student to learn more practical knowledge and field experience.
Evaluation Scheme:

Exams	Marks	Coverage
P-1	15 Marks	Based on Lab Exercises: 1-5
P-2	15 Marks	Based on Lab Exercises: 6-11

Day-to-Day Work	Viva	20 Marks	70 Marks
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		100 Marks	

Learning Resources:
Lab manuals, code books, regular lab demonstration & notes, study material, videos, and expert lecture & slides available in NPTEL site

Textbooks:

1. Concrete Technology by M. S.Shetty, S.Chand Publishing
2. Concrete Technology by M.L.Gambhir, McGraw Hill Publication

Course Description

Title: Numerical Techniques In Civil Engineering **Code: CE362**
L-T-P scheme: 3-0-0 **Credits: 3**

Prerequisite: Engineering Mathematics

Objective: The objective of this course is to acquaint the student with knowledge about various mathematical techniques to solve any civil engineering problem.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** various mathematical techniques to solve any civil engineering problem.
CO2	**Identify** suitable mathematical technique to solve a given problem.
CO3	**Analyze** the given structural engineering problem using available techniques.
CO4	**Describe** the structural behavior based on the mathematical outcome obtained through analysis.
CO5	**Determine** the solution to structural problem in hand through numerical techniques.
CO6	**Apply** the concepts of numerical techniques to solve real life problems.

Course Content:

Unit 1: Fundamentals of numerical methods; Error analysis; Approximation in Numerical Computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic. Interpolation: Difference Operator: Forward and Backward, Shift Operator, Newton forward interpolation, Newton backward interpolation, Lagrange's Interpolation, Curve fitting; Interpolation and extrapolation. Applications to civil engineering problems

Unit 2: Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's Rule, Expression for corresponding error terms. Numerical Solution of Ordinary Differential Equation: Taylor series method, Euler's method, Euler's modified method, fourth order Runge-Kutta method and Milne's Predictor-Corrector methods. Numerical solution of partial differential equation: Finite Difference method, Crank– Nicolson method. Applications to civil engineering problems

Unit 3: Solution of nonlinear algebraic and transcendental equations; Applications to civil engineering problems.

Unit 4: Elements of matrix algebra; Solution of systems of linear equations; Eigen value problems; Solution of differential equations. Computer oriented algorithms; Numerical solution of different problems, Applications to civil engineering problems.

Unit 5: Conventional optimization, Multi-objective Optimization, Fuzzy logic and its extensions, in multi-objective optimization, Multi-criterion Decision Making, Deterministic

analysis, Stochastic analysis, Fuzzy analysis, Classification problems, Hybrid approaches in Decision Making, Genetic Algorithms

Unit 6: Introduction to Artificial Intelligence and soft computing; Neural networks: Introduction, models, and its application in civil engineering, fuzzy logic and its application in decision making, Clustering; Introduction to machine learning, case studies

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizzes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on & Unit-2, & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on numerical methods in civil engineering (will be added from time to time): Digital copy will be available on the JUET server.

Textbooks:

1. Ayyub and McCuen, Numerical Methods for Engineers, Prentice Hall, NJ, 1996.

2. Neural Networks, Fuzzy logic, and Genetic Algorithms Synthesis and Applications; S. Rajasekaran, G.A. Vijayalakshmi Pai, PHI Learning Pvt. Ltd, Delhi

References:

1. Artificial Intelligence A Modern Approach; Stuart J.Russell, Peter Norvig, Third Edition Pearson Education, Inc., India
2. K. E. Atkinson, An Introduction to Numerical Analysis, Wiley, New York, 1989.
3. G. E. Golub and C.F. Van Loan, Matrix Computations, Johns Hopkins University Press, Baltimore, 1989.
4. W. H. Press, S.A. Teukolsky, W.T. Vetterling, B.P. Flannery (Eds.), Numerical Recipes in
5. The Art of Scientific Computing, Cambridge University Press, Cambridge, 1993.
6. B. N. Datta, Numerical Linear Algebra and Applications, Brookes/Cole Publishing Company, Pacific Grove, California, 1995.
7. J.D. Hoffman, Numerical Methods for Engineers and Scientists, Marcel Dekker, New York, 2001

Course Description

Title: Health Monitoring of Structures **Code: CE363**
L-T-P scheme: 3-0-0 **Credits: 3**

Prerequisite: Mechanics of Solids

Objective: The objective of this course is to acquaint the student with knowledge about different types of sensing technology and concepts of health monitoring.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the concepts sensing technology.
CO2	**Identify** suitable techniques of health monitoring of structures.
CO3	**Analyze** various stresses present in structures.
CO4	**Describe** the behavior of structure using sensing technology
CO5	**Determine** the member forces, stresses and moments in various structures using sensing methods.
CO6	**Apply** the concepts of Sensing Technology and Structural Health Monitoring to real life problems of mechanics

Course Content:

Unit- I: Sensors & Transducer: Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm, piezoelectric sensor, accelerometers.

Unit-II: Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.

Unit-III: Data Acquisition Methods: Basic block diagram, Analog and Digital IO, Counters, Timers, Types of ADC: successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

Unit IV: Methodologies and Monitoring Principles, Local & Global Techniques for SHM, Static & Dynamic Field Testing, Short & Long-Term Monitoring, Active & Passive Monitoring. Vibration Based SHM Techniques - Use & Demonstration of Dynamic Properties of Structures for Damage Detection & SHM, Ambient Vibration Test, Acoustic Emission Technique, Electromechanical Impedance Technique, Wave Propagation Based Techniques, Fibre Optics Based Techniques, Remote & Wireless SHM Techniques, IoT Application in SHM, Artificial Intelligence & Machine Learning in SHM.

Unit V: Structural Assessment & Need for retrofitting: Introduction to health assessment of structures, structural damages & failures, Principles of structural assessment, Classification & levels of assessment, Current scenario of infrastructure through case studies.

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on & Unit-2, & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Health Monitoring of Structures (will be added from time to time): Digital copy will be available on the JUET server.

Text Books:

1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
4. Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill 1997.

Reference Books:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2. A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001 3. Hermann K.P. Neubert, “Instrument Transducers” 2nd Edition 2012, Oxford University Press.

Course Description

Title: Structural Health Monitoring Lab **Code: CE403**
L-T-P scheme: 0-0-1 **Credits: 1**

Prerequisite: Health Monitoring of Structures

Objective: To understand the techniques available for monitoring the health of structures.
Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the various techniques available health monitoring of structures.
CO2	**Identify** the suitable technique for health monitoring of a particular structure.
CO3	**Analyze** the results obtained by various transducers.
CO4	**Describe** the significance of the different tests for health monitoring.
CO5	**Enumerate** the step-by-step procedure of different tests.
CO6	**Apply** the concepts of health monitoring of structures to various real world problems.

Course Content:

Unit-1: Wire strain gauges
Unit-2: Strain measurements in beams using wire strain gauges
Unit-3: Linearly Varying Differential Transducers
Unit-4: Piezoelectric sensors
Unit-5: Thermal Sensors
Unit-6: Pressure Sensors
Unit-7: Half Cell Potential measurements
Unit-8: Rebound Hammer
Unit-9: Rapid Chloride Penetration test
Unit-10: Ultrasonic Pulse Velocity test

Teaching Methodology:

This course is introduced to help students to know about the fundamental knowledge of monitoring the health of structures. This course has been divided into ten units and each section includes theory and practical exercises to help a student gain more experience in structural health monitoring. This theory course is well complemented by a theory course under the name 'Health Monitoring of Structures' in the same semester that helps a student to learn more practical knowledge and field experience.

Evaluation Scheme:

Exams	Marks	Coverage
P-1	15 Marks	Based on Lab exercises 1-5
P-2	15 Marks	Based on Lab exercises 6-10

Day-to-Day Work	35 Marks	
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:
Lab manuals, code books, regular lab demonstration & notes, study material, videos, and expert lecture & slides available in NPTEL site

Textbooks:

1. Piezoelectric Materials, Applications in Structural Health Monitoring (SHM), Energy Harvesting and Bio Mechanics by Dr. Suresh Bhalla, Anne Books Pvt. Ltd.

Course Description

Title: Special Reinforced Concrete Structures **Code: CE364**
L-T-P scheme:3-0-0 **Credit: 3**

Prerequisite: Design of Concrete Structures

Objective: To familiarize students with special RC structures other than beam, column and slabs. Students will also learn about design of different solid and water retaining structures.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the governing factors for the design of a given structure.
CO2	**Describe** the step by step procedure for the design of a given member.
CO3	**Develop** the detailing concepts of structures.
CO4	**Identify** the permissible limits for the design of a specific structure.
CO5	**Apply** the codal provision for the design of structures.
CO6	**Understand** the structural behavior of special structures.

Course Content:

Unit-1: Introduction: Review of Limit State Design of Beams, Slabs & Columns according to IS 456-2000

Unit-2: Design of special rc elements: Design of Slender Columns,

Unit-3: Grid Floors, Curved Beams, Deep Beams, Plain & Reinforced Concrete Walls, Retaining Wall. Slabs: Design of Circular & Flat Slabs. Yield Line Analysis of Slabs.

Unit-4: Bunker and silos

Unit-5: water tanks: Rectangular Water Tanks, Circular Water Tanks,

Unit-6: Overhead and Underground Water Tanks.

Teaching Methodology:

- At the start, of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The lecture may be conducted with the aid of a multi-media projector, whiteboard, OHP, etc.
- Attendance is compulsory in lectures that carry marks.
- At regular intervals, assignments will be given. Students should submit all assignments during the given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carry marks.
- There will be assignments and quizzes at regular intervals. Students can build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1,
Test-2	25 Marks	Based on Unit-2 & Unit-3and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4, Unit-5, and Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Special Reinforced Concrete Structures (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:

1. Advanced Reinforced Concrete Design, by N.Krishna Raju (CBS Publishers & Distributors),
2. Advanced Reinforced Concrete Design, by P.C.Varghese (Prentice Hall of India)
3. IS3370 (Part I to IV) “Code of Practice for the storage of Liquids”, Bureau of Indian Standards.

Reference Books/Material:

1. Concrete, Prentice Hall, by P. K. Mehta, P J M Monteiro, New Jersey
2 Handbook of Concrete Mixes, Special Publications No 24 BIS New Delhi
3. EFNAARC Guidelines on SCC
4. ACI Special Publications
5. IS Specifications

Course Description

Title: Structural Design and Detailing **Code: CE365**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisites: Design of Concrete structures
Objective: To familiarize students with detailing of beams, columns, slabs and other structural elements.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the governing factors for the design of a given structure.
CO2	**Describe** the step by step procedure for the design of a given member.
CO3	**Develop** the detailing concepts of structures.
CO4	**Identify** the permissible limits for the design of a specific structure.
CO5	**Apply** the codal provision for the design of structures.
CO6	**Understand** the structural behavior of special structures.

COURSE OUTLINE:

Unit-1: Introduction: Basics of Detailing, different types of drawing styles; Outline of Drawings
Unit-2: Design drawing and detailing of RC elements / structures – preparation of detailed design documents, Bar bending schedule of structures and reinforcement details (structural drawing) – Slabs, Beams, Columns and Footing,
Unit-3: Design drawing and detailing of special RC elements / structures – Retaining Wall, Water Tanks, Flat slabs, Circular Slabs.
Unit-4: Design and detailing of welded and bolted joints, steel elements / structures - Built-up columns and Column bases, Roof trusses and joints including purlins.
Unit-5: Computer aided analysis and design

- Multi-storey frame analysis for dead, live and wind loads – Applications.
- Design of Reinforced concrete Beams, Columns – Footings – Steel beams – columns – Trusses and Pre Engineered Buildings

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.

- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2 & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

TEXT BOOKS / REFERENCES:

1. Design of Reinforced Concrete Structures 1st Edition by N. Subramanian
2. Design of Reinforced Concrete Structures (IS:456-2000) 3rd Edition by N. Krishna Raju
3. Design Of Reinforced Concrete Structures by Ramamrutham
4. Limit State Design of Reinforced Concrete, 2nd Edition by P. C. Varghese
5. D. Krishnamoorthy, "Structural Design & Drawing Vol. I&II", CBS Publishers, 2012.
6. Karve, Shah,"Illustrated Design of R. C. Buildings (G+3)", Standard Publishers Distributors, 2008.
7. SP:34-1987, "Handbook on Concrete Reinforcement and Detailing", BIS.
8. Practical Design of Reinforced Concrete Structures 1st Edition by Ghosh

Course Description

Title: Earthquake Engineering **Code: CE366**
L-T-P scheme:3-0-0 **Credit: 3**

Prerequisite: Mechanics of Solids, Structural Analysis I & II, Design of Reinforced Concrete Structure

Objective:

1. Introduce the basic concepts in dynamic and probabilistic modeling of earthquake loading and dynamic analyses/simulation with uncertainty in earthquake engineering.
2. Introduce the basics of structural dynamic analyses with emphasis on earthquake engineering applications. Introduce the basics of probabilistic assessment of seismic hazard and structural reliability.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the nature and characteristics of the earthquake.
CO2	**Identify** various structural systems based on degrees of freedom and perform free vibration analysis.
CO3	**Analyze** the multi-storied buildings with seismic coefficient and response spectrum methods.
CO4	**Describe** the significance of ductility in the design of multi-storeyed structures
CO5	**Enumerate** various seismic design principles as per Indian standard codes.
CO6	**Design** reinforced concrete buildings according to the capacity design principle.

Course Content:

Unit-1: Nature of Earthquakes
Plate Tectonics Theory, Faults and fault movements, Magnitude of earthquakes, Intensity scaling of earthquakes: subjective intensity and instrumental intensity, Characteristics of earthquake ground motions
.
Unit-2: Response of Simple Structures to Earthquake Ground Motions:
Seismic response of linear elastic single degree of freedom (SDOF) systems, Seismic response of inelastic SDOF systems Response spectra
Unit-3: Response of Multi Degree of Freedom Systems (MDOF) To Earthquake Ground Motions

Unit-4: Seismic Design Principles:
Earthquake design philosophy, Design spectrum, Earthquake resistance of building systems, Response modification factors

Unit-5: Seismic Code Procedures:
Classification of building systems, Selection of analysis procedure, Capacity design principles for reinforced concrete buildings,

Unit-6: Case study: analysis and design of a multistory R/C frame

Teaching Methodology:

- At the start of the course, the course delivery pattern, prerequisite of the subject will be discussed.
- The lecture may be conducted with the aid of a multi-media projector, whiteboard, OHP, etc.
- Attendance is compulsory in lectures that carry marks.
- At regular intervals, assignments will be given. Students should submit all assignments during the given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carry marks.
- There will be assignments and quizzes at regular intervals, where students can build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2 & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4, Unit-5, and Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slide on Earthquake Engineering (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:

1. Earthquake Resistant Design of Structures by Pankaj Agarwal & Manish Shrikhande, Prentice Hall India.
2. Earthquakes by B. Bolt. Freeman, 1993.
3. Dynamics of Structures by A. Chopra. Prentice-Hall, 1995.
4. Seismic Design of Reinforced Concrete and Masonry Buildings by T. Paulay and M.J.N. Priestley, J. Wiley, 1992

5. B. I.S., Codes No. IS: 1893-2002, IS: 4326-1993, IS: 13920-1993
6. Park &Pauly; Behaviour of RC structure
7. John M.Biggs; Introduction to Structural Dynamics

Reference Books/Material:

1. Dynamics of Structures by Clough R.W. and Penzien J., McGraw-Hill, 2nd edition, 1992
2. Fundamentals of Earthquake Engineering by Newmark N.M. and Rosenblueth E., Prentice-Hall, 1971.
3. C V R Murthy - Earthquake Tips, NICEE
4. IITK-GSDMA EQ26 – V -3.0 Design Example of a Six Storey Building

Web References:

[1] https://www.nicee.org/IITK-GSDMA_Codes.php
[2] https://nptel.ac.in/course.html

Journals References:

[1] Journal of Earthquake Engineering
[2] Journal of structural Engineering
[3] Journal of seismology
[4] Journal of Earthquake Engineering & structural dynamics

IS Codes:

- Criteria for earthquake resistant design General provision & Building - IS: 1893 (Part I) - 2002
- Code of Practice for Ductile Detailing of RC Structures - IS: 13920 (1993).
- Code of Practice for earthquake resistant design & Construction of buildings – IS 4326 (1993).
- Improving Earthquake Resistance of Earthen Buildings - IS 13827(1993)-
- Guide lines for Improving Earthquake Resistance low strength masonry buildings - IS:13828 (1993)

Course Description

Title: Building Planning and Drawing **Code: CE371**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite: Building materials and construction

Objective:
The objective of this course is to introduce the conventional building materials and techniques used in civil engineering construction.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** and understand basic principles of building design and planning
CO2	**Develop** the necessary drawing skills; create multilayer architectural and working drawing
CO3	**Describe** the Guidelines for staircases and its planning
CO4	**Identify** Plan a building following the bye-laws
CO5	**Demonstrate** the Specifications for Truss and roof Drawings.
CO6	**Apply** the building drawings concept to discover and develop ideas for designing residential, commercial, and public buildings.

Course Content:
Unit-1: Drawing Standards- Guidelines for Building Drawing, General convention, for showing different materials in section, Thumb rules for effective planning,
Unit-2: Building Bye-Laws, Specifications of Buildings.
Unit-3: Stairs and Double Storeyed Buildings – Terminology, Guidelines for staircases are planning, Different types of Stairs, Specifications.
Unit-4: Doors and Windows – Guidelines for selecting Doors and Windows, Terminology.
Unit-5: Inclined roof buildings – Terminology, Problems on inclined roof buildings.
Unit-6: Specifications for Truss Drawings, Problems on Trusses.

Teaching Methodology:

- At the start, of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The lecture may be conducted with the aid of a multi-media projector, whiteboard, OHP, etc.
- Attendance is compulsory in lectures that carry marks.
- At regular intervals, assignments will be given. Students should submit all assignments during the given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carry marks.

- There will be assignments and quizzes at regular intervals. Students can build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1,
Test-2	25 Marks	Based on Unit-2 & Unit-3and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4, Unit-5, and Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slide on Building planning and drawing (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:

1. 'Building Drawing Book by C. M. Kale, M. G. Shah, and S. Y. Patki
2. "Building Construction," by Jha, J. & Sinha, S.K., Khanna Publishers, Delhi
3. Building Drawing: With an Integrated Approach to Built Environment Book by C. M. Kale, M. G. Shah, and S. Y. Patki
4. "A Text Book of Engineering Construction", by Kulkarni, C. J.Ahmedabad Book Depot, Ahmedabad.
5. Civil Engineering Drawing and House Planning Book by B. P. Verma

Reference Books/Material:

1. "Building Design & Drawing Book by A D Pawar and V S Limaye

Course Description

Title: Estimation of Building and Roads **Code: CE372**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite: Building materials and construction

Objective:

- Determination of quantities of items and labour requirement of civil engineering works.
- Preparation of estimate of the civil engineering works.
- Preparation of specification of construction items.
- To introduce the students to depth knowledge of professional practice as well the quantity
- Analysis of construction works like multi-storied structures, Waterworks & sanitary works, Irrigation works, Road estimates, culverts, etc.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** diverse knowledge of estimating, costing, and professional practice, which will be used to tackle real-life problems.
CO2	**Develop** the ability to identify, formulate, and solve engineering problems
CO3	**Describe** and understand the procedure to carry out the estimation and steps to prepare reports of construction works.
CO4	**Identify** the purpose and importance of valuation
CO5	**Demonstrate** the structural aspects of different materials and the technicalities involved in construction methods.
CO6	**Apply** the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Content:

Unit-1: Procedure for Estimating

Unit-2: Methods of Building Estimate, Estimates of Buildings

Unit-3: Estimate of different types of roofs

Unit-4: Estimates R.C.C. work and structures

Unit-5: Estimates of Sanitary and Water supply works,

Unit-6: Road Estimating

Teaching Methodology:

- At the start, of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The lecture may be conducted with the aid of a multi-media projector, whiteboard, OHP, etc.
- Attendance is compulsory in lectures that carry marks.

- At regular intervals, assignments will be given. Students should submit all assignments during the given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments and quizzes at regular intervals. Students can build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1,
Test-2	25 Marks	Based on Unit-2, Unit-3 & around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4, Unit-5, and Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:
Tutorials and lecture slides on an estimation of buildings and roads (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:
1. B. N. Dutta, Estimating and Costing In Civil Engineering, UBS Publishers Distributors Ltd.
2. S. C. Rangwala, Estimating And Costing, Charotar Publishing House, Anand
3. G. S. Biridi, Textbook of Estimating & Costing, Dhanapat Rai & Sons. Delhi.

Reference Books/Material:
1. Patil, B.S., Civil Engineering Contracts, Vol. – I, Orient Longman Publication, 1998.
2. Rangwala, S.C., Elements of Estimating and Costing, Professional practice, Charotar Publishing House, Anand.
3. Aggarwal, A., Upadhyay, A.K., Civil Estimating, Costing &Valuation, S.K Kataria& Sons, New Delhi.

Course Description

Title: Quantity Surveying of Bridges and Hydraulic Structures **Code: CE373**
L-T-P scheme:3-0-0 **Credit: 3**

Prerequisite: Building materials and construction, estimation of buildings and roads

Objective:

- Determination of quantities of items and labour requirement of civil engineering works.
- Preparation of estimate of the civil engineering works.
- Preparation of specification of construction items.
- To introduce the students to depth knowledge of professional practice as well the quantity
- Analysis of construction works like multi-storied structures, Waterworks & sanitary works, Irrigation works, Road estimates, culverts, et.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** diverse knowledge of estimating, costing, and professional practice, which will be used to tackle real-life problems.
CO2	**Develop** the ability to identify, formulate, and solve engineering problems
CO3	**Describe** and understand the procedure to carry out the estimation and steps to prepare reports of construction works.
CO4	**Identify** the purpose and importance of valuation
CO5	**Demonstrate** the structural aspects of different materials and the technicalities involved in construction methods.
CO6	**Apply** the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Content:

Unit-1: Culvert- methods of estimating, estimates of R.C.C slab culvert, culvert with varying span arch culvert.

Unit-2: Estimation of pipe culvert, well foundation, R.C.C T- beam bridge

Unit-3: Estimate of earthwork in canal – different cases,

Unit-4: Estimation of earthwork in an irrigation channel, an estimate of permanent land and temporary land, estimate of distributaries, estimate of aqueduct, syphon, village road culvert

Unit-5: Analysis of rates in building works , specification- general specification, and detailed specification.

Unit-6: rules and methods of measurement: general rules: earthwork: concrete: brickwork: woodwork plastering pointing, whitewashing, color washing

Purpose of valuation, types of property- Depreciation, Sinking fund, Leasehold and freehold property, obsolescence, Gross income, Outgoing and Net income, Capitalized value, and year's purchase. Rental method of valuations, and typical problems

Teaching Methodology:

- At the start, of course, the course delivery pattern, prerequisite of the subject will be discussed.
- The lecture may be conducted with the aid of a multi-media projector, whiteboard, OHP, etc.
- Attendance is compulsory in lectures that carry marks.
- At regular intervals, assignments will be given. Students should submit all assignments during the given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments and quizzes at regular intervals. Students can build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1, Unit-2
Test-2	25 Marks	Based on Unit-3, Unit-4 & around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5,and Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Quantity Surveying of Bridges and Hydraulic Structures (will be added from time to time): Digital copy will be available on the JUET server.

Text Book:

1. B. N. Dutta, Estimating and Costing In Civil Engineering, UBS Publishers Distributors Ltd. 2. S. C. Rangwala, Estimating And Costing, Charotar Publishing House, Anand
3. G. S. Biridi, Textbook of Estimating & Costing, Dhanapat Rai & Sons. Delhi.
4. M.Chakroborti, Estimating, Costing, Specification, and Valuation.Calcutta.
5. P.W.D. Hand Book Is Codes

Reference Books/Material:

1. Patil, B.S., Civil Engineering Contracts, Vol. – I, Orient Longman Publication, 1998.
2. Rangwala, S.C., Elements of Estimating and Costing, Professional practice, Charotar Publishing House, Anand.
3. Aggarwal, A., Upadhyay, A.K., Civil Estimating, Costing &Valuation, S.K Kataria& Sons, New Delhi.
4. Chandola, S.P., and Vazirani Estimating and Costing, Khanna Publication

Course Description

Title: Construction Contracts and Laws **Code: CE374**
L-T-P scheme: 3-0-0 **Credits: 3**

Prerequisite: Building Materials and Construction

Objective:
To learn how to prepare the contract and bidding documents for various construction work. This course will enhance the knowledge of liability, mechanics liens, litigation and arbitration through the Indian and international contracts act.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** various contracts and bidding documents for any proposed construction work.
CO2	**Identify** the disputes and disputes resolutions according construction laws.
CO3	**Analyze** features-suitability-design of contract documents
CO4	**Describe** tendering and bidding-accepting-evaluation of tender, formation and interpretation, potential contractual problems.
CO5	**Determine** arbitration, comparison of actions and laws, agreements, conditions of arbitrations, powers and duties of arbitrator, rules of evidence.
CO6	**Apply** legal requirements, insurance and bonding, laws governing sale, purchase and use of urban and rural land, land revenue codes and taxes.

Course Content:

Unit-1
Basics of the legal system including contracts, torts, land zoning and property ownership, bonds and insurance, bidding, subcontracting, contractor liability, mechanics liens, litigation and arbitration,

Unit-2
Indian and international construction law, hazardous waste issues and labor laws, disputes and disputes resolutions, case studies.

Unit-3
Indian contract act, elements, types, features-suitability-design of contract documents, international contract document, law of torts;

Unit-4
Tenders: prequalification bidding-accepting-evaluation of tender, formation and interpretation, potential contractual problems, world bank procedures and guidelines;

Unit-5
BOT projects, arbitration, comparison of actions and laws, agreements, conditions of arbitrations, powers and duties of arbitrator, rules of evidence, Dispute Redressal Boards(DRB),

Unit-6
Laws: legal requirements, 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 customs

duties, legal requirements for planning, property law, agency law, local government laws for approval, statutory regulations.

Teaching Methodology:

- At the start of course, the course delivery pattern, importance of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2,3, & Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Lecture slides and study materials on contracts and tender documents (will be added from time to time): Digital copy will be available on the JUET server.

Text Books:

1. Gajaria G.T., “Laws Relating to Building and Engineering” , Contracts in India.
2. Jimmie Hinze, “Construction Contracts”, McGraw Hill,2001.
3. Joseph T. Bockrath, “Contracts and the Legal Environment for Engineers and Architects”,McGraw Hill, 2000.
4. Kwaku, A. Tenah, P.E. Jose M.Guevara, P.E., “Fundamentals of Construction Management and Organization”, Printice Hall, 1985.M.M.Tripathi Private Ltd., Bombay, 1982.
5. Patil, B.S., “Civil Engineering Contracts and Estimates”, Universities Press (India) Private Limited,2006.

Course Description

Title: Quality Assurance & Quality Control **Code: CE375**
L-T-P scheme:3-0-0 **Credits: 3**

Prerequisite: Nil

Objective:
The objective of this course is to introduce the fundamentals of finite element methods and apply the same to the real world problems.

Learning Outcomes:

CO1	**Outline** the concepts used in finite element method
CO2	**Identify** suitable steps to solve a given problem for any shape of structure for static problems.
CO3	**Analyze** the results obtained by solving the given problem.
CO4	**Describe** the algorithm to solve 2D static problems.
CO5	**Determine** the finite element solution for axisymmetric problems.
CO6	**Apply** the finite element concept to analyze the real time problem.

Course Content:
Unit 1: Introduction, Roles & responsibilities of quality assurance manager, Introduction to the ISO 9000 series of standards, Interpret the requirement of ISO 9001:2015 standards, Barriers in quality system.

Unit 2: International codes & Indian codes, Standards &specifications, Drawings & abbreviations, Excavation & back filling

Unit 3: Quality objectives and Quality policy, Development of company / organization quality systems,

Unit 4: Preparation of Procurement Plan, Preparation of quality manuals, Maintenance organization quality systems, Develop and manage the internal quality audits program.

Unit 5: QA/QC aspects of Pavement layers, buildings, bridges and other structures.

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, white board, OHP etc.
- Attendance is compulsory in lectures which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.

- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks.
- There will be assignments, quizes at regular interval, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- There will be three exams as per the evaluation scheme

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1,
Test-2	25 Marks	Based on Unit-2 & Unit-3and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Quality Assurance & Quality Control (will be added from time to time): Digital copy will be available on the JUET server.

Text Books

1. Quality Assurance and Quality Control in the Analytical Chemical Laboratory: A Practical Approach, Second Edition, Book by Jacek Namieśnik and Piotr Konieczka. (2009)
2. Construction inspection handbook, Book by James O'Brien. (1974)
3. Introduction to Statistical Quality Control, Student Resource Manual, Book by Douglas C. Montgomery. (1985)

References:

1. Perfect: Quality Assurance & Quality Control, Book by Ram Babu Sao. (2016)
2. Quality audits for improved performance, Book by Dennis R Arter. (1989)
3. Total quality control, Book by Armand V. Feigenbaum. (1961)

Course Description

Title: Construction Financial Management **Code: CE356**
L-T-P scheme: 3-0-0 **Credit: 3**

Prerequisite: Estimation and Planning of project.

Objective:

To study the concepts of Construction Economic and Finance such as comparing alternatives proposals, evaluating alternative investments, management of funds, and management of accounting.

Learning Outcomes:

Course Outcome	Description
CO1	**Outline** the theoretical and practical aspects of project management techniques to achieve project goals.
CO2	**Identify** the organizational and leadership capabilities for effective management of construction projects.
CO3	**Analyze** the modern construction practices and techniques.
CO4	**Describe** the necessary knowledge and skills in accounting, financing, risk analysis and contracting.
CO5	**Determine** the strategies for effective planning, scheduling, executing and controlling of construction projects.
CO6	**Apply** the advanced technologies and management approaches for the given problem.

Course Content:

UNIT I- Time Value of Money – Cash Flow diagram – Nominal and effective interest-continuous interest. Single Payment Compound Amount Factor (P/F,F/P) – Uniform series of Payments (F/A,A/F,F/P,A/P)– Problem time zero (PTZ)- equation time zero (ETZ). Constant increment to periodic payments – Arithmetic Gradient(G), Geometric Gradient (C).

UNIT II- Comparing alternatives- Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR)Analysis, Benefit/Cost Analysis, Break Even Analysis.

UNIT III-Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – Inflation.

UNIT IV -Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management-foreign currency management.

UNIT V- Management accounting, Financial accounting principles- basic concepts, Financial statements – accounting ratios - funds flow statement – cash flow statement.

Teaching Methodology:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and practical which carries marks.
- At regular intervals assignments will be given. Students should submit all assignments during given period.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries marks
- Internal exam of 30 marks will be conducted as a part of mid semester evaluation. Experiments shall be performed in the field related to course contents.
- The course includes a practical, where students have an opportunity to build an appreciation for the concept being taught in lectures.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on & Unit-2 & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Study material of Construction Financial Management (will be added time to time): Digital copy will be available on the JUET server.

Text Books:

1. Blank, L.T., and Tarquin,a.J (1988) Engineering Economy,4th Edn. Mc-Graw Hill Book Co.
2. Collier C and GlaGola C (1998) "Engineering Economics & Cost Analysis", 3nd Edn. Addison Wesley Education Publishers.
3. Patel, B M (2000) "Project management- strategic Financial Planning, Evaluation and Control", Vikas Publishing House Pvt. Ltd. New Delhi.
4. Shrivastava,U.K., (2000)"Construction Planning and Management",2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi.
5. Steiner, H.M. (1996) "Engineering Economic principles", 2nd Edn. Mc-Graw Hill Book

Course Description

Title: Project Oriented Practice **Code:** CE401
L-T-P scheme: 0-0-4 **Credits:** 2

Prerequisite: Students must have already studied the basic CE courses and have explored the various dimensions of it.

Objective:
1. Students will be able to identify/formulate project problem.
2. Students will be able to write a review paper in the format of standard journal/transactions related to a particular topic.
3. Students will be able to present his work as per standard way of presentation.

Learning Outcomes:

Course Outcome	Description
CO1	Interpret data from research papers
CO2	Analyze seminar and presentations
CO3	Development of the theoretical model analysis of the planned work.
CO4	Develop writing skill for competence- technical report, design aspects, social issues, etc.
CO5	Conduct conversation practice: face to face and via media.
CO6	Write report on the basis of study carried out

Course Content

UNIT-1 Literature survey and review, the process of research, Formulation of a research problem, Experimental design –Classification. Theoretical research, Formulating a problem, verification methods, modelling and simulations, ethical aspects, IPR issues, Copyrights and Patenting etc.

UNIT-2 student is required doing an innovative work with application of knowledge earned while undergoing various courses and laboratories in the course of study.

UNIT-3 Research Problem identification, Probable solutions, verification of the proposed methodology, conclusions. Meaning, Need and Types of research design, Research Design Process, Measurement and scaling techniques, Data Collection – concept, types and methods, Processing and analysis of data, Design of Experiment

UNIT-4 Quantitative Techniques Sampling fundamentals, Testing of hypothesis using various tests like Multivariate analysis, Use of standard statistical software, Data processing, Preliminary data analysis and interpretation.

UNIT-5 Research Communication, Writing a conference paper, Journal Paper, Technical report, Dissertation/thesis writing. Presentation techniques, Patents and other IPRs, software used for report writing such as WORD, Latex etc

Teaching Methodology: Dissertation is a course requirement wherein under the guidance of a faculty member, a student is required to do an innovative work with application of knowledge earned while undergoing various courses and laboratories in the course of study. The student is expected to do literature survey and carry out development and/or experimentation. Through this the student has to exhibit both analytical and practical skills.

Evaluation Scheme:

Exams	Marks	Coverage
P-1	15 Marks	Based on Unit-1 & Unit-2
P-2	15 Marks	Based on Unit-3 & Unit-4 and around 30% from coverage of P-1
P-3	20 Marks	Based on Unit-5 and around 30% from coverage of P-2
supervisor Marks for performance and Attendance	35 Marks	
Report	15 Marks	
Total	**100 Marks**	

Learning Resources:

1. Discussion and seminar materials can be obtained from supervisor, e-resources or from library (will be added from time to time): Digital copy will be available on the JUET server.
2. https://nptel.ac.in/course.html

3. https://scholar.google.com/

Text Book: As prescribed by respective supervisor faculty member