

**JSS MAHAVIDYAPEETHA  
JSS SCIENCE AND TECHNOLOGY UNIVERSITY  
SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU – 006  
DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT**

**Scheme of Teaching and Examination for B.E. (CT&M) 2016-17**

**Semester - I**

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs	
				L	T	P	Total		CIE	SEE	Total		
1	MA110	Engineering Mathematics-I (Advanced Calculus)	Maths.	4	0	0	04	04	50	50	100	03	
2	PH110	Engineering Physics	Physics	4	0	0	04	04	50	50	100	03	
3	CV110	Engineering Mechanics	Civil	4	0	0	04	04	50	50	100	03	
4	EE110	Basic Electrical and Electronics Engineering	E&EE	4	0	0	04	04	50	50	100	03	
5	ME110	Mechanical Engineering Sciences	Mech/IP	4	0	0	04	04	50	50	100	03	
6	PH12L	Engineering Physics Laboratory	Physics	0	0	1.5	1.5	03	50	-	50	-	
7	ME12L	Basic Workshop Practice	Mech/IP	0	0	1.5	1.5	03	50	-	50	-	
8	HU120/ HU220	Functional English	Humanities	2	0	0	02	02	50	-	50	-	
				<b>Total credits</b>				<b>25</b>	<b>28</b>	<b>Total marks</b>		<b>650</b>	<b>-</b>

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**Semester - II**

Sl. No	Subject code	Course title	Teaching department	CREDITS				Contact hours	Marks			Exam duration in hrs	
				L	T	P	TOTAL		CIE	SEE	Total		
1	MA210	Engineering Mathematics–II (Multivariable Calculus)	Maths.	4	0	0	04	04	50	50	100	03	
2	CH210	Engineering Chemistry	Chemistry	4	0	0	04	04	50	50	100	03	
3	CV210	Strength of Materials	Civil	4	0	0	04	04	50	50	100	03	
4	CS210	Programming in C	CS&E / IS	4	0	0	04	04	50	50	100	03	
5	ME210	Computer Aided Engineering Graphics	Mech.	2	0	2	04	06	50	50	100	03	
6	CH22L	Engineering Chemistry Lab	Chemistry	0	0	1.5	1.5	03	50	-	50	-	
7	CS22L	Computer Programming Lab	CS&E / IS	0	0	1.5	1.5	03	50	-	50	-	
8	HU110/ HU210	Innovation Studies	Humanities	2	0	0	02	02	50	-	50	-	
9	HU130/ HU230	Kannada	Humanities	-	-	-	-	02	50	-	50	-	
				<b>Total marks</b>				<b>25</b>	<b>32</b>	<b>Total marks</b>		<b>700</b>	<b>-</b>

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**Semester: III**

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs	
				L	T	P	Total		CIE	SEE	Total		
1	MA311	Computational Mathematics	Maths.	4	0	0	04	04	50	50	100	03	
2	CT310	Construction Materials	CT&M	3	0	0	03	03	50	50	100	03	
3	CT320	Analysis of Determinate Structures	CT&M	4	0	0	04	04	50	50	100	03	
4	CT330	Surveying	CT&M	4	0	0	04	04	50	50	100	03	
5	CT340	Mechanics of Fluids	CT&M	4	0	0	04	04	50	50	100	03	
6	CT350	Management Principles and Practices	CT&M	4	0	0	04	04	50	50	100	03	
7	CT36L	Surveying Practice	CT&M	0	0	1.5	1.5	03	50	-	50	-	
8	CT37L	Basic Materials Testing Laboratory	CT&M	0	0	1.5	1.5	03	50	-	50	-	
9	HU310	Constitution of India and Professional Ethics	Humanities	-	-	-	-	02	50	-	50	-	
				<b>Total credits</b>				<b>26</b>	<b>31</b>	<b>Total marks</b>		<b>750</b>	<b>-</b>

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**Semester: IV**

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs	
				L	T	P	Total		CIE	SEE	Total		
1	MA410	Fourier Series, Integral Trans and Applications	Maths.	4	0	0	04	04	50	50	100	<b>03</b>	
2	CT410	Building Construction	CT&M	3	0	0	03	03	50	50	100	<b>03</b>	
3	CT420	Analysis of Indeterminate Structures	CT&M	4	0	0	04	04	50	50	100	<b>03</b>	
4	CT430	Transportation Engineering	CT&M	4	0	0	04	04	50	50	100	<b>03</b>	
5	CT440	Irrigation Engineering and Hydraulic Structures	CT&M	4	0	0	04	04	50	50	100	<b>03</b>	
6	CT450	Concrete Technology	CT&M	4	0	0	04	04	50	50	100	<b>03</b>	
7	CT46L	Computer Applications In Drafting And Spreadsheet	CT&M	0	0	1.5	1.5	03	50	-	50	-	
8	CT47L	Construction Materials Testing Laboratory	CT&M	0	0	1.5	1.5	03	50	-	50	-	
9	HU410	Environmental Studies	Env./ Humanities	-	-	-	-	02	50	-	50	-	
				<b>Total credits</b>				<b>26</b>	<b>31</b>	<b>Total marks</b>		<b>750</b>	<b>-</b>

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**Scheme of Teaching and Examination for B.E. (CT&M) 2016-17**

**Semester: V**

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs	
				L	T	P	Total		CIE	SEE	Total		
1	CT510	Building Services	CT&M	4	0	0	04	04	50	50	100	03	
2	CT520	Design of RC Structures	CT&M	4	0	0	04	04	50	50	100	03	
3	CT530	Construction Equipments	CT&M	4	0	0	04	04	50	50	100	03	
4	CT540	Geotechnical Engineering	CT&M	4	0	0	04	04	50	50	100	03	
5	CT550	Project Management Systems	CT&M	4	0	0	04	04	50	50	100	03	
6	CT560	Building Planning, Types and Standards	CT&M	4	0	0	04	04	50	50	100	03	
7	CT57L	Building Services Laboratory	CT&M	0	0	1.5	1.5	03	50	–	50	–	
8	CT58L	Geotechnical Engineering Laboratory	CT&M	0	0	1.5	1.5	03	50	–	50	–	
				<b>Total credits</b>				<b>27</b>	<b>30</b>	<b>Total marks</b>		<b>700</b>	<b>–</b>

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**Scheme of Teaching and Examination for B.E. (CT&M) 2016-17**

**Semester: VI**

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs	
				L	T	P	Total		CIE	SEE	Total		
1	CT610	Construction Quality and Safety Management	CT&M	4	0	0	04	04	50	50	100	03	
2	CT620	Design of Steel Structures	CT&M	4	0	0	04	04	50	50	100	03	
3	CT630	Construction Economics and Finance	CT&M	4	0	0	04	04	50	50	100	03	
4	CT640	Applied Geotechnical Engineering	CT&M	4	0	0	04	04	50	50	100	03	
5	CT650	Contracts, Specifications and Arbitrations	CT&M	4	0	0	04	04	50	50	100	03	
6	CT66*	Elective-I	CT&M	4	0	0	04	04	50	50	100	03	
7	CT67L	Computer Applications in Project Planning and Analysis	CT&M	0	0	1.5	1.5	03	50	–	50	–	
8	CT68L	Construction Technology Laboratory	CT&M	0	0	1.5	1.5	03	50	–	50	–	
9	HU610	Foreign Language	Humanities	–	–	–	–	02	50	–	50	–	
				<b>Total credits</b>				<b>27</b>	<b>32</b>	<b>Total marks</b>		<b>750</b>	

<b>*Elective-I</b>	
Sub. Code	Subject
CT661	Project Formulation and Appraisal
CT662	Matrix Methods of Structural Analysis
CT663	Traffic engineering management and road safety
CT664	Alternative Building Materials and Technologies

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Construction Materials CT310</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 3:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To study masonry and cementitious materials.
- To study timber and steel products.
- To study composite and smart materials.
- To study finishing materials.
- To study insulating, glass and polymeric materials.

### Course Outcome:

At the end of the course, the student has the ability to

- Explain masonry and cementitious materials (CO1).
- Classify timber and Steel products (CO2).
- Interpret Composite and smart materials (CO3).
- Outline finishing materials (CO4).
- Interpret Insulating, glass and polymeric materials (CO5).

### 1. MASONRY MATERIALS

Building Stones: Classification, Quarrying of stones, Dressing of stones, Deterioration and preservation of stones, Requirements of good stones, Tests on stones –Bricks- Classification of bricks, Good brick earth, Harmful ingredients, Properties of good bricks, Manufacture of bricks, Tests of bricks-Solid and Hollow Blocks- Standards, Manufacture and uses.

### 2. BINDING MATERIALS

Lime: Composition of lime, Classification of lime, Manufacture of lime, Activated – lime – puzzolona mixture, Introduction to cement, Puzzolanas: Meta kaolin, Silica Fume, Fly ash, Ground Blast Furnace Slag and rice husk ash, pavement materials.

### 3. TIMBER

Properties of good timber, Defects in timber, Preservation of timber, Tests on timber, Timber based products – Plywood, Wood Wool Boards, Lamin Boards.

### 4. STEEL

Types of steel used in Construction, Standards, Classification and Properties.

### 5. FLOORING, ROOFING AND CLADDING TILES

Types, Properties and uses.

### 6. PAINTS, VARNISHES AND DISTEMPERS

Definition, Functions, Characteristics, Types.

## **7. COMPOSITE MATERIALS**

Introduction, Classification - Particle reinforced composite, Fiber reinforced composite, Structural composite – their applications.

## **8. INSULATING MATERIALS**

Classification, Thermal insulating materials: General aspects, Requirements, Classification  
Sound insulating materials: Requirements, Classification.

## **9. GLASS, RUBBER AND PLASTICS**

Types, Properties, Uses.

## **10. INTRODUCTION TO SMART MATERIALS**

Introduction, Types, Difference between smart and intelligent material, special features, applications.

### **Self Learning:**

- Site visit to historical structure to study uses of stone.
- Visit to a construction site and prepare a report for all types of building materials.
- Conduct Market survey for building materials and their properties.

### **Text Books:**

1. Building Materials by P.C. Varghese, Prentice- Hall of India, New Delhi, 2006.
2. Building Materials by S.K. Duggal, 2nd Edition, New Age International Publishers, New Delhi, 2010.

### **References:**

1. Engineering Materials by S.C. Rangwala, Charotar Publishing House, India, 2011.
2. Materials for civil and construction engineers by Michael S. Mamlouk and John P. Zaniewski, 3rd edition, Pearson Education Inc., 2011



## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Analysis of Determinate Structures CT320</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To understand the role of structural analysis in the structural design process.
- To identify, idealise and analyse simple engineering structures.
- To apply the knowledge of mathematics, science and engineering fundamentals to analyse simple engineering structures.

### Course Outcome:

At the end of the course, the student has the ability to

- Asses the importance of structural analysis in the structural design process (CO1).
- Analyze and compute internal forces in plane trusses (CO2).
- Analyze arches and cables (CO3).
- Compute the deformations in determinate beams and trusses (CO4).
- Use the concept of ILD to find internal forces in determinate beams (CO5).

#### 1. STRUCTURAL SYSTEM

Introduction, Forms of Structures, Conditions of Equilibrium, Determinate and Indeterminate Structures, one-, two- and three-dimensional idealization of structural systems, Betti's law, Maxwell's Reciprocal theorem, Strain Energy Principle, Strain energy due to Axial load, Bending and Shear.

#### 2. ANALYSIS OF PIN JOINTED DETERMINATE PLANE TRUSS

Introduction, Assumptions, Analysis of truss by Method of joints and Method of Sections.

#### 3. ANALYSIS OF CABLES

Introduction, Analysis of Cables under concentrated loads and uniformly distributed loads with supports at same level, Analysis of anchor cables.

#### 4. ANALYSIS OF THREE HINGED ARCHES

Introduction, Analysis of Three hinged Parabolic and Circular arches with supports at same level.

#### 5. MOVING LOADS AND ILD FOR BEAMS

Introduction, ILD for simply supported beams, Analysis of simply supported beams under various standard types of loads.

#### 6. DEFLECTION OF BEAMS

Introduction, Deflection of beams using – Macaulay's Method ,Conjugate Beam Method, Unit load method, Castiglione's theorem, Moment Area Theorems (Concepts only)

## **7. DEFLECTION OF TRUSSES**

Using Castiglione's theorem and Unit load method.

### **Self-Learning:**

- Analysis of cables and arches supported at different levels.
- Determination of slope and deflection of cantilever beams using Moment area method.

### **Text Books:**

1. Pandit, G.S., Gupta, S.P. and Gupta, R., Theory of Structures Vol.–I, Tata McGraw Hill, New Delhi.
2. Punmia, B.C. and Jain, R.K., Strength of Materials and theory of structures Vol I & II, Laxmi Publication New Delhi
3. BhaviKatti, S.S. Structural Analysis Vol.–I, Vikas Publishing House Pvt. Ltd., New Delhi.

### **References:**

1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Norris C.H. and Wilbur, J.B. Elementary Structural Analysis, International Student Edition. McGraw Hill Book Co: New York.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Surveying CT330</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To know the importance of surveying in construction industry and to introduce the basic concepts of surveying.
- To learn fundamental concepts of planimetric survey and relief survey.
- To introduce the students to accurate and higher order survey methods.
- To introduce the students to design and setting-out of curves for highways and railways.

### Course Outcome

At the end of the course, the student has the ability to

- Explain the basic concepts of surveying (CO1).
- Analyze contour maps (CO2).
- Analyze theodolite survey data (CO3).
- Design and setting out of curves (CO4).
- Understand the various concepts of digital surveying (CO5).

### 1. INTRODUCTION

Surveying – Classification – Uses – Map and plan – Topographical maps – Basic principles of surveying – Precision and accuracy – Errors and types.

### 2. INSTRUMENTS FOR SURVEYING

Chain - Tape - ranging rods – pegs- arrows- cross staff- optical square-prism square – Compass – Dumpy level – Theodolite – Total station.

### 3. THEODOLITE

Types – Fundamental axes and parts – Temporary adjustments – Measurement of horizontal angles and vertical angles.

### 4. INTRODUCTION TO LEVELLING

Basic definitions – Fundamental axes and parts of a Dumpy level – Temporary adjustments – simple levelling – Reciprocal levelling – Profile levelling – Cross sectioning – Fly levelling – Methods of booking – Fly back levelling – Arithmetic checks – Numerical problems – Contours: Characteristics and Uses.

### 5. CURVES

Types of curves- Degree of curve- Relationship between degree and Radius of curvature- Setting out of simple curves-Transition curves.

## **6. DIGITAL SURVEYING**

EDM Devices and Total Station instruments: Working principle and functions. Introduction to Remote Sensing: Idealized remote sensing – Basic principles of remote sensing – Electromagnetic energy Electromagnetic spectrum – Wave length regions and their application in remote sensing – Remote sensing observation platforms – sensors – Application of Remote Sensing.

## **7. GPS SURVEYING**

Global Positioning System (GPS), System overview, Working principle, Satellite ranging, Position calculation, GPS errors and their calculations, Co-ordinate systems, GPS datum, GPS and heights, Mean sea level. GPS receiver and its features, Types, Selection of receiver.

## **8. GIS**

Geographic Information system concepts and spatial models. Introduction, Spatial information, temporal information, GIS Functionality – Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis. Digitizing Editing and Structuring Map Data – Entering the spatial data (digitizing), the non-spatial, associated attributes, linking spatial and non-spatial data.

### **Self-learning**

- To know about different types of GIS softwares.
- To know about different types of image processing softwares.

### **Text Books:**

1. Plane Surveying by Chandra A.M., New Age International (P) Ltd., New Delhi, 2002.
2. Global Positioning System, Principles and Applications by Satheesh Gopi, Tata McGraw Hill Publication Company Ltd., New Delhi, 2005.
3. Remote Sensing and Image interpretation edited by Thomas M. Lillesand and Ralph W. Kiefer, John Wiley, New York, 2000
4. GIS and Computer cartography by Christopher Jones, Longman Publications, Longman, 1997.

### **References:**

1. Surveying Vol.I by Dr. B. C. Punmia, Ashok Kumar Jain, Dr Arun Kuma Jain, Dr. Arun Kumar Jain . Laxmi Publications, sixteen edition 2005.
2. Surveying Vol. II. by Dr. B. C. Punmia, Ashok Kumar Jain, Dr Arun Kuma Jain, Dr. Arun Kumar Jain . Laxmi Publications, Sixteenth 2016.
3. Introduction to Surveying by James Anderson and Edward Mikhail, Mc-Graw Hill Book Company, 1985.
4. Surveying by Arthur Benister, Pearson Education, 2006.
5. Remote Sensing Principles and Interpretation by Floyd F. Sabins, W.H. Freeman and Co., (NY), 2007.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Mechanics of Fluids CT340</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L -T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the students to the properties of fluids and classification of fluids.
- To introduce the concept of static pressure of fluid and its measurement.
- To introduce the students to kinematics of fluid flow.
- To introduce the students to the basic equations of fluid flow and their applications.

### Course Outcome:

At the end of the course, the student has the ability to

- Analyze the properties of fluids (CO1).
- Determine / measure fluid pressures (CO2).
- Determine / measure hydrostatic fluid pressure (CO3).
- Classify the flow and to analyse the stream lines & equi-potential lines of fluid flow (CO4).
- Analyze the dynamics of fluid flow and its applications (CO5).

### 1. INTRODUCTION

Definition of Fluid, Distinction between solids & fluid, Distinction between liquids & gases, Concept of fluid continuum.

### 2. FLUID PROPERTIES AND CLASSIFICATION OF FLUID

Mass density, Specific Volume, Specific Weight, Specific gravity – Definitions, units and Dimensions. Viscosity, Newton's law of viscosity, Newtonian, Non-Newtonian Fluids, Ideal and Real fluids, Compressibility vapour pressure, surface tension – Definitions, units and dimensions. Capillarity – Theory and problems. Problems on Newton's law of viscosity

### 3. FLUID PRESSURE AND ITS MEASUREMENT

Definition of pressure, units and dimensions, pressure at a point in a static fluid. Pascal's law – Hydrostatic pressure law. Absolute, gauge and vacuum pressure. Measurement of pressure – Simple and Differential Manometer – Theory and problems, Micro-manometers and Mechanical pressure gauges.

### 4. HYDROSTATICS

Definition of total pressure, center of pressure, centroid, centroidal depth, depth of center of pressure, moment of Inertia, table of centroid & moment of Inertia for different geometric shapes, – Equation for hydrostatic force and depth of center of pressure on plane surfaces (vertical and inclined), – Problems on hydrostatic force vertically submerged surfaces – Problems on inclined submerged surfaces, –Hydrostatic force on submerged curved surfaces, problems, – Pressure diagram, problems.

## **5. KINEMATICS OF FLUID FLOW**

Description of fluid flow, Lagrangian and Eulerian approaches, Lines of flow, Classification of flow: steady & unsteady flows, uniform and non-uniform flows, viscous & turbulent flows, rotational & irrotational flows; 1-D, 2-D & 3-D flows, Continuity equation, Velocity potential and stream functions and relation between them, Laplace equation, Numerical problems.

## **6. DYNAMICS OF FLUID FLOW**

Concept of inertia force and other forces causing motion, Euler's equation and Bernoulli's theorem: Assumptions and limitations, Modified Bernoulli's equation, Numerical problems.

### **Self-Learning:**

- Basic principles of stability of floating and submerged bodies.
- Applications of Bernoulli's theorem: Venturi meter, orifice meter, Pitot tube.

### **Text Books:**

1. Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal, Lakshmi Publications, New Delhi.
2. Irrigation, Water Resources and Water Power Engineering – Modi P. N. Standard books house New Delhi.
3. Irrigation, Engineering and Hydraulic. Structures – S.K. Garg, Khanna publications, New Delhi

### **References:**

1. Irrigation and Water power engineering – Punmia and Pandey La! Lakshmi Publications, New Delhi.
2. Fluid Mechanics, Hydraulic and Hydraulics by K.R. Arora, Standard Book House, New Delhi.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Management Principles and Practices CT350</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### **Course Objective:**

- To introduce the students to the Principles of Management, Planning, Organizing, Staffing, Directing and Controlling in an Organisation.
- To introduce the students to the concept of Human Resource Management
- To introduce the students to Global Management Concepts.

### **Course Outcome:**

At the end of the course, the student has the ability to

- Explain fundamentals of management (CO1).
- Interpret forms and principles of organization (CO2).
- Do planning and decision making (CO3).
- Outline human resource management (CO4).
- Evaluate global management practices (CO5).

### **1. INTRODUCTION**

Evolution of Management thought, meaning, nature and characteristics of Management; Scope and functional areas of management; Management as a science, art or profession; Management & Administration; Roles of Management; Levels of Management; Development of Management thought; Early management approaches; Modern management approaches. Concept of management in developed countries like USA, Japan, Britain etc., Role of Culture, technology, economics and social system.

### **2. ORGANISATIONS**

Forms of Ownership - Public enterprise, Private enterprise, Sole proprietorship, Partnership, Joint Stock Company, Co-operative societies - Organisation Structure – Principles of organization, Types & Structures of organizations, Hierarchy, Roles – Responsibilities – Accountability, Decision making process- Means of Finance.

### **3. PLANNING**

Nature of planning, Types of plans, Principles of Planning, Importance and steps in planning & planning premises, Hierarchy of plans-Decision making tools.

### **4. HUMAN RESOURCE**

Concept, Nature, Scope, Objectives, Importance of human resource management -Staffing, Directing & Control - Nature and importance of staffing selection, Recruitment, Communication, Coordination, Leadership, Motivation, Directing, Controlling-Development – Appraisal, Gap analysis, Training and development, Career paths.

## **5. GLOBAL MANAGEMENT BEST PRACTICES**

Corporate strategies, e-governance, Business process re-engineering, Benchmarking, six sigma, Core competencies-Corporate social responsibility and impact on society-Concepts of MBO and MBE.

### **Self-Learning:**

- Concepts of centralization and decentralization in an organisation.
- Concepts of e-commerce.

### **Text books:**

1. Principles of Management by P.C. Tripathi, P.N. Reddy, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2012.
2. Management & Entrepreneurship by N V R Naidu & T Krishna Rao, I.K. International Publishing, 2009.

### **References:**

1. Management and Entrepreneurship by K. Venkataramana, Seven Hills Book Publications, Mumbai.
2. Ernest Dalc, Management Theory and Practice, McGraw Hill, Int. Edition, New York, 1973.
3. L.M. Prasad, Principles and Practice of Management, S. Chand and Sons New Delhi, 2015.



## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Surveying Practice CT36L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0:1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- To expose the student to the concepts of surveying.
- To train the students in using various surveying instruments.
- To demonstrate modern equipments of surveying.

### Course Outcome

At the end of the course, the student has the ability to

- Examine the working principles of various instruments and to use the same (CO1).
  - Prepare topographic maps of small areas (CO2).
  - Set-out horizontal curves for highways and railways (CO3).
  - Use Theodolite for data collection (CO4).
  - Use total station and digital surveying (CO5).
1. Introduction and usage of basic survey instruments (chains, ranging rods, pegs, arrows, cross staff, optical square, prism square, compass, Dumpy level).
  2. To determine distance between two inaccessible objects using compass.
  3. To determine RL of points starting from BM – different methods of booking and checks.
  4. Profile levelling for highways including cross section levelling – plotting.
  5. Block levelling and contour map generation.
  6. To use a Theodolite to measure horizontal angles – Method of repetitions and Reiterations.
  7. Measurement of vertical angles.
  8. Trigonometric levelling – Elevation of an object when base is accessible.
  9. Distance and difference in elevation between two inaccessible points – Double plane method.
  10. Setting out simple curves by linear methods – Ordinates from long chord.
  11. Measurement of distances Angles and Coordinates using Total Station instrument.
  12. To study modern techniques of surveying using GIS, GPS & remote sensing.

### References:

1. Plane Surveying by Chandra A.M., New Age International (P) Ltd., New Delhi, 2002.
2. Plane Surveying by Alak De, S. Chand & Co. Ltd., New Delhi, 2000.
3. Introduction to Surveying by James Anderson and Edward Mikhail, Mc-Graw Hill Book Company, 1985.
4. Surveying by Arthur Benister, Pearson Education, 2006.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Basic Materials Testing Laboratory CT37L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0:1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- Introduce the students to basic construction materials and various methods of testing.
- To facilitate the students to develop their intellectual to conduct tests on basic engineering materials used in construction industry.
- To train the students to analyze the data obtained from the laboratory testing rationally to get meaningful results.

### Course Outcome:

At the end of the course, the student has the ability to

- Interpret the fundamentals of testing methodology and Test the materials (CO1).
- Demonstrate practical exposure in standard procedures of testing (CO2).
- Test the materials and analyze the data rationally (CO3).

1. Tension tests on Mild steel and HYSD bars.
2. Compression tests on Mild steel, Cast iron and Wood.
3. Torsion test on Mild steel.
4. Double shear test on Mild steel.
5. Impact tests on Mild steel: Izod test and Charpy test.
6. Bending test on wood (Two point loading)
7. Hardness tests on metals: Rock well, Brinell and Vickers hardness tests.

### Text Book:

1. Testing of Engineering Materials by Davis, Troxell and Hauck, IV Edition, McGraw Hill Publications, New Delhi.

### References:

1. Books on Engineering Materials.
2. Relevant Bureau of Indian Standard Codes.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Constitution of India and Professional Ethics HU310</b>
<b>No. of Teaching Hours – 2h/week</b>	<b>Credits 0:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- The objective of studying the Constitution of India is to increase the legal and social awareness of the engineers so that they are equipped to face challenges they may confront in their careers and also to encourage them to actively participate in the political process of the country.
- The objective of studying professional ethics is to equip an engineer to face such situations and to solve such conflicts in compliance with the accepted ethical principles and norms.

### Course Outcome:

At the end of the course, the student has the ability to

- Have knowledge about and an understanding of constitutionally guaranteed rights and duties of every citizen; have knowledge about the various forums that actively participate in protecting these rights in case of violation (CO1).
  - Have an understanding of the working of the electoral process, amendment procedure; have an understanding of the different organs of the State, namely legislature, executive and the judiciary (CO2).
  - Have an understanding of the powers & functions of state legislature and Union legislature; have an understanding of the powers & functions of state executive, and Union executive and emergency provisions (CO3).
  - Have an understanding of the special provisions related to SCs, STs, Women, children and backward classes; have an understanding of the scope, limitation and functioning of the Indian judiciary; have an understanding of the importance of fundamental duties and directive principles of state policy (CO4).
  - Be able to develop the ethical autonomy i.e., the skill and the habit of thinking rationally and critically about the ethical values viz honesty, integrity and reliability; be able to build and contribute to a safe and healthy work environment; be able to better serve in responsible positions of leadership and discharge his duties better (CO5).
  - Be equipped with better decision making abilities and will be able to make morally and ethically sound decisions; be able to make positive contribution to the society; be examples of faith, character, and high professional ethics (CO6).
1. Preamble to the constitution of India. Fundamental Rights under Part III - details of Exercise of rights, Limitations and Important cases.
  2. Relevance of Directive Principles of State Policy under Part IV. Fundamental duties and their significance.
  3. Union Executive - President, Prime Minister, Parliament and the Supreme Court of India.
  4. State executive - Governors, Chief Minister, State Legislator and High Courts.
  5. Constitutional Provisions for Scheduled Castes and Tribes, Women & Children & Backward classes, Emergency Provisions.

6. Electoral process, Amendment procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments.
7. Scope & aims of engineering Ethics, Responsibility of engineers. Impediments to responsibility.
8. Honesty, Integrity and reliability, risks, safety & liability on engineering.

**Text Books:**

1. Introduction to the Constitution of India, Durga Das Basu, Prentice Hall, 19<sup>th</sup>/20<sup>th</sup> Edn. (Students Edn.) 2001.
2. Engineering Ethics, Charles E.Haries, Michael. S. Pritchard and Michael J. Robins, Thompson Asia, 2003.

**References:**

1. An Introduction to Constitution of India, M.V. Pylee, Vikas Publishing, 2002.
2. Engineering Ethics, M. Govindarajan, S. Natarajan, V.S. Senthilkumar., Prentice – Hall of India Pvt. Ltd., New Delhi, 2004.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Building Construction CT410</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 3:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the students to various components of buildings.
- To introduce the students to the concept of green buildings and construction practices.

### Course Outcome:

At the end of the course, the student has the ability to

- Analyze Significance of each and every components of a building (CO1).
- Distinguish various types of Staircase and its geometric design (CO2).
- Identify suitable type of flooring, plastering and paints (CO3).
- Use various types of temporary works (CO4).
- Analyze requirements for damp-proofing and energy-efficient buildings (CO5).

### 1. FOUNDATIONS

Definitions – necessity- Setting out of foundation works -Types of foundations - Foundations in black cotton soils / problematic soils.

### 2. MASONRY

Stone masonry – Setting out, joints, types; Brick masonry – Terminologies, Bonds and Reinforced brick work; Block masonry – Concrete block; Stone composite, brick – stone composite; Types of walls, Masonry arches and types

### 3. LINTEL, CHEJJA, CANOPY AND BALCONY

Lintel-Functions and types; Chejja- Functions and types; Canopy- Functions and types; Balcony- Functions and types.

### 4. ROOFS

Features of a good roof, Classification, Steel and timber trusses.

### 5. STAIRS

Types of stairs, Geometric design of stairs; Introduction of Ramps, Lifts and Escalators.

### 6. FLOORING, PLASTERING AND PAINTING

Flooring-Purpose and types; Plastering- Purpose and types; Painting- Purpose and types;

### 7. DOOR AND WINDOWS

Positioning and proportioning and Types.

### 8. DAMP PROOFING

Causes Effects and Methods.

## **9. TEMPORARY WORKS**

Form works- Shoring- Scaffolding and Under pinning.

## **10. ENERGY EFFICIENT BUILDINGS**

Sustainability – Concepts, Green buildings – Concepts and requirements- Energy conservation in buildings -Rating of buildings

### **Self Learning:**

- Doors and Windows Fixtures and fastenings.
- DPC treatment in buildings.
- Case studies of green buildings.

### **Text Books:**

1. Building Construction by B.C. Punmia, Laxmi Publications Pvt. Ltd., New Delhi, 2008.
2. Building Construction by S.C. Rangwala, Charotar Publishing House Pvt. Ltd, India, 2010.

### **References:**

1. Building Construction by Varghese P.C.,Prentice-Hall of India Pvt.Ltd. , New Delhi, 2007.
2. Building Construction and Materials by Gurucharan Singh , Standard Book House, Delhi, 1988.
3. Building Construction by Jha, J. &Sinha, S.K.,Khanna Publishers, New Delhi, 1977

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Analysis of Indeterminate Structures CT420</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To apply the knowledge of mathematics, science and engineering fundamentals to solve relatively complex engineering structures.
- To apply the knowledge of matrix approach in classical methods of structural analysis.
- To introduce the concept of plastic analysis and carryout plastic analysis of continuous beams.

### Course Outcome:

At the end of the course, the student has the ability to

- Identify indeterminate structures and determine their degree of indeterminacy (CO1).
- Analyze simple indeterminate beams using consistent deformation method (CO2).
- Analyze continuous beams & simple portal frames using slope deflection and moment distribution methods (CO3).
- Use matrix methods to analyse indeterminate beams (CO4).
- Determine shape factors & plastic moments and to perform plastic analysis of continuous beams (CO5).

### 1. INTRODUCTION

Degree of static and kinematic indeterminacy – Beams, plane frames and trusses, Linear and non-linear analysis, Methods of analysis of indeterminate structures – Force and displacement methods, Clapeyron's theorem – Concepts (No numerical examples).

### 2. FORCE METHOD OF ANALYSIS

Consistent deformation method- Application to analysis of propped cantilever beam and fixed beams and Matrix Method- Flexibility approach - Introduction, Analysis of continuous beams using system approach (static indeterminacy  $\leq 3$ ).

### 3. DISPLACEMENT METHOD OF ANALYSIS

Slope deflection method - Introduction, Analysis of continuous beams and simple orthogonal portal frames (kinematic indeterminacy  $\leq 3$ ), Moment distribution method - Introduction, Analysis of continuous beams and simple orthogonal portal frames, Matrix Method – Stiffness Approach - Introduction, Analysis of continuous beams using system approach (kinematic indeterminacy  $\leq 3$ ).

### 4. PLASTIC ANALYSIS

Introduction, Plastic hinge, Plastic moment capacity, Shape factor, Collapse load, Basic theorems, Plastic analysis of beams.

**Self-Learning:**

- Application of Clapeyron's theorem.

**Text Books:**

1. Basic Structural Analysis by Reddy C.S., Second Edition, Tata McGraw Hill Publication Company Ltd.
2. Theory of Structures Vol. 2, S.P. Gupta, G.S. Pandit and R. Gupta, Tata McGraw Hill Publication Company Ltd.
3. Computational Structural Mechanics by S. Rajasekaran and G. Sankarasubramanian, Prentice Hall India Pvt. Ltd., New Delhi.

**References:**

1. Indeterminate Structural Analysis by J. Sterling Kinney, Oxford and IBH Publishing Co.
2. Elementary Structural Analysis by Norris C.H., Wilbur J.B., Mc Graw Hill International Book Edition.
3. Advanced Structural Analysis by Ashok K. Jain, Nem Chand & Bros., Roorkee, India.
4. Structural Analysis by D.S. Prakash Rao, A Unified Approach, University Press.
5. Intermediate Structural Analysis by C.K. Wang, Mc Graw Hill Publications.



## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Transportation Engineering CT430</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the students to different modes of public transportation - Highways, Railways and Airways.
- To introduce the students to the basic design components of Highways, Railways and Airways.

### Course Outcome:

At the end of the course, the student has the ability to

- Analyze various modes of transportation and their characteristics (CO1).
- Classify the components in Highway and the design parameters (CO2).
- Analyze various components in Railway and the design parameter (CO3).
- Analyze components of Airport and the design parameters (CO4).

### 1. INTRODUCTION

Importance of Transportation – Different modes of transportation, characteristics and comparison of different modes.

### 2. HIGHWAYS

Road Types and classification – Road Planning concepts and principles – Present scenario of road development in India –Road Alignment: Factors affecting alignment, engineering surveys for new and realignment projects – Highway Geometric Design: Primary Functions, design concepts and principles – Pavements: Types of pavements, Components of pavements and Design factors – Properties and requirements of Pavement Materials – Specifications and Construction of Bituminous and Concrete roads.

### 3. RAILWAYS

Railways for Urban Transportation – LRT & MRTS – Obligatory points, Conventional and Modern methods – Permanent Way: its Components and their Functions – Rails: Types of Rails, Concept of Gauges, Sleepers: Functions, Materials, Density – Ballast: Functions, Materials, Ballast less Tracks – Geometric Elements of Railway track: Primary Functions, design concepts and principles. Working Principles of: Points and Crossings, Turnouts, Signaling, Interlocking and Track Circuiting – Construction & Maintenance: Lay outs of Railway Stations and Yards, Rolling Stock, Level Crossings.

### 4. AIR TRANSPORT

Components of Airports - Airport Planning – Site Selection – Runway Design: Orientation, Cross wind Component, Wind rose Diagram, Corrections for Gradients – Taxiway: Geometric Elements, Minimum Separation Distances, Design Speed.

**Self-Learning:**

- Exit Taxiway design and significance

**Text Books:**

1. Khanna S K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee.
2. Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi.
3. Khanna S K, Arora M G and Jain S S, Airport Planning and Design, Nemchand and Brothers, Roorkee.

**References:**

1. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi
2. Rangwala, Railway Engineering, Charotar Publishing House.
3. Rangwala, Airport Engineering, Charotar Publishing House.
4. Relevant BIS and IRC codes

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Irrigation Engineering and Hydraulic Structures CT440</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objective:

- To prepare the students to deal with the behavior of the fluids at rest as well as in motion and also to know about Physical and Stability aspects of some well-established hydraulic Structures.

### Course Outcome:

At the end of the course, the student has the ability to

- Analyze pipe flow problems and design the pipe dimensions for the given flow (CO1).
- Analyze open channel flow and design open channels and to do dimensional analysis of fluid flow problems (CO2).
- Interpret the terms related to Irrigation engineering, Water requirement of crop and Reservoir (CO3).
- Use stability analysis for Gravity dams, Earthen dams, Spillways, Energy Dissipaters, Intakes and Outlet Works (CO4).
- Prioritize the use of Canal Regulators, Cross Drainage Works and Diversion Works (CO5).

### 1. FLOW THROUGH PIPES

Laminar and turbulent flow discussions- Reynolds' number, Definition of hydraulic and energy gradients, Major and minor losses in pipe flow, Head loss due to friction (Darcy-Weishbach equation – no derivation), Pipes in series and parallel, equivalent pipe, Numerical problems.

### 2. FLOW IN OPEN CHANNELS

Difference between pipe & open channel flows, Geometric properties of open channels, Chezy's and Manning's formulae, Most economical rectangular, trapezoidal & circular channel sections (no derivations), Critical flow in rectangular channels, Hydraulic jump and Venturi flume (no derivations), Numerical problems.

### 3. DIMENSIONAL ANALYSIS

Dimensional homogeneity, Rayleigh's and Buckingham's theorem.

### 4. INTRODUCTION TO IRRIGATION

Introduction, Necessity, Advantages and disadvantages of irrigation, Classification, Methods of irrigation, Soil – water - crop and their relationship, Frequency of irrigation.

### 5. WATER REQUIREMENT OF CROP – Water Requirement of Crop, Optimum use of water, Factors affecting water requirement of a crop, Duty, Delta and base period and their relationship, Consumptive use, irrigation efficiency

## **6. RESERVOIRS**

Definitions, Types: storage reservoirs, flood control reservoirs, detention basins and retarding reservoirs, distribution reservoirs, multipurpose reservoirs, capacity reservoirs.

## **7. GRAVITY DAMS**

Definition. Forces acting on a Gravity dam, design criteria, Elementary and practical profiles, Low and high gravity dams, types of failure, foundation treatment (No designs).

## **8. EARTHEN DAMS**

Types of earthen dams, design criteria, types of failure.

## **9. SPILLWAYS, ENERGY DISSIPATORS, RIVER INTAKES, OUTLET WORKS**

Definition, Types of spillway – main spillway & emergency spillways, controlled & uncontrolled spillways, straight drop & ogee spillways, chute spillway, River intakes; Outlet works (No designs).

## **10. CANAL REGULATION, CROSS DRAINAGE WORKS and DIVERSION WORK**

Canal regulation, canal regulation works – distributor head and cross regulators (No designs). Cross drainage works, aqueduct, difference between a weir and a barrage, gravity and non-gravity weirs, layout of diversion head works, diversion weir, types of weirs

### **Self-Learning:**

- Importance of Drainage galleries of gravity dams and Drainage arrangements of earthen dams.

### **Text Books:**

1. Fluid Mechanics and Hydraulic Machines by Dr. R.K. Bansal, Lakshmi Publications, New Delhi.
2. Irrigation, Water Resources and Water Power Engineering – Modi P. N. Standard books house New Delhi.
3. Irrigation, Engineering and Hydraulic. Structures – S.K. Garg, Khanna publications, New Delhi

### **References:**

1. Irrigation and Water power engineering – Punmia and Pandey La! Lakshmi Publications, New Delhi.
2. Fluid Mechanics, Hydraulic and Hydraulics by K.R. Arora, Standard Book House, New Delhi.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Concrete Technology CT450</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the students to concrete and its materials used for concrete.
- To introduce the students to properties of fresh and hardened concrete.
- To introduce the students to mix design of concrete and testing of concrete.

### Course Outcome:

At the end of the course, the student has the ability to

- Interpret the properties of ingredients required for concrete (CO1).
- Analyze the fresh properties of concrete (CO2).
- Analyze the Harden properties of concrete (CO3).
- Design the concrete for the required engineering properties (CO4).
- Evaluate the properties of concrete using NDT Instruments (CO5).

### 1. CONCRETE INGREDIENTS

Cement- chemical composition, manufacture of cement, hydration of cement, types of cement. Testing of cement, Fine aggregate- grading analysis, specific gravity, bulking, moisture content, deleterious materials, Coarse aggregate- Importance of size, shape and texture. Grading of aggregates. Fineness modulus. Water- qualities of water, Admixtures – chemical admixtures- Plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures- Fly ash, silica fumes and rice husk ash

### 2. FRESH CONCRETE

Workability – factors affecting workability, Measurement of workability – slump, compaction factor, vee -bee and flow tests, Segregation and bleeding, Process of manufacturing of concrete – Batching, Mixing, transporting, Placing and compaction, Curing – methods of curing- Water curing, membrane curing, steam curing. Accelerated curing.

### 3. HARDENED CONCRETE

Factors affecting strength, w/c ratio, gel-space ratio. Maturity concept, Effect of aggregate properties, Relations between compressive strength, tensile strength and bond strength and modulus of rupture, Elasticity – Relation between modulus of elasticity and strength, Factors affecting modulus of elasticity, Poison's ratio, Creep – measurement of creep, factors affecting creep, effect of creep, Shrinkage of concrete- plastic shrinkage and drying shrinkage, factors affecting shrinkage, moisture movement, Durability – definition and significance of durability. Permeability, Sulphate attack, chloride attack, carbonation, freezing and thawing.

### 4. CONCRETE MIX DESIGN

Concept of Mix design, Variables in proportioning and exposure conditions, Procedure of mix design as per IS 10262-2009, Numerical examples of Mix design.

## **5. NON DESTRUCTIVE TESTING OF CONCRETE**

Penetration and pull out tests, rebound hammer test, ultrasonic pulse velocity – Principles, applications and limitations.

### **Self-Learning:**

- Analysis and design of high strength concrete using binary cementitious materials.

### **Text Books:**

1. M.S. Shetty, Concrete technology by Theory and practice. Published by S. Chand and company, New Delhi.

### **References:**

1. Concrete Technology by Neville A.M and Brooks J.J, ECBS edition.
2. Concrete Technology by Gambhir M.L., Dhanpat Rai & Sons, New Delhi.
3. Concrete Mix Design by N. Krishna Raju, Sehgal Publishers.
4. Concrete Manual by Gambhir M.L., Dhanpat Rai & Sons, New Delhi.
5. IS: 10262 – Recommended guidelines for concrete mix design – BIS Publication.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Computer Applications in Drafting and Spreadsheet CT46L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0:1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- To understand the fundamentals of computer drafting.
- To understand and practice the drafting and detailing of different building components using various tools of AUTO CADD, MS EXCEL.

### Course Outcome :

At the end of the course, the student has the ability to

- Use various tools of AUTO CAD in drafting. (CO1)
- Draft the simple building components. (CO2)
- Use various basic tools of Spreadsheet. (CO3)

### 1. INTRODUCTION TO DRAFTING

Drawing tools: Lines, Circle, Arc, Polyline, Multiline, Polygon, Rectangle, Spline, Ellipse-Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet-Using Text : Single line text, Multiline text, Spelling, Edit text-Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, working with multiple drawings.

### 2. SKETCHING AND DRAFTING OF SIMPLE BUILDING COMPONENTS

Foundation: Size stone masonry, isolated concrete footing, Lintel and chejja details, Doors and Windows.

### 3. USE OF ELECTRONIC SPREAD SHEET

Introduction to electronic spread sheets and their usage in engineering problem solving. Identify and describe the purpose and function of the extensive features of electronic spread sheet program. Working with electronic spreadsheet for – Creating, saving, retrieving, formatting, editing, and printing worksheets – Simple calculations and creating formulas – Charting and Graphing – Performing What-If Analysis – Naming cells and ranges – Array Formulae, matrix manipulations – Working with Tables – Lookup tables – Conditional Formatting, Data Validation – Statistical Analysis-Application of electronic spreadsheet for solving Engineering problems like analysis, design, estimation, etc.

### References:

1. Introduction to Autocad-2010 by Alf Yarwood, Elsevier Publishers, New Delhi.
2. User Manual of AutoCAD from Autodesk.
3. Microsoft Office Excel Manual, Microsoft Corporation.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Construction Materials Testing Laboratory CT47L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0:1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- To facilitate the students to develop their intellectual skills to conduct the tests as per the standards.
- To provide the students hands on experience in the testing of cement, aggregates and concrete both in plastic and hardened states.
- To train the students to analyze the testing data obtained from the laboratory to conform I.S. standards.

### Course Outcome:

At the end of the course, the student has the ability to

- Test concrete and its ingredients using relevant I.S. codes (CO1).
- Analyze the test results rationally and to certify the materials (CO2).

### 1. TESTS ON BRICKS AND TILES

### 2. TESTS ON CEMENT

Normal consistency, setting time, Soundness by Le chatelier's method, Soundness by autoclave method, Compression strength test, Fineness by sieving, Fineness by Blaine's air permeability method, Specific gravity of cement and cementations materials.

### 3. TESTS ON AGGREGATES

Specific Gravity test, Water absorption test, rodded density test, Angularity number, Determination of voids by density approach.

### 4. TESTS ON FRESH CONCRETE

Slump test, Compaction factor test, Vee Bee test, Flow test.

### 5. HARDENED CONCRETE

Compressive strength test using cubes and cylinder for medium and high strength concrete, Split tensile strength test using cylinders and cubes, Flexural strength test, Use of accelerated curing tank, Fatigue test.

### 6. CONCRETE MIX DESIGN

A study on concrete mix design as per IS: 10262-2009 for medium strength and high strength concrete with and without admixtures.

### 7. BITUMINOUS MATERIALS AND MIXES

Specific Gravity, Penetration, Ductility, Softening point, Flash and fire point, Viscosity and Solubility tests; Marshall Stability test and Mix design procedure.



## **8. NDT INSTRUMENTS**

Introduction to Non-destructive Testing, Codal Provisions, Use of rebound hammer, UPV tester, Profometer, Resistivity meter, Corrosion meter, Core cutter. To establish relation between rebound number and UPV for 3 different grades of concrete cast for nominal mix proportion.

### **Text Books:**

1. Concrete Technology by M.S. Shetty, Nem Chand and Brothers, New Delhi.
2. Concrete Manual by M.L. Gambir, Dhanpath Rai and Sons, New Delhi.
3. Relevant BIS codes on Cement, Concrete and Aggregates.

### **References:**

1. Properties of Concrete by A.M. Neville, Longmans, 4<sup>th</sup> Edition, 1995
2. Concrete – Structure, Properties and Materials by P. Kumar Mehta, Prentice Hall, New Jersey, USA 2002.
3. SP: 23 Explanatory Hand Book for Concrete Mix Design, BIS, New Delhi.
4. IS: 10262 – Recommended guidelines for concrete mix design – BIS Publication.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Environmental Studies HU410</b>
<b>No. of Teaching Hours – 2h/week</b>	<b>Credits 0:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- Understand the basic concepts of earth's spheres, ecosystem and food chain
- Know the different types of pollution sources and their impacts on the environmental compartments such as water, air, land and ecosystems
- Appreciate and understand the importance of various cycles of elements
- Assess the energy requirements, different forms of energy. Conventional and alternative energy sources
- Get a feel of current environmental issues of concern such as urbanization, population, climate change, ozone layer depletion etc.,
- Know the role of individuals and other related agencies including governmental organizations involved in Environmental Protection and Pollution Control

### Course Outcome:

At the end of the course, the student has the ability to

- At the end of the course, students will have gained complete fundamental concepts of Environmental pollution sources, their impacts, control measures and preventive actions. The course also reinforces the concepts of role of individuals, NGOs and Governmental organizations, legal frame work, Acts, Regulations and Rules pertaining to Environmental Protection and Conservation (CO1).
1. Environment, spheres of earth (lithosphere, hydrosphere, atmosphere, biosphere); Ecosystem-Balanced ecosystem, Biome, food chain and food web.
  2. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Environmental Impact Assessment (EIA), Sustainable Development
  3. Natural resources - Water resources-Availability and quality aspects. Water borne diseases, water induced diseases, Fluoride problems in drinking water. Mineral Resources; Forest Resources,
  4. Biogeochemical Cycles - Carbon, Nitrogen, Phosphorus and Sulphur Cycles.
  5. Energy- Different types of energy, Electro-magnetic radiation. Conventional energy sources.
  6. Non-conventional sources-hydro electric fossil fuel based, nuclear, solar, biomass and biogas.
  7. Hydrogen as an alternative future source of energy, Environmental pollution and their effects. Water pollution, land pollution, noise pollution, public health aspects

8. Current Environmental issues of importance: population growth; climate change; global warming- effects, urbanisation, automobile pollution; acid rain, ozone layer depletion, animal husbandry
9. Environmental protection- role of government, legal aspects, initiatives by non-governmental organization, environmental education, women education.

**Text Books:**

1. Benny Joseph, (2009), “Environmental Studies”, Second Edition, Tata McGraw Hill Publishing Company, New Delhi.
2. Ranjit Daniels R.J., and Jagadish Krishnaswamy, (2009), “Environmental Studies”, Wiley India Pvt. Ltd., New Delhi.

**References:**

1. Tyler Miller Jr. G, (2006), “Environmental Science – Working with the Earth”, Eleventh India Edition, Thomson Brooks / Cole
2. Tyler Miller Jr. G., (2005), “Living in the Environment – Principles, Connections and Solutions” (2005), Thomson Brooks / Cole
3. Rajagopalan R, (2005), “Environmental Studies – From Crisis to Cure”, Oxford University Press
4. Raman Sivakumar (2005), “Principles of Environmental Science and Engineering”, Second Edition, Thomson Learning, Singapore
5. Meenakshi P, (2006), “Elements of Environmental Science and Engineering”, Eastern Economy Edition, Prentice Hall of India Private Ltd., New Delhi.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Building Services CT510</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To incorporate the knowledge of building services provided for various types of buildings.
- To introduce the engineering concepts, design procedures, practical applications and related codes and regulations of the plumbing and drainage, electrical services, lighting, lifts, escalators and security systems.
- To introduce the fundamental principles, engineering concepts, design procedures, practical applications and related codes/standards of HVAC and other services systems.
- To introduce the concept of Intelligent buildings, IEQ & Energy management.

### Course Outcomes:

At the end of the course, the student has the ability to

- Explain the engineering concepts and design methods of plumbing, drainage and electrical services systems (CO1).
- Explain the fundamental principles and design concepts of Thermal comfort, HVAC, acoustics and communication systems (CO2).
- Explain the engineering concepts of lifts & escalators systems (CO3).
- Have an understanding of the concepts of intelligent building (CO4).
- Have an understanding of the importance of indoor environmental quality & energy management in buildings (CO5).

### 1. WATER SUPPLY AND DRAINAGE SYSTEMS IN BUILDINGS

Water Supply Introduction, Distribution System, Service Connection, Water Supply Appurtenances, Types of Pipes, Types of Pipe Fittings, Storage Tank, Systems of drainage, Drainage appurtenances, Solid waste disposal from buildings.

### 2. ELECTRICAL WIRING & ILLUMINATION OF BUILDINGS

Systems of Wiring-domestic and commercial buildings, Over ground and underground services, Laws & Principles of Illumination, Artificial, Day & Flood Lighting, Introduction to various types of Lamps.

### 3. THERMAL COMFORTS IN BUILDING AND AIR CONDITIONING OF BUILDINGS

Thermal comfort Introduction, Factors affecting heat transfer through buildings, Thermal properties of building materials, Insulation materials for buildings, Air conditioning systems, types, Air conditioning design, installation and maintenance cost.

#### **4. ACOUSTICS AND COMMUNICATION SYSTEM**

Definition of Terminologies, Acoustic materials-properties, Behavior of sound in Enclosures, Characteristics of audible sound, Design of Assembly halls, Design of Assembly music studio, Noise control in buildings, Vertical Barrier for sound insulation, Horizontal barrier for sound insulation, Terminologies and Systems of communication.

#### **5. ELEVATORS AND ESCALATORS**

Types of Elevators, Working Principle, Principles of Design; Types of Escalators, Working Principle, Principles of Design

#### **6. CONTEMPORARY BUILDING SERVICES**

Intelligent Buildings: Concept & use; Sensors – working & application in – HVAC, Fire protection systems, security & safety systems & general energy efficiency. Building management / automation systems: principles, working & integration in building design, IBMS; Reticulated Gas Systems. IT Services: Communication systems, CCTV, Wireless systems; digital systems.

#### **7. INDOOR ENVIRONMENTAL QUALITY (IEQ) ANALYSIS AND STRATEGIES**

IEQ issues and problems to include Sick Building Syndrome (SBS) and Building Related Illness (BRI), IEQ factors, managing IEQ during construction, become familiar with the LEED-NC 2009 category of IEQ.

#### **8. ENERGY MANAGEMENT**

Carbon and energy audit: Carbon footprint; scopes of emission & removal; codes and standards.

Economic analysis: Payback period; life cycle costing.

#### **Self Learning :**

- Visit to residences/ apartments, Sewage treatment plant, hospital, hotel, office and institutions. Documentation and Analysis of building-services systems.
- Standards related to building-services systems- NBC 2005.
- Lighting Design: Lighting simulation and performance analysis using lighting software – Autodesk Ecotect Analysis, Dialux or Lite Pro.
- Study of Solar Hot Water Generation for a small residence.
- Types of Electrical-Substations.

#### **Text Books:**

1. Rangwala, “Water supply and sanitary engineering”.
2. S.K.Kandaswamy(Ed), “Acoustics and noise control-theory, design”, practice-allied publishers.
3. Mc Gainess and stein, John Wiley and Sons(1977), “Mechanical and electrical systems”.
4. B.C.Punmia, “Building construction”, Laxmi Publications.
5. Bran David, “Architectural Lighting”.
6. O.H.Koenigsberger and others, “Manual of Tropical Housing and Building-Part-I-Climatic Design”, Longmans, London,1980.
7. "Indoor Air Quality & Control", by A.L Hines, T.K. Gosh, S.K. Loyalka and R.C.Warder, Jr., PTR Prentice Hall (1993).

8. "Indoor Air Pollution - Characterization, Prediction, and Control", by Richard A. Wadden, and Peter A. Scheff, John Wiley & Sons (1983).

**References:**

1. ISSP35: Hand Book on water supply and drainage.
2. IS SP41 and SP32-hand book on functional requirements of buildings
3. Acenteen and Cowan, "Architectural acoustic design guide", Book Base Member.
4. Eastop, "Mechanical Services for Buildings", Longman Publications.
5. Chadderton D.V. (1991) Building Services Engineering, E. & F.N. Spon
6. Hassan G. (1996) Building Services, Macmillan
7. Hall F. (1988) Essential Building Services & Equipment, Newnes
8. Atkin B. (1993) Intelligent Buildings: Application of IT and Building Automation to High Technology Construction Projects, Unicom Seminars, England.
9. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Company Limited.
10. Green Building Construction, Commissioning, Economics, and Future Green Buildings.
11. Uppal S. L.: Electrical Wiring, Estimating and Costing, Khanna Publishers, 2013.
12. Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs) by Reinhold A. Carlson, Robert A. Di Giandomenico.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Design of RC Structures CT520</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the basic concepts of reinforced concrete design and compare different philosophy of design.
- To introduce the basic principles of mechanics as applied to the analysis and design of reinforced concrete elements.
- To introduce the design procedure for RC elements according to IS: 456-2000 with limit state format.
- To develop skills regarding detailing and drafting of various RC structural elements as per codes of practices.

### Course Outcome:

At the end of the course, the student has the ability to

- Analyse RC elements for stresses and serviceability conditions (CO1).
- Design RC Beams to meet desired needs as per Indian Standards (CO2).
- Design RC Slabs to meet desired needs as per Indian Standards (CO3).
- Design RC Columns and Footings to meet desired needs as per Indian Standards (CO4).
- Draw detailing for various elements as per Indian Standards (CO5).

### 1. GENERAL FEATURES OF REINFORCED CONCRETE

Introduction, Materials for Reinforced Concrete and Code requirements, Loads and their types, Design Philosophy of Working stress method, Ultimate load method and Limit State Method.

### 2. PRINCIPLES OF LIMIT STATE DESIGN AND ULTIMATE STRENGTH OF R.C. SECTION

Philosophy of limit state design, Principles of limit states, Factor of Safety, Characteristic and design loads, Characteristic and design strength, General aspects of Ultimate strength, Stress block parameters for limit state of collapse Ultimate flexural strength of singly reinforced rectangular sections, Ultimate flexural strength of doubly reinforced rectangular sections, Ultimate flexural strength of flanged sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage, Analysis examples of singly reinforced, doubly reinforced, flanged sections, shear strength and development length.

### 3. SERVICEABILITY LIMIT STATES

General aspects, Deflection limits in IS: 456 – 2000 for beams and slabs, modification factors, Cracking in structural concrete members, Calculation of deflections and crack width, Durability requirements as per IS: 456-2000.

#### **4. DESIGN OF BEAMS**

Practical requirements, Size of beam, Cover to reinforcement, spacing of bars, Design procedures for critical sections for moments and shears, Anchorages of bars, check for development length, Reinforcement requirements, Design examples for Simply supported and Cantilever beams for rectangular and flanged sections. Detailing requirements and drawing.

#### **5. DESIGN OF SLABS**

General consideration of design of slabs, Rectangular slabs spanning one direction, Rectangular slabs spanning in two directions for various boundary conditions. Design of simply supported, cantilever and one way continuous slabs and two way slabs as per IS: 456 – 2000. Detailing requirements and drawing

#### **6. DESIGN OF COLUMNS**

General aspects, effective length of column, loads on columns, slenderness ratio for columns, minimum eccentricity, design of short axially loaded columns, design of column subject to combined axial load and uniaxial moment and biaxial moment using SP – 16. Detailing requirements and drawing.

#### **7. DESIGN OF FOOTINGS**

Introduction, Types of footings, Design of isolated square and rectangular footings for axial load, axial load and uniaxial moment, Detailing requirements and drawing.

#### **Self Learning:**

- Types of footing and their details.

#### **Text Books:**

1. Limit State Design of Reinforced Concrete by P. C. Varghese, Prentice-Hall of India Private Limited, New Delhi, India
2. Limit State Method of Design by A.K. Jain, Nem Chand and Bros., Roorkee, India

#### **Reference:**

1. Reinforced Concrete by Park & Paulay, John Wiley & Bros, New York, USA
2. Limit State Design of Reinforced Concrete by B.C. Punmia, Ashok Kumar Jain & Arun kumar Jain, Laxmi Publication, New Delhi, India.
3. BIS codes namely IS: 456:2000, IS:875-1987, SP-16, SP-23 and SP-34



## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Construction Equipments CT530</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### **Course Objective:**

To study the importance, operations and understand the various types of equipments used for

- Earthwork,
- Tunneling,
- Drilling, blasting,
- Dewatering, material handling conveyors and its applications in construction projects.

### **Course Outcome :**

At the end of the course, the student has the ability to

- Costs involved in various construction equipments (CO1).
- Equipments for earthwork activities (CO2).
- Equipments for deep excavations (CO3).
- Equipments for producing aggregate and concrete (CO4).

### **1. INTRODUCTION**

Identification, Construction Economy, Construction Planning, Importance of Planning, Lack of Planning, Types of Planning, Equipment Management in Projects, Classification of equipments, Selection of construction equipments, equipment cost and operating cost, Economic life of equipment, cost control of equipment, Depreciation Analysis, replacement of equipment and replacement analysis.

### **2. EQUIPMENTS FOR EARTHWORK**

Fundamentals of earthwork operations, basic parts, types of equipments such as Tractors, Scrapers, Motor Graders, Power Shovel, Dragline, Clamshells, Hoe, Bull dozer.

### **3. EQUIPMENTS FOR DEEP EXCAVATIONS**

Classification, construction and operations for compaction, Dredging, grouting, Trenching, Hauling and Pile driving Dewatering Tunneling Drilling- Blasting Explosives-Transporting, Handling and storing of explosives.

### **4. EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETE**

Crushers, Screening, Hauling, Pouring equipment, batching and mixing equipment, handling equipment Pumping equipment

### **Self Learning :**

- Hauling and Pile driving equipments.
- Heavy lifting equipments.
- Equipments used in highway.

**Text Books:**

1. Construction, Planning and Equipment by B. Satyanarayana and S.C. Saxena, Standard Publishers, New Delhi-1985
2. Construction, Planning Equipment and Methods by Robert.L. Peurifoy, I.L., Ledbetter, W.B. and Schexnayder, C., 5<sup>th</sup> edition, Mc Graw Hill, Singapore, 1996.

**References:**

1. Construction Equipment and Management by Sharma S.C., Khanna Publishers, New Delhi,1988
2. Construction Equipment and job Planning by Deodhar, S.V., Khanna Publishers, New Delhi,1988
3. Construction Equipment and its planning and Application by Mahesh Varma,, Metropolita Book Company, New Delhi, 1983.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Geotechnical Engineering CT540</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objective:

- To introduce about the basics of geotechnical engineering.
- To teach classification methods, laboratory determination of index properties, strength parameters, compaction characteristics, consolidation characteristics etc.,
- To develop confidence in evaluating the engineering properties of soil.

### Course Outcome:

At the end of the course, the student has the ability to

- Perform fundamental calculations and analyses including weight-volume relationships and soil classification. Understand influence of soil structure and mineralogy on soil behavior (CO1).
- Perform basic laboratory tests on soils including sieve analysis, Atterberg limits, compaction, direct shear, triaxial shear and consolidation. Be able to perform the basic calculations associated with laboratory tests on soils (CO2).
- Understand basic principles of flow through porous media including Darcy's law, the equation of continuity, seepage forces and flow nets (CO3).
- Understand compaction & basic consolidation theory. Compute the amount of settlement and the time required for settlement under a given load (CO4).
- Understand shear strength principles including Mohr-Coloumb failure criterion. Perform basic calculations related to shear strength analysis (CO5).

### 1. INTRODUCTION

History of soil mechanics. Origin and formation of soil. Phase Diagram; Basic definitions - Void ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their inter relationships.

### 2. INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION

Index Properties of soils: Particle size distribution, Consistency limits and indices, in-situ density, density index, swell potential and their laboratory determination procedures; Activity of Clays.

### 3. CLASSIFICATION OF SOILS

Purpose of soil classification; plasticity chart and its uses, MIT, Unified and Indian soil classification systems; Field identification of soils.

#### **4. CLAY MINERALOGY AND SOIL STRUCTURE**

Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Electrical diffuse double layer, adsorbed water. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

#### **5. FLOW OF WATER THROUGH SOILS**

Darcy's law-assumption and validity; seepage velocity, superficial velocity, coefficients of permeability and coefficients of percolation; Determination of coefficient of permeability (laboratory and field methods), factors affecting permeability, permeability of stratified soils; Effective stress concept-total stress, pore water pressure and effective stress, effective stress equation; Capillarity in soils; Quick sand phenomenon.

#### **6. COMPACTION OF SOILS**

Definitions, Principle of compaction, Standard and Modified Proctor's compaction tests and their Indian Standard versions, factors affecting compaction, effect of compaction on soil properties, Field compaction methods and equipments: Shallow depth and deep compactions; Field compaction control; Specification of compaction requirements.

#### **7. COMPRESSIBILITY OF SOILS**

Definition, Mass-spring analogy; Normally consolidated, under consolidated and over consolidated soils; pre-consolidation stress and its determination by Casagrande and log – log methods; Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), Laboratory one dimensional consolidation test, Determination of consolidation characteristics of soils-Compression index, and coefficient of consolidation, determination of coefficient of consolidation by square root of time fitting method, logarithm of time fitting method, rectangular hyperbola method and one point method;

#### **8. SHEAR STRENGTH OF SOILS**

Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelopes, Total and effective shear strength parameters, factors affecting shear strength of soils, Sensitivity and Thixotropy of clay. Determination of shear parameters- Direct shear test, unconfined compression test, Triaxial compression test and vane shear test, Test under different drainage conditions.

#### **Self Learning :**

- Determination of coefficient of consolidation by rectangular hyperbole method and one point method.

#### **Text Books:**

1. Punmia B. C. (2005) Soil Mechanics and Foundation Engineering, 16th Edition, Laxmi Publishing Co., New Delhi.
2. Murthy. V. N. S. (1996) Soil Mechanics and Foundation Engineering, 4th Edition, UBS Publishers and Distributors, New Delhi.

**References:**

1. Bowles. J. E. (1996) Foundation Analysis and Design, 5<sup>th</sup> Edition, McGraw Hill Publishing Co., New York.
2. Gopal Ranjan and Rao A. S. R. (2000) Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
3. Venkataramaiah. C. (2006) Geotechnical Engineering, 3<sup>rd</sup> Edition, New Age International Pvt. Ltd., New Delhi.
4. Craig. R. F.. (1987) Soil Mechanics, Van Nostrand Reinhold Co. Ltd.
5. Braja M Das (2002) Principles of Geotechnical Engineering, 5<sup>th</sup> Edition, Thomson Business Information India (P) Ltd., India
6. Alam Singh and Chowdhary G R (1994) Soil Engineering in Theory and Practice, CBS Publishers and Distributors Ltd, New Delhi
7. Wintercorn. (1991) Foundation Engineering Handbook. 2nd ed. Van Nostrand Reinhold Company

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Project Management Systems CT550</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objective:

- To understand the project phases, processes and common attributes of construction project.
- To understand project management techniques for planning, scheduling and controlling of construction project.
- To be conversant with Cost-Time relationship of a project.
- To understand concept of resource allocation, resource leveling and resource smoothing.

### Course Outcomes:

At the end of the course, the student has the ability to

- Have the knowledge of project phases, WBS and common attributes of construction project (CO1).
- Construct the network diagram, identify the critical path and calculate project duration, floats using different project network techniques (CO2).
- Understand time & cost relationship and earned value of the project (CO3).
- Allocate resource, leveling and smoothing of resource (CO4).

### 1. CONSTRUCTION PROJECTS & PROJECT PHASES

Project management, characteristics feature of a project, common attributes of a project, development of construction project – various phases and processers, WBS, defining work tasks – defining precedence relationships among activities – estimating activity durations and resources requirement.

### 2. SCHEDULING PROCEDURES AND TECHNIQUES

Introduction, scheduling using net work analysis- introduction, terms and definitions, types of networks, rules for drawing network, Fulkerson’s rule for numbering the event, related problems.

PERT network- introduction, time estimates, terms and definition, calculation of slack, probability of completion time for a project, related problems.

CPM network (A-O-A network)-introduction, differences between CPM and PERT, terms and definition, calculation of floats, related problems.

Precedence net work (A-O-N network)- logic and control of precedence diagrams, advantages, drawing a-o-n network from a-o-a network and related problems.

### 3. NETWORK COMPRESSION AND TIME COST TRADE-OFF

Network compression, direct and indirect cost, step in optimization of cost, project cash flow, earned value management, related problem.

#### **4. ALLOCATION OF RESOURCES**

Resource scheduling, resource smoothing, resource leveling and related problem.

#### **Self Learning:**

- Analysis of project with respect to time and cost.
- Work break down structure of any construction project with their dependencies.

#### **Text Books:**

1. Project management – A systems approach to planning, scheduling and controlling by Harold. K, John Wiley & Sons, New Jersey.
2. Construction Project Management – Planning, Scheduling and Controlling by Chitkara K.K., Tata McGraw Hill, New Delhi, 2000.
3. A Management Guide to PERT/CPM by Jerome D. and Ferdinand K., Prentice-Hall of India, New Delhi.
4. Scheduling Construction Projects Principles and Practices by Weber S, Prentice-Hall of India, New Delhi.

#### **References:**

1. Project Management by Ahuja H.N., John Wiley, New York, 1999.
2. Critical Path Methods in Construction Practice by Antil J.M. and Woodhead R.W., John Wiley, Canada, 1999.
3. Project Management in Construction by Levy Sidney, McGraw Hill Professional, New York, 2000.
4. CPM in Construction Management by O'Brien James, McGraw Hill, New York, 1999.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Building Planning, Types and Standards CT560</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objective:

- To create the knowledge of classifying different types of buildings as per the standards.
- To know the planning of different types of buildings considering various functional parameters.
- To prepare free hand sketches of various elements of different types of building.

### Course Outcome:

At the end of the course, the student has the ability to

- Understand the principle of planning of building (CO1).
- Understand the basic requirements of residential and industrial buildings (CO2).
- Understand the need and significance of educational and hospital buildings (CO3).
- Understand the various functional parameters required for commercial and government building (CO4).
- Understand the functional behavior of various recreation facilities (CO5).

### 1. INTRODUCTION

Types of buildings and its classification according to building bye - laws, Calculation of built up area and FAR, Selection of site for construction projects.

### 2. PRINCIPLES OF PLANNING

Favorable and unfavorable conditions, Main consideration for architectural design, Orientation of building, Factors affecting orientation, General principles of planning of buildings, concept of bubble diagram.

### 3. PLANNING OF RESIDENTIAL BUILDING

Planning of a residential building based on utility point of view, Functional and optional requirements of different rooms of a residential building- their arrangement, position and purpose, Classification of urban residential buildings.

### 4. PLANNING OF INDUSTRIAL BUILDINGS

Classification of industrial structures, Selection of site, Planning aspect of industrial structures, Functional requirements of big industrial units, Industrial town ship or estate, Establishment of industrial township considering various parameters

### 5. PLANNING OF EDUCATIONAL BUILDINGS

Governing criteria for planning of educational buildings, various factors to be considered during planning stage.



## **6. PLANNING OF HOSPITAL BUILDINGS**

Classification of hospital buildings, planning requirements for hospital building.

## **7. PLANNING OF COMMERCIAL BUILDINGS AND HOTELS**

Classification of commercial building, Planning requirements of commercial building, Different units of a hotel, Planning requirements of a hotel.

## **8. PLANNING OF GOVERNMENT OFFICE AND OTHER BUILDINGS**

Planning requirements for government office, municipal office, post office, bus station and library.

## **9. PLANNING OF RECREATIONAL FACILITIES**

Planning requirements of Auditorium, Sports complex, Swimming pool and Cinema theatre.

### **Self Learning:**

- Auditorium
- Sports Complex
- Swimming pool
- Cinema Theatre
- Gymnasium

### **Text Books:**

1. Building Planning, Designing and Scheduling by Gurucharan Singh and Jagadish Singh,
2. II Edition Standard Publishers Distribution, Delhi.
3. Building Planning and Drawing by G. M. Deshpande, Chaitanya offset printers, Gadag.

### **References:**

1. Time Saver Standards for Building Types by Joseph De Chiara and Michael. J. Crosbie, 4th Edition, McGraw- Hill international Edition.
2. Hospitals- Facilities Planning and Management by G.D.Kunders, Tata McGraw- Hill Publishing Company Ltd., Fifth Reprint, New Delhi.
3. National Building Code of India 1983 Group 4, Indian Standards Institution, New Delhi.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Building Services Laboratory CT57L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0: 1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- To familiarize the students with building science, related parameters and its application in buildings.
- To understand various equipment and their principles for the determination of functional efficiency of buildings.
- To determine the qualities of water.
- To determine basic calculations of heating and cooling load requirements of a room.

### Course Outcomes:

At the end of the course, the student has the ability to

- Understand the students with building science, related parameters and its application in buildings (CO1).
- Understand the various equipment and their principles for the determination of functional efficiency of buildings (CO2).
- Analyze the various parameters like pH & Hardness in water (CO3).
- Do basic calculations of heating and cooling load requirements of a room (CO4).

### **1. DEMONSTRATION OF ELECTRICAL, PLUMBING AND SANITARY MATERIALS**

### **2. TO DRAW WATER-SUPPLY AND SANITARY SERVICE LAYOUT TO RESIDENTIAL BUILDING**

Drawing, Supply Line, Estimation, Checklist - Water consumptions in Residential Buildings.

### **3. TO DRAW ELECTRICAL SERVICE CONNECTION TO A RESIDENTIAL BUILDING**

Drawing, Supply Line, Estimation, Checklist - Power Consumption in Residential Buildings.

### **4. TO DRAW FIRE-EVACUATION LAYOUT TO A RESIDENTIAL BUILDING**

Drawing, Supply Line, Estimation, Checklist

### **5. DESIGN OF RAINWATER HARVESTING SYSTEM FOR BUILDINGS**

Drawing, Supply Line, Design & Calculation, Checklist.

### **6. EXPERIMENT TO MEASURE QUALITIES OF WATER**

Determination of pH and Hardness in water.

## **7. EXPERIMENT TO MEASURE MOISTURE OF WOOD**

To measure the moisture of wood using wooden moisture meter.

To measure the moisture of wood using oven-dry method.

## **8. EXPERIMENT TO MEASURE INTENSITY OF LIGHT**

To measure the light intensity at various places in LUX [lumen] or candela using light-meter.

To investigate the relationship between light intensity (measured in lux) of a normal light source and the distance from the source (measured in centimetres).

## **9. EXPERIMENT TO MEASURE INTENSITY OF SOUND**

To measure the intensity of sound at various places using integrated sound-level meter.

## **10. BASIC CALCULATIONS OF HEATING AND COOLING LOAD REQUIREMENTS OF A ROOM & PAYBACK ANALYSIS.**

Centralized AC layout drawing has to be prepared for an office building showing all connections of units.

To calculate cooling load of a confined space using table and compare the same with load estimation sheet.

### **Self Learning :**

- Collect the Catalog of Plumbing, Electrical & Electronics Product Catalog.
- Calculating the water footprint of buildings.
- Establishing Energy Consumption Quota for Residential Buildings Using Regression Analysis and Energy Simulation.
- To Calculate the Type and Number of Ventilating Fan required for a building.

### **References:**

1. G.E.Baker, R.Miller, Miller's Guide to Home Plumbing, McGraw- Hill
2. Malaysian Standard MS 1402 : 1996 Code of practice for sanitary system in buildings, SIRIM, Shah Alam, Selangor, Malaysia, [1996]
3. Jenkins, B.D. (1991), Electrical Installation Calculations, Blackwell Scientific.
4. Angle, J., Gala, M., Harlow, D., Lombardo, W., & Maciuba, C. (2008), Fire Fighting Strategies and Tactics, (2nd Ed.). Albany, NY: Delmar Thomson Learning.
5. Jones, W.P. (1985), Air Conditioning Engineering, 3rd Ed., Edward Arnold (Publishers) Limited.
6. Frederick J.Trost & Ifte Choudhury (2004) Design of Mechanical & Electrical System Building.
7. "Standard Methods for the Examination of Water and Waste Water", American Public Health Association, APHA, 20th Edition, 1995.
8. Otto Koenigsberger et al., "Manual of Tropical Housing and Building", Orient Longman, India, 2003.
9. Martin Evans, "Housing, Climate and Comfort", Thames and Hudson, New York, 1984. 31
10. David Egen, "Architectural Acoustics", J Ross Publishers, Canada, 2008.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Geotechnical Engineering Laboratory CT58L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0: 1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- To facilitate the students to develop their intellectual and motor skills to conduct tests on soils.
- To provide the students of civil engineering, hands on experience in the testing of soils to obtain their basic, index and engineering properties.
- To train the students to analyse the data obtained from the laboratory testing of soils rationally to obtain soil properties required in the field geotechnical engineering practice.

### Course Outcomes:

At the end of the course, the student has the ability to

- Test the basic, index and engineering properties of soil, analyse the test data and to draw conclusions (CO1).
1. Determination of specific gravity of coarse grained and fine-grained soils.
  2. Determination of in situ density:
    - a. Core cutter method
    - b. Sand Replacement method
  3. Grain size analysis of soils: sieve analysis.
  4. Determination of Atterberg limits of fine-grained soils:
    - a. Determination of liquid limit
    - b. Determination of plastic limit
    - c. Determination of shrinkage limit and shrinkage factors
  5. Determination of compaction characteristics of soils:
    - a. Light compaction test
    - b. Heavy compaction test
  6. Determination of coefficient of permeability of soils:
    - a. Constant head permeability test
    - b. Variable head permeability test
  7. Determination of unconfined compressive strength of soils
  8. Determination of shear strength parameters of soils
    - a. Box shear test
    - b. Triaxial compression test (Unconsolidated, undrained condition)
  9. Determination of undrained shear strength of soil by vane shear test
  10. Determination of pre-consolidation pressure, compression index, coefficient of volume change and coefficient of consolidation by one dimensional consolidation test.
  11. Free-swell tests.
  12. Determination of relative density of sands.
  13. Demonstration of hydrometer test.

**References:**

1. Compendium of Indian Standards on Soil Engineering – SP36 (Part – I & Part – II): 1987, BIS, New Delhi.
2. Soil testing for Engineers by Lambe, T.W., Wiley Eastern Ltd., New Delhi.
3. Manual of Soil Laboratory Testing by Head, K.H., Vol. 1, 2 & 3, Princeton Press, London, 1986.  
Engineering Properties of Soil and their Measurements by Bowles, J.E., McGraw-Hill Book Co., New York, 1988

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Construction Quality and Safety Management CT610</b>
<b>No. of Teaching Hours –4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objective:

- To introduce the concept of Quality Management System in Construction.
- To be facilitate students with TQM, ISO certification procedures.
- To understand the Quality control in Construction Projects.
- To introduce the concept of benchmarking process in construction industry.
- To incorporate the knowledge of various causes, effects of accidents in construction.
- To acquire the knowledge of safety programmes and safety standards.

### Course Outcomes:

At the end of the course, the student has the ability to

- Understand Quality Management System and Quality control in Construction Projects (CO1).
- Understand total Quality Management and ISO certification and benchmarking process (CO2).
- Understand the various causes and effects of accidents, various safety measures to be adopted in construction (CO3).
- Understand the various aspects of safety programmes and safety standards (CO4).

### 1. QUALITY

Principles, Concepts in Quality Management, Managing for quality, Impact of Quality Management in Business and Commerce. Quality Control, Quality costs and its components, Features of Quality, Determinants of service Quality, Need for Quality management in industry.

### 2. TOTAL QUALITY MANAGEMENT

Meaning and Scope, TQM models, Benefits of TQM programme, causes for TQM failures, Remedial measures, Quality Manuals, System Procedures, Project Quality Plan and quality Assurance System as per ISO: 9000:2000, TQM Road Map, ISO:9000 for construction, Quality standards and Certification Procedures.

### 3. BENCH MARKING

Sources of Benchmarking, Process of Benchmarking, Step model for Benchmarking, Types of Benchmarking, Code of Conduct for Benchmarking, Internal and External Benchmarking, Advantages of Benchmarking.

### 4. QUALITY CONTROL IN CONSTRUCTION PROJECTS

QC in concreting, Brick work, stone masonry, Formwork, Foundations, Piling work, Structural work, Woodwork & Timber, Painting, Electrical system, Waste recovery and maintenance.

## **5. CONSTRUCTION ACCIDENTS AND SAFETY**

Accident- Causes, Effects and Safety measures, Legal requirements, Responsibility of the employers, Reporting occurrence of accidents, Reporting occurrence of hazards, Action to be taken by the Site-in-charge in case of accidents.

## **6. DESIGNING FOR SAFETY**

Safety clause in a typical contract document, Scheme for safety, Breach of safety regulations, General safety condition, Safety culture, Company activities and safety, Project co-ordination and safety procedures, Workers compensation.

## **7. SAFETY PROGRAMMES**

Safety standards: Safe working environment, Safety clauses in contract documents, Safety programme, Safety policy, Safety department, safety officers, safety records, safety training, standards for safety in construction, BIS standards, American National Standards.

### **Self Learning:**

- Statistical evaluation based on field tests.
- Quality system document reports in an ongoing construction projects.
- Preparation of control charts and sampling criteria for materials.
- Prepare life cycle costing for a construction project.
- Case based reasoning, case indexing, retrieval, accident prevention and forecasting using CBR method.
- Systems safety analysis, faulty tree analysis, failure modes and effects analysis in construction industry.

### **Text Books:**

1. Total Quality Management for Engineers by Mohammed Zairi, Aditya Books Pvt. Ltd., New Delhi. 1992.
2. Total Quality Management by B. Janakiraman and R.K. Goopal, Prentice-Hall of India Private Limited, New Delhi.
3. Construction Safety Management, NICMAR Publications, Hyderabad, October 2003.

### **References:**

1. The search for Industry Best Practices that led to superior performance by Robert (QMP) Bench Marking, American Society of Quality, 1995.
2. Quality in the Construction Project by Fox, Arthur J., and Holly A. Cornell, American Society of Civil Engineers, New York, Latest Edition.
3. Total Quality Management by Mohantray R.P. and Lakhe R.R., Jaico Publishing House, Mumbai, 2000.
4. Total Quality Management by Break Joseph and Susan Joseph, Excel Books, New Delhi, 1995.
5. Project Planning and Control with PERT and CPM by B.C. Punmia and K.K. Khandelwal, Lakshmi Publications Pvt. Ltd., New Delhi.
6. Quality Assurance in Construction 2nd Edition by Thorpe, Brian, Gower, Aldershort, 1996.
7. Jimmy W. Hinze, construction safety, Prentice hall Inc 1997

8. Richard.J.Coble, Jimmoe and Theoe Hampt, Construction safety and health management, Prentice Hall Inc 2001.
9. Kohli Udes, Chitkara KK. (2008), Project Management Handbook, Tata McGrawHill Publishing Company Limited, New Delhi.
10. Watson, P. and Howarth, T. (2011), Construction Quality Management: Principles and Practice, Taylor and Francis Group, 2011
11. Razzak Rumane, A. (2011), Quality Management in Construction Projects, CRC Press. MBA-Construction Project Management 58
12. Hinze, J.W. (1996), Construction Safety, Prentice Hall.
13. Rowlinson, S. (2004), Construction Safety Management Systems, Taylor and Francis.
14. Levitt, R.E. and Samelson, N.M. (1993), Construction Safety Management, Wiley
15. Howarth, T. and Watson, P. (2008), Construction Safety Management, Blackwell Publishing.
16. ISO 9001-2008 and ISO 14001-2004



## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Design of Steel Structures CT620</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the students to the basic philosophy of structural steel design.
- To introduce the students to detailing of steel structures.

### Course Outcomes:

At the end of the course, the student has the ability to

- Idealise and analyse components of steel structures subjected to loads as per Indian Standards (CO1).
- Analyze and design connections for various structural elements (CO2).
- Analyze and design tension members (CO3).
- Analyze and design built up members (CO4).
- Analyze and design of flexural members (CO5).

### 1. STRUCTURAL STEEL

Manufacture, Metallurgy, Engineering properties and characteristics, Types of sections, Rolling process – necessity and importance, Specifications, Advantages and disadvantages. Loads and loading standards, Assessment of wind load and earthquake loads, codes and formats.

### 2. DESIGN APPROACHES

Methods of design – working stress, LRFD and Limit state design, Fundamental concepts, Performance criteria, Comparison of methods.

### 3. CONNECTIONS

Bolted connections – Types of bolts, specifications, Strength, Pitch, Gauge and edge distances, Bolt value, Analysis and design of bolted connections subjected to direct and eccentric loadings. Welded connections – Types of welds, specifications, strength, continuous and intermittent welds, Design of welded connections subjected to direct and eccentric loadings.

### 4. DESIGN OF TENSION MEMBERS AND LUG ANGLES

### 5. DESIGN OF AXIALLY LOADED COMPRESSION MEMBERS

Built up and compound members –Lacing, Battening.

### 6. DESIGN OF BEAMS

Concept of lateral restraint, Section classification, Elastic and plastic sections modulus, Determination plastic section modulus of sections, Design of beams, Splices.

**Self Learning:**

- Design of Lacings in compression members.
- Design of splices.
- Design of connections subjected to eccentric loadings.

**Text Books:**

1. Design of Steel Structures by N. Subramanyam, Oxford University Press, New Delhi, 2008.
2. Design of Steel Structures by Duggal, Tata McGraw Hill, New Delhi, 2011.
3. Design of Steel Structures by Dayaratnam, Prentice Hall, New Delhi, 2011.

**References:**

1. Steel Design by Dowling, Knowles and Bowles, Bulterworth's, London, 1988.
2. Structural Steel Design – Limit State Method by Clark and Coverman, Oxford University Press, New Delhi.
3. 800-2007- General Construction in Steel – Code of Practice, (Third Revision).
4. 801 and relevant codes.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Construction Economics and Finance CT630</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To gain the knowledge of basic principles of economics, laws, supply and demand.
- To understand the concept of present worth, future worth, annual worth and payback period with more economic alternatives.
- Introduce the concept of benefit/cost, life cycle and break even analyses on one or more economic alternatives and depreciation.
- Acquire the knowledge of preparing account statement and understanding the method of financial Management to tackle common financial problems.

### Course Outcomes:

At the end of the course, the student has the ability to

- Differentiate several economic terms and apply economic laws for solving economic problems (CO1).
- Perform and evaluate present worth, future worth and annual worth analyses on one or more economic alternatives (CO2) .
- Evaluate payback period, rate of return on one or more economic alternatives, carry out and evaluate benefit/cost, life cycle and break even analyses on one or more economic alternatives (CO3).
- Calculate depreciations, valuation of buildings, understand the impact of inflation and to recognize the economic impact of engineering solutions (CO4) .
- Describe the basic concepts of book keeping, functions of accounting, financial management and to apply financial theory to tackle common financial problems in practice (CO5).

### 1. ENGINEERING ECONOMICS

Introduction, Definitions - Micro and Macro Economics, Goods, Utility, Value, Asset, Liability, Capital, Revenue, Income, Wealth & Welfare, Economic Laws – Basics of Supply & Demand, Various forms & functions of market, Role of engineering economy in decision making.

### 2. TIME VALUE OF MONEY

Nominal and effective value of interest, simple interest, compound interest , present worth comparison, Present worth equivalence, Annual worth analysis, comparison of deferred investments, future worth comparison, pay back comparison, problems on rate of return method, Benefit cost analysis and Break even analysis.

### 3. COST ESTIMATING

Cost Concept and Classification of Cost, Cost output relationship, Activity based costing; Cost estimation techniques – Cost indexes, Allocation of overheads, Problems.

#### **4. ECONOMIC VALUATION OF PROPERTIES**

Definition, Purpose, Cost-Price-Value, Different forms of value, Gross income, Net income, outgoing, Types of outgoing, Years purchase, Capital Cost, Capitalized value, Sinking fund – Depreciation - Methods of depreciation, Mortgage, lease, Fixation of rent on buildings, Problems.

#### **5. FUNDAMENTALS OF MANAGEMENT ACCOUNTING**

Basic Concepts, Definitions of Book keeping and Accounting, Objectives and Functions of Accounting, Types of Accounts, Rules for Debiting and Crediting, Journal, Ledger, Trial Balance.

#### **6. FINANCIAL MANAGEMENT**

Introduction, the financial goal of a firm, taxation and policies, Construction accounting, Chart of accounts, Financial statements, Balance sheet, Financial ratios, Working capital management, Working capital financing.

#### **Self-Learning:**

- The financial goal of a firm, taxation and policies, understanding financial statements, analyzing financial statements, profit planning and control, management of assets.

#### **Text Books:**

3. Banga & Sharma, “Industrial Organization & Engineering Economics”, Khanna Publishers, 2003.
4. Prasanna Chandra, “Projects - Planning Analysis Selection Implementation & Review ”, Fourth Edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 1995.

#### **References:**

1. James L. Riggs, David D. Bedworth, Sabah U. Randhawa, “Engineering Economics” Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 1996.
2. Tarachand, "Engineering Economics", Nemchand and Brothers. Roorkee, 2000.
3. Yogesh Maheshwari, "Managerial Economics", PHI Learning Pvt. Ltd. New Delhi, 2004.
4. Sengunthar, B and Guha, H. “Construction Management and Planning”, Tata MC Graw – Hill, 2002.
5. Kutchal H C, "Financial Management", Chaitanya publishing house, 2000.
6. Parker, D.E., “Value Engineering Theory”, Sundaram publishers, 1990.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Applied Geotechnical Engineering CT640</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the students to various geotechnical structures such as foundations, slope, retaining walls and deep excavations.
- To introduce the students to the geotechnical analysis and design of geotechnical structures
- To introduce the students the knowledge of SBC and settlement characteristics of soils.
- To introduce the students to the stresses in soils.

### Course Outcomes:

At the end of the course, the student has the ability to

- Determine the stresses in soils using various approaches (CO1).
- Draw phreatic lines in earth dams and flownets (CO2).
- Compute lateral earth pressure using different methods (CO3).
- Analyse the stability of earth slopes (CO4).
- Compute the bearing capacity of soils and determine foundation settlements (CO5).

### 1. STRESSES IN SOIL

Boussinesq's and Westergard's theories for concentrated, circular, rectangular, line and strip loads; Comparison of Boussinesq's and Westergard's analyses; Newmark's chart; Pressure distribution diagrams, Contact Pressure

### 2. FLOWNETS

Laplace equation for two dimensional flow(No derivation) – Assumptions and Limitations only; Characteristics and uses of flownets; Methods of drawing flownets for dams, wiers and sheet piles(Both isotropic and anisotropic soils); estimating quantity of seepage and exit gradient; Determination of phreatic line in earth dams with horizontal filter; numerical problems.

### 3. LATERAL EARTH PRESSURE

Active and Passive Earth Pressures, Earth Pressure at rest, Earth pressure coefficients; Earth pressure theories - Rankine's and Coulomb's – Assumptions and limitations; Graphical solutions for active earth pressure (Cohesionless soil only) – Culmann's and Rebhan's methods; Lateral earth pressure in cohesive and cohesionless soils,; Earth pressure distribution diagram, numerical problems.

### 4. STABILITY OF EARTH SLOPES

Types of slopes, Causes and types of failure of slopes; Definition of factor of safety; Stability of finite and infinite slopes – Methods of slices, Friction circle method, Felineous method; Taylor's stability number

## **5. BEARING CAPACITY & FOUNDATION SETTLEMENT**

Definition of ultimate, net and safe bearing capacities, Allowable bearing pressure; Terzaghi's and Brinch Hansen's bearing capacity equations – assumptions and limitations; Bearing capacity of footings subjected to eccentric loading; Effect of ground water table on bearing capacity; Plate load test, Standard Penetration Test, Cone Penetration Test; Settlement Analysis, Data for settlement analysis; Computation of settlement; Concept, Immediate, Consolidation and Secondary settlements (no derivation); Tolerance, BIS Specifications for total and differential settlements of footings and rafts.

## **6. SUBSURFACE EXPLORATION**

Importance, exploration program; Methods of exploration: Boring, sounding tests, geophysical methods – electrical resistivity and seismic refraction methods; Types of samples – undisturbed, disturbed and representative samples; Samplers, sample disturbance, area ratio, recovery ratio, clearance; Soil sampling; Rock sampling, RQD; Stabilization of bore holes; Typical boring log; Number and depth of borings for buildings and dams; Determination of ground water level by Hvorslev method (Raising water level method); Control of ground water during excavation: Dewatering – Ditches and sumps, Well point system, Shallow well system, Deep well system, vacuum method, Electro – Osmosis method.

### **Self Learning :**

- Case studies on failure of retaining walls.

### **Text Books:**

1. Soil Mechanics and Foundation Engineering by Punmia B. C., 16th Edition, Laxmi Publishing Co., New Delhi, 2005.
2. Soil Mechanics and Foundation Engineering by Murthy. V. N. S., 4th Edition, UBS Publishers and Distributors, New Delhi, 1996.

### **References:**

1. Foundation Analysis and Design by Bowles. J. E., 5<sup>th</sup> Edition, McGraw Hill Publishing Co., New York, 1996.
2. Basic and Applied Soil Mechanics by Gopal Ranjan and Rao A.S.R., New Age International (P) Ltd., New Delhi, 2000.
3. Geotechnical Engineering by Venkataramaiah. C., 3<sup>rd</sup> Edition, New Age International Pvt. Ltd., New Delhi, 2006.
4. Soil Mechanics by Craig. R. F., Van Nostrand Reinhold Co. Ltd, 1987.
5. Principles of Geotechnical Engineering by Braja M Das, 5<sup>th</sup> Edition, Thomson Business Information India (P) Ltd., India, 2002.
6. Soil Engineering in Theory and Practice by Alam Singh and Chowdhary G.R., CBS Publishers and Distributors Ltd, New Delhi, 1994.
7. Foundation Engineering Handbook by Wintercorn and Fang, 2nd ed. Van Nostrand Reinhold Company, 1991.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Contracts, Specifications and Arbitrations CT650</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objective:

- To study the various processes involved in construction contracts.
- To study various labour regulations as per the Indian acts.

### Course Outcome:

At the end of the course, the student has the ability to

- Understand types of contracts and contract documents (CO1).
- Know the preparation and evaluation of tenders (CO2).
- Know the importance of writing specifications (CO3).
- Know the process of arbitration in construction (CO4).
- Know the various labour regulations under Various Indian Acts (CO5).

### 1. CONTRACTS

Introduction- construction industry –contracting methods-Indian Contracts Act – Elements – Types of Contracts – Features – Suitability – Design of Contract Documents –Standard Contract Document – termination of contract - contractual obligations, Breach of contract, frustration of contract.

### 2. TENDERS

Prequalification – Bidding – Accepting – Rejecting Evaluation of Tenders .

### 3. SPECIFICATIONS

Definition, objective of writing specifications, essentials in specifications, types of specifications, general and detail specifications for excavation, concrete materials, reinforcement, brick work and cement plastering.

### 4. ARBITRATION

Introduction- Types of dispute resolution Advantages of arbitration, Qualification, appointment and removal of arbitrator/s Conditions of Arbitration – Powers and Duties of Arbitrator, Essentials of Award.

### 5. LABOUR REGULATIONS

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen’s Compensation Act – Indian Factory Act – Child Labour Act.

**Self Learning:**

- Writing the specifications for stone masonry Doors and windows and other items connected to a residential building.
- Study of other Labour Laws relating to construction Industry.
- FEDIC Contracts.

**Text Books:**

1. Civil engineering Contracts and estimates by B.S.Patil 3<sup>rd</sup> edition.

**References:**

1. Construction Contracts by Jimmie Hinze, 2<sup>nd</sup> Edition, McGraw Hill, 2001.
2. Contracts and the Legal Environment for Engineers and Architects by Joseph T. Bockrath, 6<sup>th</sup> Edition, McGraw Hill, 2000.
3. Govt of India, Central Public Works Department, "CPWD Works Manual 2003."



## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Project Formulation and Appraisal CT661</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objective:

- To understand identification, evaluation, structuring and appraisal of various construction, buildings, and engineering projects.
- To understand the various analysis of the project.
- To understand the importance of time value of money.
- To understand the concept and preparation of DPR, Cash Flow and Earned Value.

### Course Outcome:

At the end of the course, the students has the ability to

- Identification, evaluation, structuring and appraisal of various construction, buildings, and engineering projects (CO1).
- Understand the importance, difficulties and phases of capital budgeting (CO2).
- Understand key aspects of generation and screening of project ideas (CO3).
- Understand the key elements of financial estimation and projections (CO4).
- Understand the various investment criteria, investment evaluation methods and invention and innovation (CO5).

#### 1. PROJECT APPRAISAL

Introduction, Meaning and Overview of Project Appraisal, What can a Project Appraisal deliver? Good appraisal systems, Key issues in appraising projects, Checklist for project appraisal, Feasibility Study –Aim, Aspects of Project Appraisal, Preparation of Detail Project Report (DPR).

#### 2. CAPITAL BUDGETING

Capital Investment: Importance and Difficulties, Types of Capital Investment, Phases of Capital Budgeting, Levels of decision making, Key issues in major investment decision, Objective Capital Budgeting, Common weakness in Capital Budgeting.

#### 3. GENERATION AND SCREENING OF IDEAS

Generation of ideas, monitoring the environment, corporate appraisal, Scouting for project ideas, Preliminary screening.

#### 4. INVESTMENT CRITERIA

Net present value, Benefit cost ratio, Internal rate of return, Urgency, Payback period.

#### 5. FINANCIAL ESTIMATES AND PROJECTIONS

Cost of Project, Means of financing, Estimates of sales and production, Cost of production, Working capital requirement and its financing, Profitability projections, projected cash flow statements, projected balance sheets.

## **6. IDEA GENERATION & EVALUATION**

Invention And Innovation ,Types Of Innovation, Sources Of Innovative Opportunities, Principles Of Successful Innovation, “Scamper”- A Method For Idea Generation, Evaluating A Business Idea.

### **Self Learning:**

- Project Idea generation
- Investment Analysis
- Evaluation Enterprise value.

### **Text Books:**

1. Dr. Prasanna Chandra, “Projects: Planning, Analysis, Financing, Implementation & Review” – , Tata McGraw Hill.

### **References:**

1. Practical Techniques of Effective Project investment Appraisal: Tiffin – Viva Books 2007
2. Project Finance – Appraisal & Followup: Sarda – ADB Publishers 2007
3. Project Reports & Appraisal: Pahwa – Bharat Law 2007

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Matrix Methods of Structural Analysis CT662</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To introduce the students to system approach and element approach in matrix method of analysis.
- To introduce the students to the analysis of trusses, beams and simple portal frames using flexibility and stiffness methods by element approach.
- To introduce the students to the concepts of direct stiffness method involving formulation and assembly of stiffness matrices.

### Course Outcomes:

At the end of the course, the student has the ability to

- Analyse trusses, beams and simple portal frames using element approach by flexibility method (CO1).
- Analyse trusses, beams and simple portal frames using element approach by stiffness method (CO2).
- Use direct stiffness method for formulation and assembly of stiffness matrices in trusses and beams (CO3).

### 1. FLEXIBILITY METHOD

Introduction to flexibility method, Element flexibility matrix, Force Transformation Matrix, Construction of structure flexibility matrix. Determination of member forces.

2. Analysis of axially rigid continuous beams, rigid plane frames and pin jointed plane trusses by flexibility method using Force Transformation Matrix (Degree of static indeterminacy  $\leq 3$ ).
3. Concepts of lack of fit and temperature in pin jointed plane truss.

### 4. STIFFNESS METHOD

Fundamentals of the stiffness method, Element stiffness matrix, Displacement Transformation Matrix, Principle of contragradience, Construction of structure stiffness matrix. Determination of member forces.

5. Analysis of axially rigid continuous beams, rigid plane frames and pin jointed plane trusses by stiffness method using Displacement Transformation Matrix (Degree of kinematic indeterminacy  $\leq 3$ ).

## **6. DIRECT STIFFNESS METHOD**

Introduction, Local and global co-ordinate system, Member Stiffness Matrix for truss element, beam element and grid element, Transformation of variables, Transformation of the member stiffness matrix, Computation of internal forces.

7. Analysis of trusses by direct stiffness method (Degree of kinematic indeterminacy  $\leq 3$ ).

### **Self-Learning:**

- Use of electronic spread sheet and software tools to perform matrix structural analysis.

### **Text Books:**

- Structural Analysis A Matrix Approach by Pandit G.S. and Gupta S.P., Tata Mc Graw-Hill, New Delhi, 1981.
- Basic structural Analysis, Reddy C.S., Tata Mc Graw-Hill, New Delhi, 1996.
- Computational structural Mechanics by Rajshekharan S., Sankara Subramanian G., PHI, New Delhi, 2001.
- Matrix, Finite Elements, Computer and Structural Analysis by Mukhopadhyay M., Oxford & IBH, 1984.

### **References:**

1. Matrix Analysis of framed structures by Weaver W., Gere J.M., CBS publishers and Distributors, New Delhi, 1986.
2. Structural Analysis – A Unified Classical and Matrix Approach by Ghali A., Neville A.M., and Brown T.G., Spon Press, London, 2004.
3. Structural Analysis by Negi L.S. and Jangid R.S., Tata Mc Graw-Hill, New Delhi, 1997.
4. Introduction to Matrix Methods of Structural analysis by Martin H.C., International Text Book Company, 1996.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Traffic Engineering Management and Road Safety CT663</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To study and understand the various aspects of Traffic Engineering, Management - operations and control,
- Study about road accidents safety measures and safety Audit.
- Study the significance of Social Engineering in the arena of Road safety.
- Understand the usage of equipments related to traffic engineering

### Course Outcomes:

At the end of the course, the student has the ability to

- Understand the traffic operation, management and signaling (CO1).
- Know the causes for road accidents and safety measures (CO2).
- Know road safety audits for traffic operations (CO3).
- Understand the importance of Social engineering in road accidents (CO4).
- Know the usage of equipments related to traffic engineering (CO5).

### 1. INTRODUCTION

Introduction to traffic engineering and management, definition, scope and importance of traffic engineering, traffic characteristics, road user, vehicle, driver and power, PIEV theory, traffic parameter studies, volume studies, speed studies, traffic flow characteristics, capacity, density, concentration and relationship, data collection, interpretation and analysis, latest equipments used for measurement, problems on above.

### 2. TRAFFIC OPERATION, REGULATION AND CONTROL

Various methods of traffic operation and its management, traffic regulation (signs and signages not included), traffic signals, signal coordination, Vehicle Activated Signal and Vehicle Actuated Signal, design of traffic signal for an isolated signal using Webster method, control of highway traffic and its management, functional design of junctions and rotaries, effect of parking on road safety, street lighting, medians and median plantations for safety.

### 3. TRAFFIC SIGNS, SIGNAGES, ROAD MARKINGS AND TRAFFIC MANAGEMENT

Introduction-importance and need, types of Traffic signs, signages as per IRC. Function, types, principles, material and colour of road markings and their application, international practices, Traffic management interventions, planning and design of safer roads.

#### **4. INTRODUCTION TO ROAD ACCIDENTS AND SAFETY**

Road accidents, factors affecting road accidents, causes and effects of road accidents, collision diagram and condition diagram, importance of road safety, accident studies and analysis and modeling, problems on above, proposed action plans for safety and measures to improve road safety, mitigative measure for road accidents, emerging trends in road safety, Introduction to accident cost.

#### **5. ROAD SAFETY AUDIT**

Definition, objectives, aim and importance, basic concepts, geometric design of safety audit, Development of Safety Indices-Road Safety Index (RSI), Vehicle Safety Index (VSI), Driver Safety Index (DSI), Pedestrian Safety Index (PSI), aggregation of various indices and measurement, measures for improving road safety.

#### **6. RECENT TRENDS IN ROAD SAFETY**

Road Safety education, awareness and programs, world bank and government interventions, agencies involved, intelligent transport system application on road safety, concept of smart roads, smart driver and smart vehicle, road safety manual, social, financial and environmental impacts of road accidents, international and national proposed action plans.

#### **7. SOCIAL ENGINEERING**

Society and individual - Goals and objectives – social responsibilities- micro level objectives of RWA – impact of project on society – Environmental issues and challenges – Area traffic management – concept of modal roads and smart roads – intelligent roads and traffic management.

Best practices and solutions to traffic, road safety and social problem. Public education and awareness program.

#### **8. DEMONSTRATION**

Field / lab studies by using latest equipments for urban roads and Highways to include Traffic volume counts for mid block and at intersections, spot speed studies at mid block using Speedar, Accident case studies, accident reporting, study of FIRs and accident reports from records and interpretation, measurement of RSI and PSI.

#### **Self Learning:**

- Social engineering, Environmental issues and challenges, Intelligent roads and traffic management.

#### **Text Books:**

1. Traffic Engineering and Transport Planning – Dr. L R Kadiyali, Khanna Publishers.
2. Khanna and Justo, “Text book of Highway Engineering”, Nemchand Brothers, Roorkee, 2001.

**References:**

1. Traffic Engineering – Matson and Smith: Mc. Graw Hill and Co.
2. Drew, D. R. “Traffic Flow Theory and Control”, McGraw Hill Book Co.
3. William R McShane and Roger P Roess, “Traffic Engineering”, Prentice hall, New Jersey, 2000.
4. Pignataro, Louis: “Traffic Engineering-Theory and Practice”, John Wiley.
5. Babkov V F, “Road conditions and Traffic Safety”, MIR, publications, Mascow – 1975.
6. K W Ogden, “Safer roads-A guide to Road Safety Engineering”, Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.
7. Latest IRC Publications and SP publications for road safety.
8. Upcoming publication authored by Prof. M N Sreehari, Ashwini V and Bharathi B on Road Safety.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Alternative Building Materials and Technologies CT664</b>
<b>No. of Teaching Hours – 4h/week</b>	<b>Credits 4:0:0 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- 100</b>

### Course Objectives:

- To acquire the knowledge of alternative building materials used in construction Industry.
- To acquire the knowledge of alternative building technologies used in construction Industry.
- To introduce the students to design the structural masonry under axial compression.
- To introduce the cost effective building design & equipment for production of alternative materials.

### Course Outcomes:

At the end of the course, the student has the ability to

- Understand the problems of environmental issues concerned to building materials and cost effective building technologies (CO1).
- Suggest appropriate type of masonry units & lime-pozzolana cements (CO2).
- Effectively use the building materials from agro and industrial wastes (CO3).
- Understand the alternative building technologies & design the structural masonry under axial compression (CO4).
- Effectively use the cost concepts in building design & equipment for production of alternative materials (CO5).

### 1. INTRODUCTION

Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions

### 2. ALTERNATIVE MASONRY UNITS

Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks: mud blocks, steam cured blocks, Fal-G Blocks, stone masonry block.

### 3. LIME-POZZOLANA CEMENTS

Raw materials, Manufacturing process, Properties and uses.

### 4. BUILDING MATERIALS FROM AGRO AND INDUSTRIAL WASTES

Types of agro wastes, Types of industrial and mine wastes, Properties and applications, Field quality control test methods.



## **5. ALTERNATIVE BUILDING TECHNOLOGIES**

Alternative for wall construction: Types, Construction method, Masonry mortars: Types, Preparation, Properties, Ferrocement and ferroconcrete building components: Materials and specifications, Properties, Construction methods, Applications, Alternative roofing systems: Concepts, Filler slabs, Composite beam panel roofs Masonry vaults and domes

## **6. STRUCTURAL MASONRY**

Compressive strength of masonry elements, Factors affecting compressive strength, Strength of units, prisms / wallettes and walls, Effect of brick work bond on strength, Bond strength of masonry : Flexure and shear, Elastic properties of masonry materials and masonry, IS Code provisions, Design of masonry compression elements, Concepts in lateral load resistance.

## **7. COST EFFECTIVE BUILDING DESIGN**

Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

## **8. EQUIPMENT FOR PRODUCTION OF ALTERNATIVE MATERIALS**

Machines for manufacture of concrete, Equipments for production of stabilized blocks, Moulds and methods of production of precast elements .

### **Self Learning :**

- FRP and GRP Blinding materials.
- Green Building, Eco-Friendly building.

### **Text Books:**

1. Alternative Building Materials and Technologies by K.S. Jagadish, B.V. Venkatarama Reddy and Nanjunda Rao, New age, International, Indian Institute of science, Bangalore.
2. Structural Masonry by Arnold W. Hendry.

### **References:**

1. Relevant IS Codes.
2. Proceedings of Workshop on Alternative Building Material and Technology, 19th to 20th December 2003 @ BVB College of Engineering. & Tech., Hubli.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Computer Applications in Project Planning and Analysis CT67L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0: 1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- To understand the basic concept of Planning, Scheduling & Controlling.
- To understand the various tool and its application in MS project software.
- To understand and practice scheduling, resource planning, tracking, of the small project.

### Course Outcome:

At the end of the course, the student has the ability to

- Use various tools of MS project (CO1).
- Calculate the duration, critical path & floats for the simple projects (CO2).
- Allocate the resource, track the project with base plan and control the project (CO3).
- Generate the various reports of the project (CO4).

### 1. INTRODUCTION

The Microsoft project data base, creating a new project plan, save your project, setting project information.

### 2. CALENDARS

Create a calendar, apply a base calendar to a project calendar, apply a base calendar to a task calendar, apply a base calendar to a resource calendar, relationship and linking task.

### 3. CRITICAL PATH & WBS

Introduction, the critical path with the Gantt chart wizard, setting up work break down structure.

### 4. CONSTRAINTS AND FLOATS

Introduction on constraints, understanding constraints, introduction and understanding the float.

### 5. RESOURCES DEFINING, ASSIGNING & LEVELLING

Introduction, type of resource, adding, assigning, reviewing and leveling resource to your project.

### 6. TRACKING, MULTIPLE PROJECTS, GROUPING, FILTERS & REPORTS

Tracking your project with baseline, setting up a master project, grouping and filtering the project activities, various reports of your project.

### References:

MS Project - User manual, Microsoft Corporation.

## Department of Construction Technology and Management

<b>Subject Name &amp; Code</b>	<b>Construction Technology Laboratory CT68L</b>
<b>No. of Teaching Hours – 3h/week</b>	<b>Credits 0:0:1.5 L - T - P</b>
<b>CIE Marks : 50</b>	<b>SEE Marks :- -</b>

### Course Objectives:

- To introduce hand tools & equipments required for each construction activity.
- To introduce Setting-out works with the help of pegs & masonry pillars.
- To introduce the principles of masonry construction.
- To introduce the principles of bar-bending and shuttering works.

### Course Outcomes:

At the end of the course, the student has the ability to

- Follow safety norms for handling materials, tools and equipments required for each construction activity (CO1).
- Understand the Setting-out works with the help of pegs & masonry pillars (CO2).
- Understand and apply the principles of masonry construction (CO3).
- Understand and apply the principles of bar-bending and shuttering works (CO4).

### 1. READING OF BUILDING DRAWINGS

Conventional symbols for construction Materials, Doors, and Windows etc.

Types of Plans-Typical Floor Plan, Foundation Plan, Structural plan of a typical floor, Roof or Terrace Plan.

Typical Cross Section depicting various elements of a building.

### 2. APPARATUS

Study of Tools required for Masonry Works, Setting-out Works, Shuttering Works & Reinforcement works.

### 3. SETTING-OUT WORKS OF BUILDINGS

Setting-out with the help of pegs & masonry pillars.

### 4. QUALITY TESTS ON BUILDING MASONRY MATERIALS

Tests on Cement, Fine Aggregate & Bricks.

### 5. CONSTRUCTION OF BURNT BRICK MASONRY (B.B.M) WALLS & PILLARS

Joints, Level and Plumb alignment.

Construction of 1 & 1<sub>1/2</sub> Brick Thick Wall in English Bond using Cement Mortar at corner.

Construction of 1 & 1<sub>1/2</sub> Brick Thick Wall in Flemish Bond using Cement Mortar at corner.

Construction of 1 & 1<sub>1/2</sub> Brick Thick pillar, in English & Flemish Bond using Cement Mortar.

### 6. PLASTERING

Mixing Techniques & applying plaster using Trowel, float etc, by using M Sand. Plastering vertical surfaces to plumb.

### 7. BAR BENDING

Straightening, bending, and hooking of steel reinforcement for beam, column & Footing.

## **8. SHUTTERING**

Fabrication of steel or timber formwork for beam, Chejja, Column & Slab.

### **References:**

1. Practical Handbook on BUILDING CONSTRUCTION by Nabhi, Nabhi Publication; 2014 edition.
2. Practical Handbook on Building Construction PB (English) 2011 Edition by M K Gupta, Publisher: STANDARD BOOK HOUSE-DELHI.