



CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ACADEMIC REGULATIONS & SYLLABUS

(Choice Based Credit System)

Faculty of Technology & Engineering
Chandubhai S Patel Institute of Technology
M. S. Patel Department of Civil Engineering
Bachelor of Technology Programme
(Third Year Civil Engineering)

Effective From 2021-22



Vision

“To provide state of the art education in Civil Engineering guided by innovative research leading to centre of excellence in Civil Engineering education having recognition at national and international levels”

Mission

“Being a pioneering branch of Engineering, the department of Civil Engineering under the shelter of CHARUSAT is intended as a facilitator for creating a liaison between the brilliant student community and the next generation industrial needs”

Programme Educational Objectives (PEO's):

PEO 1: The graduate will possess foundation of engineering knowledge and exhibiting critical thinking and problem solving skills

PEO 2: The graduates will have trait of lifelong learning and be able to inculcate the capabilities to meet the diversified needs of industry, academia and research.

PEO 3: The graduate will exhibit the professional ethics and be supportive to the social needs

PEO 4: The graduates will possess comprehending, analyzing and designing capabilities to generate sustainable solutions

Programme Outcomes (PO's)

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO's):

By the completion of Civil Engineering program, the student will attain:

PSO 1: The ability to serve the infrastructure sector with capabilities to plan, design, analyze and building civil engineering-based systems

PSO 2: The ability to adopt to the state-of-the-art practices in all sectors of Civil Engineering.

PSO 3: Employability skills with the cognizance of social and environmental necessity along with ethical responsibility to have a successful career and to become an entrepreneur.

CHARUSAT welcomes you for a Bright Future



CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
Accredited with Grade A by NAAC,
Accredited with Grade A by KCG

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Bachelor of Technology (Civil Engineering) Programme

Charotar University of Science and Technology (CHARUSAT)
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Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in
www.charusat.ac.in

Academic Year – 2021-22

CHARUSAT

FACULTY OF TECHNOLOGY AND ENGINEERING ACADEMIC REGULATIONS

Bachelor of Technology Programmes

To ensure uniform system of education, duration of undergraduate and post graduate programmes, eligibility criteria for and mode of admission, credit load requirement and its distribution between course and system of examination and other related aspects, following academic rules and regulations are recommended.

1. System of Education

The Semester system of education should be followed across the Charotar University of Science and Technology (CHARUSAT) both at Undergraduate and Master's levels. Each semester will be at least of 90 working days duration. Every enrolled student will be required to take a specified load of course work in the chosen subject of specialization and also complete a project/dissertation if any.

2. Duration of Programme

Undergraduate programme (B. Tech.)

Minimum 8 semesters (4 academic years)

Maximum 12 semesters (6 academic years)

3. Eligibility for Admissions

As enacted by Govt. of Gujarat from time to time.

4. Mode of Admissions

As enacted by Govt. of Gujarat from time to time.

5. Programme Structure and Credits

As per Annexure – 1 attached

6. Attendance

All activities prescribed under these regulations and enlisted by the course faculty members in their respective course outlines are compulsory for all students pursuing the courses. No exemption will be given to any student regarding attendance except on account of serious personal illness or accident or family calamity that may genuinely prevent a student from attending a particular session or a few sessions. However, such unexpected absence from classes and other activities will be required to be condoned by the Principal.

Student's attendance in a course should be 80%.

7. Course Evaluation

7.1 The performance of every student in each course will be evaluated as follows:

- 7.1.2 Internal evaluation by the course faculty member(s) based on continuous assessment, for 30% of the marks for the course; and
- 7.1.3 Final examination by the University through modes such as; written paper or practical test or oral test or presentation by the student or a combination of any two or more of these, is set to 70% of the marks for each the course.

7.2 Internal Evaluation

As per Annexure – 1 attached

7.3 University Examination

The final examination by the University for 70% of the evaluation for the course will be through written paper or practical test or oral test or presentation by the student or a combination of any two or more of these.

7.4 In order to earn the credit in a course a student has to obtain grade other than FF.

7.5 Performance at Internal & University Examination

- 7.5.1 Minimum performance with respect to internal marks as well as university examination will be an important consideration for passing a course. Details of minimum percentage of marks to be obtained in the examinations (internal/external) are as follows:

Minimum marks in University course	marks in Exam per	Minimum marks Overall per course
	40%	45%

- 7.5.2 A student failing to score 40% in the final examination will get an FF grade.
- 7.5.3 If a candidate obtains minimum required marks in each course but fails to obtain minimum required overall marks, he/she has to repeat the university examination till the minimum required overall marks are obtained.

8. Grading

8.1 The total of the internal evaluation marks and final University examination marks in each course will be converted to a letter grade on a ten-point scale as per the following scheme:

Table: Grading Scheme (UG)

Range of Marks (%)	≥80	<80 ≥73	<73 ≥66	<66 ≥60	<60 ≥55	<55 ≥50	<50 ≥45	<45
Corresponding Letter Grade	AA	AB	BB	BC	CC	CD	DD	FF
Numerical point (Grade Point) corresponding to the letter grade	10	9	8	7	6	5	4	0

8.2 The student's performance in any semester will be assessed by the Semester Grade Point Average (SGPA). Similarly, his/her performance at the end of two or more consecutive semesters will be denoted by the Cumulative Grade Point Average (CGPA). The SGPA and CGPA are calculated as follows:

- (i) $SGPA = \frac{\sum C_i G_i}{\sum C_i}$ where,
 C_i = Number of credits of course i
 G_i = Grade Point for the course i
 $i = 1$ to n
 n = number of courses in the semester
- (ii) $CGPA = \frac{\sum C_i G_i}{\sum C_i}$ where,
 C_i = Number of credits of course i
 G_i = Grade Point for the course i
 $i = 1$ to n
 n = number of courses of all semesters up to which CGPA is computed
- (iii) No student will be allowed to move further in next semester if CGPA is less than 3 at the end of an academic year.
- (iv) A student will not be allowed to move to third year if he/she has not cleared all the courses of first year.
- (v) A student will not be allowed to move to fourth year if he/she has not cleared all the courses of second year.

9. Award of Degree

9.1 Every student of the programme who fulfils the following criteria will be eligible for the award of the degree:

- 9.1.1 He/ She should have earned minimum required credits as prescribed in course structure; and
- 9.1.2 He/ She should have cleared all internal and external evaluation components in every course; and
- 9.1.3 He/ She should have secured a minimum CGPA of 4.5 at the end of the programme;
- 9.1.4 **In addition to above, the student has to complete the required formalities as per the regulatory bodies, if any.**

9.2 The student who fails to satisfy minimum requirement of CGPA will be allowed to improve the grades so as to secure a minimum CGPA for award of degree. Only latest grade will be considered.

10. Award of Class

The class awarded to a student in the programme is decided by the final CGPA as per the following scheme:

Distinction	:	CGPA ≥ 7.5 & ≤ 10.0
First class	:	CGPA ≥ 6.0 & < 7.5
Second Class	:	CGPA ≥ 5.0 & < 6.0
Pass	:	CGPA < 5.0

11. Transcript

The transcript issued to the student at the time of leaving the University will contain a consolidated record of all the courses taken, credits earned, grades obtained, SGPA, CGPA, class obtained, etc.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING (FTE)

CHOICE BASED CREDIT SYSTEM

A. Choice Based Credit System:

With the aim of incorporating the various guidelines initiated by the University Grants Commission (UGC) to bring equality, efficiency and excellence in the Higher Education System, Choice Based Credit System (CBCS) has been adopted. CBCS offers wide range of choices to students in all semesters to choose the courses based on their aptitude and career objectives. It accelerates the teaching-learning process and provides flexibility to students to opt for the courses of their choice and / or undergo additional courses to strengthen their Knowledge, Skills and Attitude.

1. CBCS – Conceptual Definitions / Key Terms (Terminologies)

1.1. Core Courses

1.1.1 University Core (UC)

University Core Courses are those courses which all students of the University of a Particular Level (PG/UG) will study irrespective of their Programme/Specialization.

1.1.2 Programme Core (PC)

A 'Core Course' is a course which acts as a fundamental or conceptual base for Chosen Specialization of Engineering. It is mandatory for all students of a particular Programme and will not have any other choice for the same.

1.2 Elective Course (EC)

An 'Elective Course' is a course in which options / choices for course will be offered. It can either be for a Functional Course / Area or Streams of Specialization / Concentration which is / are offered or decided or declared by the University/Institute/Department (as the case may be) from time to time.

1.2.1 Institute Elective Course (IE)

Institute Courses are those courses which any students of the University/Institute of a Particular Level (PG/UG) will choose as offered or decided by the University/Institute from time-to-time irrespective of their Programme /Specialization

1.2.2 Programme Elective Course (PE)

A 'Programme Elective Course' is a course for the specific programme in which students will opt for specific course(s) from the given set of functional course/ Area or Streams of Specialization options as offered or decided by the department from time-to-time.

1.2.3 Cluster Elective Course (CE)

A 'Cluster Elective Course' is a course which students can choose from the given set of functional course/ Area or Streams of Specialization options (e.g. Common Courses for EC/CE/IT/EE) as offered by or decided by the Institute from time-to-time.

1.3 Non Credit Course (NC) - AUDIT Course

A 'Non Credit Course' is a course where students will receive Participation or Course Completion certificate. This will not be reflected in Student's Grade Sheet. Attendance and Course Assessment is compulsory for Non Credit Courses.

Annexure - 1

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (CHARUSAT)

TEACHING & EXAMINATION SCHEME FOR B TECH PROGRAMME IN CIVIL ENGINEERING (CBCS)

Level	Course Code	Course Title	Teaching Scheme								Examination Scheme				
			Contact Hours				Credit				Theory		Practical		Total
			Theory	Practical	Tutorial	Total	Theory	Practical	Project	Total	Internal	External	Internal	External	
Level 3	CL341	Structural Analysis-II	4	2	0	6	4	1		5	30	70	25	25	150
	CL344	Summer Internship - I	0	3	0	3	0	0	3	3	0	0	75	75	150
	CL349	Concrete Technology	3	2	1	6	3	1		4	30	70	25	25	150
	CL350	Building Planning	3	2	1	6	3	1		4	30	70	25	25	150
	HS131.02 A	Communication And Soft Skills	0	2	0	2	0	2		2	0	0	30	70	100
	CL370- CL382	Programme Elective-I	3	2	0	5	3	1		4	30	70	25	25	150
					28					22					850
Level 4	CL351	Environmental Engineering-I	4	2	0	6	4	1		5	30	70	25	25	150
	CL346	Geotechnical Engineering-I	3	2	0	5	3	1		4	30	70	25	25	150
	CL352	Water Resources Engineering-I	4	2	1	7	4	1		5	30	70	25	25	150
	CL353	Transportation Engineering-I	4	2	1	7	4	1		5	30	70	25	25	150
	HS132.0 A	Contributory Personality Development	0	2	0	2	0	2		2			30	70	100
	CL376- CL383	Programme Elective-II	3	2	0	5	3	1		4	30	70	25	25	150
					32					25					850

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B. Tech. (Civil Engineering) Programme

SYLLABI (Semester – 5)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CL341: STRUCTURAL ANALYSIS-II
B. TECH 5th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	2	6	5
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Energy Principles	10
2	Fixed and Continuous Beam	08
3	Influence Line for Indeterminate Structures	10
4	Consistent Deformation	06
5	Slope-Deflection Method	10
6	Moment-Distribution Method	10
7	Introduction to Matrix- Beam Element	06

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

B. Detailed Syllabus:

- | | | | |
|----------|---|-----------------|------------|
| 1 | Energy Principles | 10 Hours | 17% |
| 1.1 | Strain energy- Introduction | | |
| 1.2 | Strain energy stored in linear elastic systems | | |
| 1.3 | Castigliano's theorems | | |
| 1.4 | Computation of displacements of statically determinate beams and frames by unit load method | | |
| 1.6 | Analysis of statically indeterminate structures-beams and frames by unit load method | | |

2	Fixed and Continuous Beam	08 Hours	13%
2.1	Statically determinate and indeterminate structures		
2.2	Degree of static indeterminacy		
2.3	Advantages and disadvantages of indeterminate structures		
2.4	Analysis of fixed beams for various types of loads and secondary effects		
2.5	Claypeyron's three moment theorem and its application		
2.6	Analysis of continuous beams		
2.7	Analysis of propped cantilever beams		
3	Influence Line for Indeterminate Structure	10 Hours	17%
3.1	Muller-Breslau's principle		
3.2	Quantitative I.L. for reaction and internal forces in propped cantilever and continuous beams		
3.3	Qualitative I.L. for rigid jointed structures having higher degree of static indeterminacy		
4	Consistent Deformation	06 Hours	10%
4.1	Introduction		
4.2	Method of consistent deformation		
4.3	Analysis of Statically indeterminate beams		
5	Slope-Deflection Method	10 Hours	17%
5.1	Introduction		
5.2	Basic concepts, Definitions and Sign conventions		
5.3	Development of Slope-deflection equations		
5.4	Analysis of indeterminate beams		
5.5	Analysis of portal frames with no lateral translation of joints		
5.6	Analysis of frames with lateral translation of joints		
6	Moment-Distribution Method	10 Hours	17%
6.1	Introduction		
6.2	Absolute and relative stiffness of members, Carry over factor (COF), Distribution factor (DF)		
6.3	Sign conventions		
6.4	Applications of method		
6.5	Analysis of continuous beam with secondary effects		

- 6.6 Symmetrical frames
- 6.7 Analysis of frames with no lateral translation of joints
- 6.8 Analysis of frames with lateral translation of joints
- 7 Introduction to Matrix- Beam Element 06 Hours 09%
- 7.1 Introduction to flexibility and stiffness method
- 7.2 Application of stiffness method system approach to analysis of beam

C. Course Outcomes:

On the completion of the course the students will be able to:

- CO1 Identify the fundamentals of structure and various methods of Analysis
- CO2 Recognize the role of professional societies in developing new structural software and updating current knowledge
- CO3 Identify and formulate an engineering problem and to develop a solution
- CO4 Use various classical methods for analysis of indeterminate structures
- CO5 Demonstrate the concepts of qualitative influence line diagram for rigid jointed structures having higher degree of statically indeterminacy
- CO6 Apply the basic concepts of matrix methods in structural analysis

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	1	3	1	2	1	-	-	-	-	-	-	1	-	1
CO3	2	2	3	1	1	-	-	-	-	-	-	-	2	-	-
CO4	2	2	2	1	2	-	-	-	-	-	-	-	1	-	-
CO5	3	1	2	1	1	-	-	-	-	-	-	-	1	-	-
CO6	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Junarkar, S.B. & Shah, H.J., Mechanics of Structures Vol-I & II, Charotar Publishing House
2. Negi, L.S. and Jangid, R.S., Structural Analysis, Tata McGraw Hill
3. Vazirani, V.N. and Ratwani, N.M., Analysis of Structures, Khanna Publishers

4. Weaver William and Gere James, Matrix Analysis of Framed Structures, CBS Publishers
5. R.S. Khurmi and N. Khurmi, Theory of structures, S. Chand

Reference Books:

1. Gere & Timoshenko, Mechanics of Materials, CBS Publishers & Distributors, Delhi
2. Hibbler, R.C., Structural Analysis, Pearson Education
3. Wang, C.K., Intermediate Structural Analysis, Tata McGraw Hill
4. Reddy, C.S., Basic Structural Analysis, Tata McGraw Hill
5. Jangid, R.S., Structural Analysis, Tata McGraw Hill
6. Devdas Menon., Structural Analysis, Alpha Science
7. William M.C. McKenzie, Examples in Structural Analysis, Second Edition, CRC Press

Web Materials:

1. <http://nptel.ac.in/downloads/105101085/>
2. <http://nptel.ac.in/courses/105101086/>
3. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New_index1.html
4. <http://www.nptelvideos.in/2012/11/structural-analysis-ii.html>
5. <http://nptel.ac.in/courses/105106050/2>
6. [http://nptel.iitg.ernet.in/Civil_Eng/IIT%20Delhi/Structural%20Analysis%201%20\(Video\).htm](http://nptel.iitg.ernet.in/Civil_Eng/IIT%20Delhi/Structural%20Analysis%201%20(Video).htm)
7. <http://freevideolectures.com/Subject/Civil-Engineering>
8. <http://freevideolectures.com/Course/97/Structural-Analysis-II>

LIST OF EXPERIMENTS

Experiment No.	Name of Experiment
1	Deflections of beams and cantilevers
2	Continuous and indeterminate beam
3	Pin jointed frameworks
4	Frame deflections and reactions
5	Bending moments in a portal frame

CL344: SUMMER INTERNSHIP-I
B TECH 5th SEMESTER (CIVIL ENGINEERING)

Credit and Hours:

Teaching Scheme	Project	Total	Credit
Hours/week	30	90	3
Marks	150	150	

A. Instructional Method and Pedagogy:

- Summer internship shall be for at least 90 hours during the summer vacation only.
- Department/Institute will help students to find an appropriate company/industry/organization for their summer internship.
- The student must fill up and get approved a Summer Internship Acceptance form by the company and provide it to the Coordinator of the department within the specified deadline.
- Students shall commence the internship after the approval of the department Coordinator. Summer internships in research centers is also allowed.
- During the entire period of internship, the student shall obey the rules and regulations of the company/industry/organization and also those of the University.
- Due to inevitable reasons, if the student will not able to attend the internship for few days with the permission of the supervisor, the department Coordinator should be informed via e-mail and these days should be compensated later.
- The student shall submit following two documents to the Coordinator for the evaluation of the summer internship:
 - Summer Internship Report
 - Summer Internship Assessment Form
- Upon the completion of summer internship, a hard copy of “Summer Internship Report” must be submitted to the Coordinator by the first day of the new term.
- The report must outline the experience and observations gained through practical internship, in accordance with the required content and the format described in this guideline. Each report will be evaluated by a faculty member of the department on a satisfactory/unsatisfactory basis at the beginning of the semester.

- If the evaluation of the report is unsatisfactory, it shall be returned to the student for revision and/or rewriting. If the revised report is still unsatisfactory the student shall be requested to repeat the summer internship.

B. Format of Summer Internship Report:

The report shall comply with the summer internship program principles. Main headings are to be centered and written in capital boldface letters. Sub-titles shall be written in small letters and boldface. The typeface shall be Times New Roman font with 12pt. All the margins shall be 2.5cm. The report shall be submitted in printed form and filed. An electronic copy of the report shall be recorded in a CD and enclosed in the report. Each report shall be bound in a simple wire vinyl file and contain the following sections:

- Cover Page
- Page of Approval and Grading
- Abstract page: An abstract gives the essence of the report (usually less than one page). Abstract is written after the report is completed. It must contain the purpose and scope of internship, the actual work done in the plant, and main conclusions arrived at.
- TABLE OF CONTENTS (with the corresponding page numbers)
- LIST OF FIGURES AND TABLES (with the corresponding page numbers)
- DESCRIPTION OF THE COMPANY: Summarize the work type, administrative structure, number of employees (how many engineers, under which division, etc.), etc. Provide information regarding
 - Location and spread of the company
 - Number of employees, engineers, technicians, administrators in the company
 - Divisions of the company
 - Your group and division
 - Administrative tree (if available)
 - Main functions of the company
 - Customer profile and market share
- INTRODUCTION: In this section, give the purpose of the summer internship, reasons for choosing the location and company, and general information regarding the nature of work you carried out.

- **PROBLEM STATEMENT:** What is the problem you are solving, and what are the reasons and causes of this problem.
- **SOLUTION:** In this section, describe what you did and what you observed during the summer internship. It is very important that majority of what you write should be based on what you did and observed that truly belongs to the company/industry/organization.
- **CONCLUSIONS:** In the last section, summarize the summer internship activities. Present your observations, contributions and intellectual benefits. If this is your second summer internship, compare the first and second summer internships and your preferences.
- **REFERENCES:** List any source you have used in the document including books, articles and web sites in a consistent format.
- **APPENDICES:** If you have supplementary material (not appropriate for the main body of the report), you can place them here. These could be schematics, computer programs, drawings, etc. If the document is a datasheet and it can be easily accessed from the internet, then you can refer to it with the appropriate internet link and document number. In this manner you don't have to print it and waste tons of paper.

C. Course Outcomes:

After completion of the course students will able:

- CO1 To apply knowledge and skills gained in company/industry/organization to real-world problems and to solve engineering problems.
- CO2 To learn to work as a team and to work with teammates from other disciplines.
- CO3 To use experience related to professional and ethical issues in the actual work environment.
- CO4 To explain the impact of engineering solutions employed in a project, in a global, economic, environmental, and societal context.
- CO5 To find relevant sources (e.g., library, Internet, experts) and gathers information and to demonstrate knowledge of contemporary issues related with engineering in general and to use new tools and technologies.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	2	1	1	1	3	3	3	3	3	3
CO2	-	-	-	-	-	-	-	-	3	2	-	-	-	-	-
CO3	-	-	-	-	-	1	-	3	-	-	-	-	-	-	-
CO4	3	3	2	2	2	2	3	1	-	1	1	2	1	1	1
CO5	2	3	2	3	3	2	2	1	-	2	1	2	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

CL349: CONCRETE TECHNOLOGY
B TECH 5th SEMESTER (CIVIL ENGINEERING)

Credits and hours:

Teaching Scheme	Theory	Tutorial	Practical	Total	Credit
Hours/week	3	1	2	6	4
Marks	100	-	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	01
2	Cement	07
3	Aggregate	07
4	Admixtures	05
5	Fresh Concrete	06
6	Harden Concrete	06
7	Selection of Concrete Mix Proportion (Mix Design)	07
8	Special Concrete	04
9	Non-Destructive test of Concrete	02

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1	Introduction	01 Hours	02%
1.1	Ingredients of concrete		
1.2	Strength development		
1.3	Different types of concrete		
1.4	New developments and future trends		

2	Cement	07 Hours	15%
2.1	History of portland cement		
2.2	Manufacture process of portland cement		
2.3	Chemical composition		
2.4	Hydration and heat of hydration		
2.5	Structure of hydrated cement and product of hydration		
2.6	Setting of cement		
2.7	Field testing of cement, standard consistency test, initial and final setting time, strength of cement, soundness test		
2.8	Storage of cement		
2.9	Types of cement		
3	Aggregate	07 Hours	15%
3.1	Source and classification of aggregates		
3.2	Shape, size and texture of aggregates		
3.3	Mechanical properties of aggregates, strength of aggregates, specific gravity, bulk density, porosity and absorption of aggregates, moisture content of aggregates, bulking of fine aggregate		
3.4	Deleterious substance in aggregate		
3.5	Soundness of aggregates		
3.6	Alkali aggregates reaction		
3.7	Grading of aggregates		
3.8	Test on aggregate: Aggregates crushing value, aggregates impact value, aggregates abrasion value, sieve analysis and fineness modulus.		
3.9	Quality of mixing water		
3.10	Use of Sea water in concrete		
4	Admixtures	05 Hours	11%
4.1	Advantages of admixture		
4.2	Types of admixture: Accelerators, retarders, water reducing admixture, plasticizers and air entraining, super plasticizer, water proofing admixture, antibacterial admixture		
4.3	Cementitious materials: Fly ash, silica fume, rice husk ash, ground granulated blast furnace slag, metakaolin		

5	Fresh Concrete	06 Hours	14%
5.1	Rheology of fresh concrete		
5.2	Workability and factors affecting workability		
5.3	Measurement of workability		
5.4	Segregation		
5.5	Bleeding		
5.6	Process of manufacture of concrete: batching, mixing, transportation, placing, compaction, curing, re-tampering, finishing		
6	Hardened Concrete	06 Hours	14%
6.1	Gain of strength of concrete		
6.2	Factors affecting strength of concrete: water cement ration, gel space ratio, age of concrete		
6.3	Durability and permeability		
6.4	Nature of strength of concrete		
6.5	Microcracking , Creep and Shrinkage		
6.6	Aggregate cement paste interface		
6.7	Maturity of concrete		
7	Selection of Concrete Mix Proportions (Mix Design)	07 Hours	15%
7.1	Concept of concrete mix design: variables in proportioning, various methods of proportioning, statistical quality control of concrete, calculation of standard deviation, relation between average design strength and specified minimum strength		
7.2	Principle of mix proportioning		
7.3	Factors governing the selection of mix proportion		
7.4	Mix proportions and quantities per batch		
7.5	ACI, IS Method, concrete mix design using admixture, mix design for pumpable concrete		
7.6	Variability of test result		
7.7	Acceptance criteria and IS code provisions		

8	Special Concrete	04 Hours	9%
8.1	High performance concrete		
8.2	Lightweight aggregate		
8.3	High strength concrete		
8.4	Polymer concrete		
8.5	Fibre reinforce concrete		
8.6	Ready mix concrete		
8.7	Mass concrete		
8.8	Self-Compacting Concrete		
9	Non Destructive testing of Concrete	02 Hours	5%
9.1	Introduction to Destructive, Semi destructive and Non-destructive testing,		
9.2	Problem faced during Non-destructive evaluation.		
9.3	Rebound Hammer test,		
9.4	Ultrasonic Pulse Velocity test		

C. Course Outcomes:

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

- CO1 The students will be able to: test all the concrete materials as per IS code.
- CO2 The students will understand concrete mix design using ACI and IS code methods.
- CO3 The students able to determine the properties of fresh and hardened concrete.
- CO4 The students have knowledge of special concretes and their specific applications

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	-	-	3	-	2	-	-	1	-	1
CO2	1	-	-	-	-	-	-	3	-	2	-	-	1	-	1
CO3	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-
CO4	-	-	-	-	-	-	2	-	-	-	1	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text books:

1. Neville, A.M., Concrete Technology, Pearson Education.
2. Santakumar, A.R., Concrete Technology, Oxford University Press.
3. Shetty, M.S., Concrete Technology, S. Chand Publication.
4. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publication.

Reference books:

1. Paulo, Mehta P. Kumar and Monteiro, J.M., Concrete Micro-structure, Properties and Materials, Prentice Hall INC and McGraw Hill, USA.
2. IS: 10262- 2009 Recommended guidelines for Concrete Mix Design.
3. IS: 456- 2000, Indian Standard Plain and Reinforced Concrete Code of Practice.

Web Materials:

1. <http://nptel.iitm.ac.in/video.php?courseId=1059>
2. <http://www.aboutcivil.com/concrete-technology.html>
3. www.understanding-cement.com
4. <http://www.engineeringcivil.com/theory/concrete-engineering/>

CL350: BUILDING PLANNING
B. TECH 5th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	2	1	6	4
Marks	100	50		150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Min. No. of Hours
1	Building Drawing	03
2	Building Byelaws	06
3	Planning of Residential Buildings	12
4	Planning of Public Buildings	04
5	Building Services	06
6	Perspective Drawing	08
7	Introduction to Town Planning	06

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

- | | | | |
|----------|--|----------|-----|
| 1 | Building Drawing | 03 Hours | 07% |
| 1.1 | Classification of buildings | | |
| 1.2 | Basic principles of planning | | |
| 1.3 | Principles of Architecture | | |
| 1.4 | Standard conventional signs, symbols and abbreviations | | |
| 1.5 | ISI nomenclature: Size of scale, standard method of Dimensioning | | |
| 2 | Building Byelaws | 06 Hours | 13% |
| 2.1 | Objectives, Scope, Applicability and Principles | | |
| 2.2 | Basic terminology | | |
| 2.3 | Various forms of building coverage | | |
| 2.4 | Bye-laws for Open spaces, Area limitations, Height limitations, | | |

Plinth Area, Means of Access, Light and Ventilation, Parking spaces		
2.4 Minimum standard dimensions of building elements		
2.5 Examples on FSI or FAR		
2.6 Submission of drawings for issue of permission for construction		
3 Planning of Residential Buildings	12 Hours	28%
3.1 Different types of Residential Buildings		
3.2 Selection of site for residential buildings		
3.3 Orientation of Buildings		
3.4 Guidelines for making wall thickness plan from line diagram		
3.5 Detailed drawing–plan, elevation, sections		
3.6 Design of Individual rooms with particulars attention to anthropometric data, functional and furniture requirements.		
3.7 Design of buildings with particular attention to orientations, FSI and allowable built up area.		
3.8 Furniture layout, Kitchen layout with emphasis on kitchen work triangle		
4 Planning of Public Buildings	04 Hours	08%
4.1 School – Principles of planning a school building, Components, Design of a classroom, Sanitary Requirements		
4.2 Hospital – Site selection, Principles of planning a hospital building, Wards, Different departments, Operation theatre, Sanitary Requirements		
4.3 Hostel – Site selection, Principles of planning a hostel building, wardens office, residential area, recreation room, special requirements, Sanitary Requirements, Kitchen and Dining Hall		
5 Building Services	06 Hours	13%
5.1 Water supply and Drainage – water distribution systems, materials used for plumbing, drainage systems		
5.2 Electrification – distribution of electrical energy, accessories of electrical installation, purpose of earthing		
5.3 Working drawing of a building – Electrical layout, Water supply and drainage layout		

6	Perspective Drawing	08 Hours	18%
6.1	Introduction & technical terms		
6.2	Classifications, elements of perspective		
6.3	Examples		
7	Introduction to Town Planning	06 Hours	13%
7.1	History, ancient planning in India		
7.2	Objects & importance of town planning		
7.3	Principles of town planning		
7.4	Horizontal growth, vertical growth		
7.5	Satellite town, ribbon development, concentric growth		

C. Course Outcomes:

On the successful completion of this course, the students will be able to:

- CO1 Discern various aspects of principles of planning and architecture in building design and read the building drawings.
- CO2 Understand local building bye-laws and provisions of National Building Code in respect of building and town planning.
- CO3 Utilise basic principle of planning and architecture in design of residential buildings and public buildings.
- CO4 Utilise the knowledge of different types of plumbing and electric fitting and laying procedure to create working drawings.
- CO5 Understand perspective drawing and represent various forms in perspective view.
- CO6 Have basic understanding of town planning and its history.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	-	2	-	-	-	1	-	-	-	-	-	3	-	-
CO4	1	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO6	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Singh Gurcharan, Building Planning, Designing and Scheduling, Standard Publishers and Distributors.
2. Dr. N. Kumara Swamy & Rao A. Kameswara, Building Planning and Drawing, Charotar Publishing House.
3. Wagh Sajjan V., Building and Town Planning, Tech-Max Publications.
4. Khasiya R. B, Motiani A. T and Khasiya K. R, Building & Town Planning, Mahajan Publishing House.

Reference Books:

1. Rangwala S. C., Town Planning, Charotar Publishing House, Anand.
2. Hiraskar G. K., Town Planning, Dhanpatrai & Sons, New Delhi.
3. Sikka V. B., Civil Engineering Drawing, S. K. Kataria & Sons Publication.
4. Shah M. G., Kale C. M and Patki S. Y., Building Drawing, Tata McGraw Hill Publication, New Delhi.
5. General Development Control Regulations published by AUDA and GICEA.
6. National Building Code of India, Indian Standard Institution (ISI), New Delhi, 2005.

Web Materials:

1. <http://www.vastu-design.com/vastu-video-workshop/>
2. https://www.youtube.com/watch?v=EIDX28_8eQ
3. <https://www.youtube.com/watch?v=VYiVjVulnm4>
4. <https://www.youtube.com/watch?v=bCn0X9RRjN0&list=PL060E3166E87E1FD5>
5. https://www.designingbuildings.co.uk/wiki/Types_of_drawings_for_building_design
6. <http://freevidelectures.com/Course/86/Building-Materials-and-Construction/31>

List of Drawings for Lab Sessions

Sr. No.	Details
1	Conventional Signs & Symbols
2	Plan, Sectional Elevation, Front Elevation and site plan for a small house
3	Plan, Sectional Elevation, Front Elevation and site plan for Duplex Type House

4	Working Drawings
5	Design of houses with given functional requirements and climatic data and Model Making
6	Perspective Drawing: One Point Perspective
7	Perspective Drawing: Two Point Perspective

HSI31.02 A: COMMUNICATION AND SOFT SKILLS
B. TECH 5th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	--	30/15	--	30/15	02
Marks	--	100	--	100	

Pre-requisite courses:

- Communicative English

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	An Introduction to Communication	06
2.	Cross-cultural Communication and Globalization	03
3.	Communication for Career Building	10
4.	Group Dynamics and Soft Skills	05
5.	Effective Presentation Strategies	04
6.	Contemporary Issues in Communication and Soft Skills	02
	Total hours (Theory) :	--
	Total hours (Practical) :	30
	Total hours :	30

B. Detailed Syllabus:

1. **An Introduction to Communication** **06 Hours 20%**
 - 1.1 Basics of Communication: Origin, Concept, Process, Levels, Principles and Barriers;
 - 1.2 Applications of Communication;
 - 1.3 Rhetoric in Professional Communication;
 - 1.4 Importance of Ethos, Logos, and Pathos in Communication

2. Cross-cultural Communication and Globalization	03 Hours 10%
2.1 Basic Concepts: Culture, Globalization and Cross-cultural Communication;	
2.2 Social and People Skills;	
2.3 Communicating with People of Different Cultures;	
2.4 Conflicts in Cross-cultural Communication and Tactics / techniques to resolve them;	
2.5 Persuasive Communication	
3. Communication for Career Building	10 Hours 33%
3.1 Cover Letters and Resume;	
3.2 E-mail and Report;	
3.3 Types of Resume;	
3.4 Concept and Rationale of Group Discussion Skills and Aspects assessed in Group Discussion;	
3.5 Concept and Rationale of Personal Interview;	
3.6 Types of Personal Interview;	
3.7 Writing Statement of Purpose	
4. Group Dynamics and Soft Skills	05 Hours 17%
4.1 An Introduction to Group Dynamics and Soft Skills;	
4.2 Groups and their Structures;	
4.3 Roles and Functions of Members in Groups;	
4.4 Conflict Management;	
4.5 Aptitude and Attitude;	
4.6 Various Intelligences;	
4.7 Developing an Open Mindset	
5. Effective Presentation Strategies	04 Hours 14%
5.1 Designing Appealing Presentation;	
5.2 Audience Analysis and Supporting Material;	
5.3 Presentation Mechanics and Presentation Process;	
5.4 Managing Yourself during Q and A Session;	
5.5 Fundamentals of Persuasion	
6. Contemporary Issues in Communication and Soft Skills	02 Hours 06%
6.1 Trends and Practices in Communication, Case Studies	

C. Learning Outcomes:

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

- CO1 Gain thorough understanding and proficiency in various Professional Communication Skills.
- CO2 Develop awareness and competence in cross-cultural communication in their personal, academic and professional environments.
- CO3 Develop business writing and presentation skills to succeed in career.
- CO4 Develop soft skills to stand out and take their career to the next level.
- CO5 Develop various intelligences and open Mindset to function in multi-disciplinary and cross-cultural work environment.
- CO6 Practice new trends in communication in multiple perspectives at personal, professional, and social level.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	2	2	2	-	2	-	-	-	2	-
CO2	-	-	2	-	-	3	-	-	3	-	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	1	-	-	2	1	3	2	-	-	-	2	-
CO5	-	-	-	-	-	2	2	-	-	-	2	-	-	2	-
CO6	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) no correlation, put “-”

Recommended Study Material:

- Text book:
 1. Koneru, A. Professional Communication, Tata McGraw Hill Education Private Limited
 2. Disanza, J.R. & Legge, N. Business and Professional Communication, Pearson Education
 3. Raman, M & Singh, P. Business Communication, Oxford University Press
- Reference book:
 1. Disanza, J.R. & Legge, N. Business and Professional Communication, Pearson Education

2. Anandamurugan, A. Placement Interviews – Skills for Success, Tata McGraw Hill Education Private Limited

- Web material:

1. <https://www.coursera.org/learn/careerdevelopment>
2. <https://www.futurelearn.com/courses/writing-applications>
3. <https://www.futurelearn.com/courses/workplace-englis>

CL370: CONSTRUCTION ENGINEERING MATERIALS
B. TECH 5th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - I

Credits and Hours:

Teaching Scheme	Theory	Practical / Tutorial	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Construction Materials	3
2	Timber	7
3	Masonry Units	8
4	Plastics	4
5	Glass	4
6	Ceramic Materials	4
7	Metals	7
8	Paint & Varnishes	3
9	Advanced Construction Materials	5

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1	Introduction to Construction Materials	03 Hours	07%
1.1	General Introduction		
1.2	Physical Properties		
1.3	Mechanical Properties		
1.4	Classification of materials based upon their uses		
2	Timber	07 Hours	15%
2.1	General Introduction		

2.2	Classification of trees		
2.3	Structure of a tree		
2.4	Seasoning of Timber – Meaning, Objects, Methods, Advantages and Disadvantages of different methods of seasoning		
2.5	Defects in Timber		
2.6	Industrial Timber		
3	Masonry Units	08 Hours	18%
3.1	Bricks – general, composition of good brick earth, qualities of good bricks, factors affecting qualities of bricks, tests for bricks		
3.2	Stone - Qualities of good building stone, tests for stones, dressing of stones		
3.3	AAC blocks - General introduction, Composition, Manufacturing process, Advantages and Disadvantages, properties		
4	Plastics	06 Hours	09%
4.1	General Introduction		
4.2	Composition of Plastic, Polymerization		
4.3	Classification of Plastics		
4.4	Properties of Plastics, Uses of Plastic		
4.5	Biodegradable plastic		
4.6	Fibre Glass Reinforced Plastic		
5	Glass	04 Hours	09%
5.1	General		
5.2	Classification of glass and composition of glass		
5.3	Properties of glass , Types of glass		
5.4	Coloured Glass and special varieties of glass		
6	Ceramic Materials	04 Hours	09%
6.1	General Introduction, Properties, Importance		
6.2	Terracota, Stoneware		
6.3	Tiles - Characteristics, types		
6.4	Glazing and refractories		

7	Metals	07 Hours	15%
7.1	Ferrous - Introduction to different types of ferrous metals		
7.2	Steel - General Information, Manufacture of steel, Uses of Steel, Factors affecting physical properties of Steel, Defects in steel, Properties of Mild Steel, Properties of Hard Steel, Mechanical Treatment of Steel, Market forms of steel		
7.3	Non-Ferrous Metals - Different types Aluminium - Manufacture, Properties, Evaluation as building material, Economics of using aluminium, Uses		
8	Paint & Varnishes	03 Hours	07%
8.1	Paints - Characteristics, Pigment Volume Concentration Number, Ingredients, Types		
8.2	Varnishing - Characteristics, Ingredients, Types		
9	Advanced Construction Materials	05 Hours	11%
9.1	Application of Nano Technology in construction materials		
9.2	Advanced Composite Reinforcement		
9.3	Ground granulated blast furnace slag		
9.4	Hydrophobic concrete for waterproofing		
9.5	Insulated concrete forms		

C. Course Outcomes:

On the successful completion of this course, the students will:

- CO1 Understand the constituents of various materials like timber, glass, plastic, ceramic material, metal, varnish and paint.
- CO2 Be familiar with the varieties of construction material available in market.
- CO3 Understand the application of various construction materials with their properties like timber, glass, plastic, ceramic material, metal, varnish and paint.
- CO4 Be familiar about various advanced construction materials available in market.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	3	2	-	-	-	-	-	-	-	-	2
CO2	1	2	-	-	-	-	1	-	-	1	-	-	1	-	-
CO3	1	2	-	-	2	-	1	-	1	1	-	-	-	-	-
CO4	2	-	-	-	3	2	-	-	-	-	-	-	1	-	2

D. Recommended Study Material:

Text Books:

1. Duggal S. K., Building Materials, New Age International Publication.
2. Rangwala S.C., Engineering Materials, Charotar Publishing House
3. Soni Saurabhkumar, Building Materials & Construction, S.K.Kataria publication

Reference Books:

1. Dr. Janardan Jha, Engineering Materials, Khanna Publication
2. A K Roy, Materials of Construction, Chaudhary Publication
3. Vazirani and Chandola, Engineering Materials
4. D.N. Ghose, Construction Materials, TATA Mc Graw Hill
5. TTTI, Chandigarh, Civil Engineering materials TTTI
6. Rangwala Ketki, Essential of Civil Engineering, Charotar Publishing House

Web Materials:

1. https://onlinecourses.nptel.ac.in/m?desturl=cHJvZmlsZQ==#/course/noc19_ce42
2. https://onlinecourses.nptel.ac.in/m?desturl=cHJvZmlsZQ==#/course/noc19_ce40
3. https://en.m.wikipedia.org/wiki/Insulating_concrete_form
4. <https://www.nbmcmw.com/tech-articles/concrete/3725-new-construction-materials-for-modern-projects.html>
5. <https://nptel.ac.in/courses/105106053/>
6. https://geniebelt-com.cdn.ampproject.org/v/s/geniebelt.com/blog/10-innovative-construction-materials/amp?usqp=mq331AQQKAFwAZgB47zlkNnQu6WrAQ%3D%3D&_js_v=a2&am_gsa=1#referrer=https%3A%2F%2Fwww.google.com&share=https%3A%2F%2Fgeniebelt.com%2Fblog%2F10-innovative-construction-materials

CL372: FLUID MECHANICS-II
B. TECH 5th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1	Dimensional analysis and Model similitude	8
2	Viscous fluid flow	8
3	Turbulent flow in pipes	8
4	Flow around a body- Forces on submerged body	6
5	Non-uniform flow in open channel	7
6	Hydraulic machinery	8

Total Hours (Theory): 45
 Total Hours (Practical): 30
 Total Hours: 75

B. Detailed Syllabus:

1	Dimensional analysis and Model similitude	08 Hours	18%
1.1	Fundamental dimensions		
1.2	Rayleigh's and Buckingham's method		
1.3	Dimension less numbers and their significance		
1.4	Hydraulic similitude		
1.5	Type of models		
2	Viscous fluid flow	08 Hours	18%
2.1	N-S equations in Cartesian Coordinates and Cylindrical coordinates.		
2.2	Exact Solutions of N-S equations, Poiseuille flow		
2.3	Couette flow		

2.4	Laminar flow in pipe		
	Boundary Layer, Developments of boundary layer along flat plate,		
2.5	laminar boundary layer, turbulent boundary layer, boundary layer separation		
2.6	Boundary Layer thicknesses		
3	Turbulent flow in pipes	08 Hours	18%
3.1	Laminar flow stability, causes and mechanism of turbulence, shear stress due to turbulence		
3.2	Prandtl's mixing length theory, Laws of turbulent flow		
3.3	Turbulent flow in pipes, pipe resistance factors smooth and rough pipes		
3.4	Resistance to commercial pipes, Moody's diagram, Explicit equation for friction factor		
3.5	Pipe Network, Aging of pipes		
3.6	Water Hammer, Causes, Rapid closure, slow closure, Basic equation of water hammer		
3.7	Surge tanks, Types of surge tanks		
4	Flow around a body- Forces on submerged body	06 Hours	13%
4.1	Regime of external flow, Drag and Lift , Pressure drag, Friction drag, stream lined body, Blunt body		
4.2	Drag coefficient and similarity considerations		
4.3	Flow past a cylinder, sphere		
4.4	Flow past airfoil of infinite length and finite length		
5	Non-uniform flow in open channel	07 Hours	15%
5.1	Specific energy, specific energy diagram, Discharge Diagram		
5.2	Application specific energy diagram and discharge diagram, Critical depths, critical flow, critical slope		
5.3	Momentum principle to open channel flow, specific force, small waves in open channel		
5.4	Gradual Varied flow, Derivation of water surface slopes, classification of water surface profiles		
5.5	Hydraulic Jump, Types, elements and characteristics of hydraulic jump		
6	Hydraulic machinery	08 Hours	18%
6.1	Jet striking a stationary plate and moving plate,		

- 6.2 Force exerted by jet on curved vane
- 6.3 Turbo machineries, Pumps and turbines
- 6.4 Classification of hydraulic turbines, impulse turbine
- 6.5 Reaction turbines, specific of turbines
- 6.6 Centrifugal pump, classification, definitions for CF,
- 6.7 Installation and priming of pump, NPSH, Cavitation in pump,

C. Course Outcomes:

On the completion of the course one should be able to:

- CO1 Develop an ability to analyze laminar flow and turbulent flow for pipe
- CO2 Will be able to design the pipe system (Network) and process for the required need of whether discharge or head.
- CO3 Develop the skill to perform experiments as well as analyze and interpret the results.
- CO4 Design open channels for non-uniform flow water surface profiles and dissipation of energy in hydraulic jump.
- CO5 Select the type of pumps and turbine required with reference to available head of water and discharge
- CO6 Able to define the relationship between dimensional magnitude contained in mass, force and acceleration and empirical constants linking various dimensionless parameters.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	1	-	1	1	-	-	-	1	2	1	1	-
CO2	-	-	1	1	-	2	1	-	-	-	1	2	1	1	-
CO3	2	2	2	2	2	2	2	-	-	-	1	2	1	2	1
CO4	1	-	-	2	-	-	1	-	1	-	3	2	2	1	-
CO5	-	2	-	-	2	1	-	1	1	1	-	-	1	-	2
CO6	-	1	-	-	2	-	-	1	-	-	1	-	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi.
2. Bansal, R.K., Fluid Mechanics, Laxmi Publication, New Delhi.

Reference Books:

1. Streeter, V.L. and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1985, New York.
2. Subramanya, K., Theory and Applications of Fluid Mechanics, Tata-McGraw Hill Publishing Co., New Delhi, 1993.
3. Shaughnessy, E.J., Katz, I.M. and Schaffer, J.P., Introduction to Fluid Mechanics, SI edition, Oxford University Press, New Delhi, 2005.
4. White, F.M. Fluid Mechanics, McGraw Hill Publication, New York.
5. Kumar, D.S., Fluid Mechanics, S.K.Kataria & Sons Publication.
6. Rajput, R.K., Fluid Mechanics, S. Chand & Co. Publication.
7. Modi, P.N. and Sheth, Fluid Mechanics & Hydraulic Machines, Standard Book House.
8. Ramamurtham, S., Hydraulic Fluid Mechanics & Fluid Machines, Dhanpatrai Publishing Co. Publication.
9. Garde, R.J. and Mirajgaoker, A.C., Engineering Fluid Mechanics, New Chand & Sons Publication.

Web Materials:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Guwahati/fluid_mechanics/index.htm
2. <http://nptel.iitm.ac.in/video.php?subjectId=105101082>
3. <http://www.mvsengineering.com>
4. <http://nptel.iitm.ac.in/courses/IIT-MADRAS/Hydraulics/index.php>
5. <http://nptel.iitm.ac.in/video.php?subjectId=105103096>

CL373: AIR POLLUTION AND CONTROL
B. TECH 5th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours / week	03	02	05	04
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Air Quality: History, Definitions, Characteristics and Perspectives	04
2	Sources and Effects of Air Pollution	06
3	Meteorological Aspects of Air pollution	06
4	Transport of Pollution in Atmosphere	07
5	Sampling and analysis of Air Pollutants	05
6	Air Pollution Control Systems	12
7	Air Pollution Legislation	02
8	Current Global Issues of Air Pollution	03

Theory Hours: 45
Laboratory Hours: 30
Total Hours: 75

B. Detailed Syllabus:

- 1 Air Quality: History, Definitions, Characteristics and Perspectives 04 Hours 08%
 - 1.1 Composition of dry ambient air properties of air, function of air, definition of pollution
 - 1.2 Air pollution – historical overview
 - 1.3 Air pollutants – classification
 - 1.4 Global and national scope of the problem- general, urban, rural and specific
 - 1.5 Air quality management concept

2	Sources and Effects of Air Pollution	06 Hours	10%
2.1	Air pollutants – sources		
2.2	Units for measurement of air pollution, Emission factors		
2.3	Major pollutants from different sources in Gujarat		
2.4	Effects of air pollution on human health, plants , animals, properties and visibility		
2.5	Economic effects of air pollution		
2.6	Indoor air pollution and personal exposure to air pollution		
2.7	Simple numerical problems based on COH, CoHb		
3	Meteorological Aspects of Air Pollution	06 Hours	16%
3.1	Introduction to meteorology: Global winds, Hadley cells, wind rose terrestrial wind profile		
3.2	Effects of terrain and topography on winds		
3.3	Atmospheric stability and instability		
3.4	Theory and application of acoustic sounding (SODAR) technique		
4	Transport of Pollution in Atmosphere	07 Hours	16%
4.1	Lapse rate		
4.2	Plume behaviour under different atmospheric conditions		
4.3	Plume behaviour in valley and terrains		
4.4	Maximum mixing depths		
4.5	Mathematical models of dispersion of air pollutants		
4.6	Stack design		
5	Sampling and analysis of Air Pollutants	05 Hours	12%
5.1	Methods and Instruments for sampling and analysis of air for stack and ambient air monitoring		
6	Air Pollution Control Systems	12 Hours	25%
6.1	Air Pollution control at source		
6.2	Equipment for control of air pollution : For particulate matter - Settling chambers - Fabric filters - Scrubbers - Cyclones - Electrostatic precipitators		
6.3	For Gaseous pollutants : control by absorption - adsorption - scrubbers - secondary combustion after burners		

- 6.4 Working principles advantages and disadvantages
- 6.5 Design criteria and examples
- 6.6 Fugitive Emissions – sources and control , odour control
- 7 **Air Pollution Legislation** 02 Hours 06%
- 7.1 Government of India: air pollution laws
- 7.2 Indian standards- emission and air quality standards
- 7.3 Role of pollution control boards
- 8 **Current Global Issues of Air Pollution** 03 Hours 07%
- 8.1 Greenhouse effect, Ozone depletion, heat island, dust storms
- 8.2 Automobile pollution sources and control
- 8.3 Photochemical smog
- 8.4 Future engines and fuels

C. Course Outcomes:

On the successful completion of this course,

- CO1 The students will be able to classify the sources of air pollution, describe effects, various methods and equipment available for controlling air pollution.
- CO2 The students will recognize the diverse knowledge of air pollution control practices applied to real life problems.
- CO3 The students will be able to review the theories and practical aspects of air pollution control along with the applications and further, they shall have an ability to plan air pollution control systems.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	-	2	-	-	-	-	-	-	-	1	-	-	-
CO2	3	2	-	3	-	3	-	1	-	1	1	3	2	2	2
CO3	1	3	3	3	2	3	3	3	3	3	2	3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

- Peavy, Howard S., Donald R. Rowe, and George Tchobanoglous. 1985. *Environmental Engineering*. McGraw-Hill, New York (Latest edition)

2. Rao, C.S. 2007. *Environmental pollution control Engineering*. New Age International, New Delhi (Latest edition)
3. Rao. M. N. and Rao, H. V. N. 2007. *Air Pollution*. Tata McGraw Hill Publication, New Delhi (Latest edition)

Reference Books:

1. Government of India's Publication of laws related to air pollution, Gujarat Pollution Control Board's (GPCB) Publication of standards. Indian Standards relevant to Air Pollution Monitoring.
2. David H.F. Liu, Bela G. Liptak. 2016 Special Indian Edition. *Environmental Engineers' Handbook* Part 1 and Part 2, CRC Press LLC, Florida
3. Doren, K. L. 2016. *Air Pollution*, CBS Publishers and Distributors, New Delhi
4. Wark, K., & Warner, C. F. 1981. *Air pollution: its origin and control*. Harper & Row, New York (Latest edition)
5. Parker, A. 1978. *Industrial Air Pollution Handbook*. Tata McGraw Hills Publication, New Delhi (Latest edition)
6. Wang, Lawrence K., Pereira, Norman C., Hung, Yung-Tse. 1979. *Handbook of Environmental Engineering*. Vol. 1 , Air and Noise Pollution Control, The Humana Press, Clifton, New Jersey (Latest edition)
7. Brauer, H. and Verma, Y. B. G. 1981. *Air Pollution Control Equipment*. Berlin Heidelberg, New York (Latest edition)
8. Richard C. Flagan & John H. Seinfeld. *Fundamentals of Air Pollution engineering*. 1988. Prentice Hall, Englewood Cliffs, N.J (Latest edition)
9. Roy M. Harrison. *Pollution: Causes, Effects and Control*. 2000. Royal Society of Chemistry, Cambridge (Latest edition)

Web Material:

1. <<http://cpcbenvi.nic.in/airpollution/database.htm>>
2. <<http://cpcb.nic.in/>>
3. <<http://www.gpcb.gov.in/>>
4. <<http://nptel.ac.in/courses/105104099/>>
5. <<http://nptel.ac.in/courses/105102089/8>>
6. <<http://www.envfor.nic.in/legis/air/air1.html>>

7. <<http://www.indiacode.nic.in/acts-in-pdf/2015/201503.pdf>>

8. <<http://envfor.nic.in/>>

LIST OF EXPERIMENTS

Sr. No.	Title of Experiment
1	Introduction to Air Quality Monitoring and Air Quality Standards
2	Determination of Wind Direction and Speed
3	Monitoring of Suspended Particulate Matter
4	Monitoring of Respirable Particulate Matter (PM ₁₀ , PM _{2.5} and PM _{1.0})
5	Monitoring of Gaseous Air Pollutants in Ambient Air: Oxides of Nitrogen
6	Monitoring of Gaseous Air Pollutants in Ambient Air: Sulphur Dioxide
7	Monitoring of Gaseous Air Pollutants in Ambient Air: Carbon Monoxide
8	Monitoring of Stack for Particulate Matter
9	Monitoring of Stack for Gaseous Pollutants
10	Automobile Exhaust Monitoring

CL374: ARCHITECTURAL DESIGN OF FACILITIES
B. TECH 5th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Architectural Design	12
2	Architectural Detailing	15
3	Architectural Facilities	18

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1	Architectural Design	12 Hours	25 %
1.1	The Site: Challenges and Opportunities		
1.2	Site Design and Environmental Analysis		
1.3	Sustainable Infrastructure		
1.4	The Skin: Materials and Techniques		
1.5	Evolving a Sustainable Design Practice		
1.6	Sustainable Design and Existing Buildings		
2	Architectural Detailing	15 Hours	40%
2.1	General Planning and Design Data		
2.2	Site work		
2.3	Masonry		
2.4	Metals		
2.5	Wood and Plastics		

- 2.6 Thermal and Moisture Protection
- 2.7 Doors and Windows
- 2.8 Interior Stairs and Stairwells
- 2.9 Specialties
- 2.10 Conveying Systems
- 2.11 Electrical
- 2.12 Energy and Environmental Design
- 2.13 Layout of Plates
- 2.14 Exterior Details
- 3 Architectural Facilities 18 Hours 35%
- 3.1 Controlling Water
- 3.2 Controlling Air
- 3.3 Controlling Heat Flow
- 3.4 Controlling Water Vapor
- 3.5 Controlling Sound
- 3.6 Accommodating Movement
- 3.7 Providing Structural Support
- 3.8 Providing Passages For Mechanical and Electrical Services
- 3.9 Health and Safety

C. Course Outcomes:

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

- CO1 Use basic architectural principles in the design of buildings, interior spaces and sites
Understand the western architectural canons and traditions in architecture, landscape and urban design as well as the climatic, technological, socioeconomic and other cultural factors that have shaped and sustained them
- CO2
- CO3 Read architectural drawings and make technically precise drawings.

Course Articulation Matrix:

	PO 1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	-	1	2	1	2	2	2	1	1
CO2	-	-	3	-	-	3	3	2	2	-	1	2	-	1	3
CO3	3	2	3	2	2	1	-	-	2	1	2	3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Daniel E. Williams., Sustainable Design: Ecology, Architecture, and Planning, John Wiley & Sons, 2007.
2. Charles George Ramsey, Harold Reeve Sleeper, Architectural Details: Classic Pages from Architectural Graphic Standards 1940 – 1980, Wiley, 2001.
3. Louis Rouillion, Charles George Ramsey, Architectural Details: Classic Pages from Architectural Graphic Standards 1940 – 1980, J. Wiley, 1924.
4. Edward Allen, Patrick Rand, Architectural Detailing: Function, Constructibility, Aesthetics, John Wiley & Sons, 2016.

Reference Books:

1. Rangwala S. C., Building Construction, Charotar Publishing House, Anand.

LIST OF TUTORIALS

Sr. No.	Details
1	Internet Case studies of sustainable buildings like Suzlon One Earth, Pune, ZED housing, Bangalore etc. (Group work)
2	Study of green building rating systems like GRIHA, TERI, LEED etc. (Individual Work)
3	Study of materials that can bring sustainability like solar panels, wind mills etc. (Group work)
4	Case study and model making on: (Group Work) A. DOORS: Types of doors, its use, materials and joinery details B. EXTERIOR DETAILS: Type of paints finishes, alco panels, aluminum panels, glass etc. C. MASONRY: Brick masonry detail and types of brick bonds D. METALS: Types of metals and its use in building construction E. INTERIOR STAIRCASES: Study and analysis of staircases used in interior spaces F. EXTERIOR STAIRCASES: Study and analysis of staircases used in exterior spaces F. ELECTRICAL SYSTEMS: Electric conducting systems, types of conduits used in construction and interior designs
5	To make a detail report on one building/mall that depicts all the Architectural facilities like; HVAC (Heating Ventilation and Air Conditioning), AHU (Air Handling Units), Fire safety

	measure and fire Exits, Plumbing and Sanitation, Structural layout, Mechanical Services, Water supply services etc. (Group work)
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CL375: BUILDING SERVICES
B. TECH 5th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Building Services	5
2	Plumbing Services in Buildings	8
3	Mechanical Services in Buildings	10
4	Illumination, Fire Protection, Acoustic and Sound Insulations	12
5	Heating, Ventilation and Air Conditioning (HVAC)	10

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

B. Detailed Syllabus:

- | | | | |
|-----------|---|-----------------|------------|
| 1. | Introduction to Building Services | 05 Hours | 11% |
| 1.1 | Definitions, Objective and uses of services | | |
| 1.2 | Applications of services for different types building considering | | |
| 1.3 | Classification of building services | | |
| 1.4 | Types of services and selection of services | | |
| 2 | Plumbing Services in Buildings | 08 Hours | 18% |
| 2.1 | Elements of plumbing | | |
| | Objectives of plumbing, purpose of plumbing, role of plumber, licensing of plumbers their functions, sewer Air, supply pipes, drainage & vent pipes application for obtaining supply connection | | |

2.2 Pipes joints & fittings

Introduction. Types of Pipe – G.I. Pipes, PVC Pipes, Copper pipes, C.I. Pipes, A.C. Pipes, prestressed concrete pipes, joints in pipes, method of fixing pipes such as G.I. fitting C.I. fitting

2.3 Valves & Terminal Fittings

Types of valves & its purpose, sluice valve, reflux valve, scour valve, Air relief valve, pressure relief valve, gate valves, Bio-taps & stop valve self-closing valve. Flush valve, mixing valve

2.4 Sanitary fixture & Building drainage system

Building sanitary fittings – water closet, flushing appliances, urinals, washbasins, flushing cisterns, principles of building drainage, siphonic action, traps & its types, capacity & sizing of pipe, soil pipe, waste pipe, rain water pipe, system of plumbing, Installation of pipes, testing of pipes

3. Mechanical Services in Buildings

10 Hours 22%

3.1 Introduction of mechanical services

3.2 **Lifts:** Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts- Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push

3.3 **Elevators & Escalators:** Different types of elevators and Escalators, Freight elevators, Passenger elevators, Hospital elevators, Uses of different types of elevators Escalators

3.4 **Pumps:** Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance

3.5 **Conveyors:** Different types of Conveyors, Uses of different types of Conveyors

4. Illumination, Fire Protection, Acoustic and Sound Insulations

12 Hours 27%

4.1 Natural and artificial lighting- principles and factors, Arrangement of luminaries, Distribution of illumination, Utilization factors

4.2 Causes of fire and Effects of fire, General Requirements of Fire

Resisting building as per IS and NBC 2005., Characteristics of Fire resisting materials, Maximum Travel Distance, Fire Fighting Installations for Horizontal Exit, Roof Exit / Fire Lifts, External Stairs

4.3 Requirement of good Acoustic, Various sound absorbers, Factors to be followed for noise control in residential building

5. Heating, Ventilation and Air Conditioning (HVAC) 10 Hours 22%

5.1 Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls

5.2 Ventilation: Definition and necessity, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, Types of Air Conditioners, (Central type, Window Type, Split Unit)

C. Course Outcomes:

On successful completion of this course

- CO1 The students will acquire competencies to plan various types of services required for different types of building.
- CO2 Students will be able to manage building services provisions in big construction sites.
- CO3 Students will be able to synchronize the construction activities with installation of building services.
- CO4 Students will learn the needs of a building occupant in an enclosed built environment regarding; thermal comfort, indoor air quality, fire safety, electric usage and wet area usage.
- CO5 Students will gain technological solution alternatives and knowledge of equipment in the market for ventilation, heating, cooling techniques, building service systems.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO4	1	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO5	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Building Services by S. M. Patil, Seema Publication, Mumbai, Revised edition.
2. Building Construction by Dr. B. C. Punmia, Laxmi Publications (P) Ltd., New Delhi.
3. Water supply and Sanitary Engineering by S. K. Garg, Delhi.

Reference books

1. A text book on Building Services by R. Uday kumar. Eswar Press, Chennai.
2. Building Construction by P. C. Varghese PHI Learning (P) Ltd., New Delhi.
3. Elements of Public Health Engineering, by K. N. Duggal, New age international.
4. Building repair and Maintenance Management by P. S. Gahlot CBS Publishers & Distribution (P) Ltd.
5. Building Construction by Charotar publishing House, Anand.
6. A to Z of practical building and its management by Sandeep Mantri, Mantri Institute of Development & Research, Pune.
7. Building Systems for Interior Designers by Corky Binggeli, John Wiley & Sons, 2003.

Web Material:

1. www.academia.edu
2. www.nptel.iitm.ac.in
3. [http://en.wikipedia.org/w/index.php?title=Dumbwaiter \(elevator\)&oldid=62176813](http://en.wikipedia.org/w/index.php?title=Dumbwaiter_(elevator)&oldid=62176813)
4. www.bis.org.in/sf/nbc.htm
5. cpwd.gov.in/Units/handbook.pdf
6. <http://www.civilengineeringnews.tk/2014/07/methods-of-demolition-of-building.html>
thecontractor.org

LIST OF PRACTICALS / EXERCISE

Tutorials	Tutorial 1	Introduction to building services
	Tutorial 2	Draw diagrams of various plumbing fixtures.
	Tutorial 3	Identify proper locations for Lift/ Escalator/ Elevator in a given commercial complex
	Tutorial 4	Prepare a case study for the firefighting services for commercial building.

	Tutorial 5	Suggestions for noise control methods for a given commercial complex
Seminar	Seminar on course related topic to be given to a group of students not more than three. Students have to present/ defend the seminar in front of teachers and students. This work should be accompanied in the submission	
Site visit	Visit a residential building & commercial building under construction and study the services like mechanical, plumbing, HVAC, Fire safety, acoustics and related allied services of civil engineering and prepare site visit detailed report	

CL381: INFRASTRUCTURE MANAGEMENT
B. TECH 5th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction and Infrastructure scenario	04
2	An overview of Basic Concepts Related to Infrastructure: Urban Infrastructure	10
3	Strategies for Successful Infrastructure Project Implementation	09
4	Private Involvement in Infrastructure	06
5	Infrastructure Economics and Finance	05
6	Infrastructure Risk Management	06
7	Infrastructure Maintenance	05

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1	Introduction and Infrastructure scenario	04 Hours	09%
1.1	Types of Infrastructure		
1.2	Role of Infrastructure		
1.3	Need and scenario of infrastructure		
1.4	Infrastructure crisis		
2	An overview of Basic Concepts Related to Infrastructure: Urban Infrastructure	10 Hours	22%

2.1	An overview of the Power Sector in India, Water Supply and Sanitation Sector in India, Road, Rail, Air and Port Transportation Sectors in India and Telecommunications Sector in India.		
2.2	An overview of the urban infrastructure in India, rural infrastructure in India		
2.3	Legislations pertaining to urban infrastructure		
2.4	State of urban and rural infrastructure		
2.5	Strategies to improve infrastructure in rural areas		
2.6	Stages of an Infrastructure Project Lifecycle		
3	Strategies for Successful Infrastructure Project Implementation	09 Hours	20%
3.1	Shaping the Planning Phase of Infrastructure Projects to mitigate risks		
3.2	Sustainable Contracts		
3.3	Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects		
3.4	Sustainable Development of Infrastructure, Information Technology and Systems for Successful Infrastructure Management		
3.5	Capacity Building and Improving the Governments Role in Infrastructure Implementation		
4	Private Involvement in Infrastructure	06 Hours	11%
4.1	Overview		
4.2	Benefits		
4.3	Problems and challenges of infrastructure privatization		
4.4	Privatization of Infrastructure in India – Case Study		
5	Infrastructure Economics and Finance	05 Hours	18%
5.1	Principles of finance		
5.2	Infrastructure economics		
5.3	Introduction to project finance		
6	Infrastructure Risk Management	06 Hours	11%
6.1	Risks in infrastructure		
6.2	Quantitative risk analysis		

6.3 Qualitative risk management

6.4 Risk management strategies

7 Infrastructure Maintenance

05 Hours

9%

7.1 Introduction to Infrastructure maintenance

7.2 Need and requirement for Infrastructure maintenance

7.3 Preventive techniques for maintenance

C. Course Outcome (COs) :

On the successful completion of this course

CO1 Students will be able to understand an overview of basic concepts of infrastructure and its scenario.

CO2 Students will be able to describe the strategies for successful infrastructure project implementation.

CO3 Students will be able to explain the role of private sector in infrastructure growth.

CO4 Students will be able to know about infrastructure economics and finance.

CO5 Students will be able to identify and manage risks involved in infrastructure.

CO6 Students will be able to execute maintenance of infrastructure.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	1	-	-	-	-	-	-	1	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	1	-	-	-	1	-	-	-	-	-	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-
CO5	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-
CO6	1	-	1	-	-	-	-	-	-	-	-	-	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford
2. P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill
3. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill

Reference Books:

1. Ronald W Hudson, "Infrastructure Management: integrating design, Construction, maintenance, rehabilitation and renovation", MGH, 1st Edition, 1997
2. L. Squire and H. G.van der Tak, Economic analysis of projects, John Hopkins University Press, London, 1975.
3. J. D. Finnerty, Project financing - Asset-based financial engineering, John Wiley & Sons, New York, 1996.

Web Materials:

1. Ministry of Urban Development: <http://moud.gov.in/>
2. Indian Infrastructure Finance Company Limited: <http://www.iifcl.co.in/>
3. Ministry of Shipping: <http://shipping.nic.in/index.php>
4. Indian Ports Association: <http://www.ipa.nic.in/abou.htm>
5. National Maritime Foundation: <http://www.maritimeindia.org>
6. India Maritime 2015: <http://www.indiamaritime.in>
7. <http://nptel.ac.in/courses/105106115/>

Term Work

Term work will be based on above syllabus with seminar/group project to be incorporated.

CL382: DISASTER PREPAREDNESS & PLANNING MANAGEMENT
B. TECH 5th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - I

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Disaster Management	6
2	Role of Remote sensing, Geographical Information System and Information Technology in Disaster Management	10
3	Risk Assessment and Vulnerability Analysis	10
4	Disaster Preparedness and Response	8
5	E-Governance and Emerging Technology in Disaster Management	6
6	Community Linkage in Disaster Management	5

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

- 1 Introduction to Disaster Management** 6 Hours 13%
- 1.1 Concepts of : Hazard, Risk, Vulnerability, Disaster
- 1.2 Natural and Manmade Disasters – Meaning, Types and effects
- Hydrological Disasters – Flood, Flash flood, Drought, Cloud burst, Cyclone, Storm, Storm surge, Tidal waves
- Geological Disasters – Earthquakes, Tsunamis, Landslides, Avalanches, Volcanic eruptions, Mudflow
- Climatic Change, Global Warming, Sea Level Rise, Ozone Depletion, Deforestation, Industrial Waste, Heat and Cold Waves

CBRN – Chemical disasters, Biological disasters, Radiological disasters, Nuclear disasters, Road accidents, Rail accidents, Air accidents, Sea accidents, Armed conflicts, Technological disasters

Fire – Building, Coal, Forest, Oil fire

Pollution – Air, Water, Soil pollution

1.3 Importance, Dimensions & Scope of Disaster Management

1.4 Disaster Management Cycle

1.5 Disaster and Development

2 Role of Remote Sensing, Geographical Information System and Information Technology in Disaster Management 10 Hours 22%

2.1 Definition of GIS, Concept of Space and Time, Spatial data, Map Projection and Datum, Domains of Spatial information system, Components of GIS (Hardware, Software, Data, People and Process), GIS Functionalities for end user / system (Data Acquisition, Data Input, Data Management, Data Analysis, Data Modeling and Data Output), Web based GIS Technology

2.2 Introduction to Remote Sensing, Fundamentals of Remote Sensing, Electromagnetic Radiation, Electromagnetic Spectrum, Energy interaction with Atmosphere, Energy interaction with Earth Surface, Platform and Sensors, Characteristics of Image, Image Interpretation and Analysis – Visual Image Interpretation & Digital Image Processing, Microwave Remote Sensing, Indian Remote Sensing Satellites

2.3 Importance of Information in Disasters :

Methods of collecting relevant information – libraries, internet, interviews questionnaires, survey, observation, Mass media, Meetings, Role of Information from disaster affected community

2.4 Organizing an effective dissemination of information: feedback for improving information, Role of Communication in Disasters, Types of communication in case of disasters – HAM radio, Satellite, Video Conferencing, Electronics devices

3 Risk Assessment and Vulnerability Analysis 10 Hours 22%

3.1 Risk Concepts, Elements Of Risk, Perception of Risk, Acceptable risk, Requirements in Risk assessment

- 3.2 Risk analysis techniques; Process of Risk assessment, Analytical systems for risk assessment, Natural hazard/ risk assessment, Understanding climate risk, Mapping of risk assessment, Decision making for risk reduction, Problems in risk assessment
- 3.3 Observation and perception of vulnerability – Vulnerability Identification, Vulnerability types and dimensions, Vulnerability – Social factors and economic factors
- 3.4 Strategic development for Vulnerability reduction :
Physical & Social infrastructure for vulnerability reduction,
Hazard resistant designs and construction, Systematic management and Strategic planning for vulnerability reduction
- 4 Disaster Preparedness and Response 8 Hours 18%**
- 4.1 Disaster Preparedness: concept and significance
- 4.2 Essentials of Disaster Preparedness Plan
- 4.3 Disaster Response Plan – Communication, Participation, and Activation of Emergency Preparedness Plan, Search, Rescue, Evacuation and Logistic Management
- 4.4 Relief and Recovery, Psychological Response and Management (Trauma, Stress, Rumor and Panic)
- 5 E-Governance and Emerging technology in Disaster Management 6 Hours 13%**
- 5.1 E-Governance : Concept and Significance
- 5.2 E-Governance in Urban and Rural Development
- 5.3 ICT Implementation in Governance: Issues and Challenges
- 6 Community Linkage in Disaster Management 5 Hours 12%**
- 6.1 Community Based Disaster Management, Human Behavior and Response: Individual, Community, Institutional
- 6.2 Community Participation and Awareness
- 6.3 Community Health During Disasters : Drinking Water, Food and Nutrition, Hygiene and Sanitation
- 6.4 Soft skills for Disaster Manager : Leadership and Coordination, Life skills, Time Management Skills

C. Course Outcomes (COs):

On the completion of the course one should be able to:

- CO1 To become familiar with definitions and terms used within the disciplines of disaster preparedness and emergency management.
- CO2 To understand the scope and extent to which disasters and emergencies influence the social and political environment.
- CO3 To know the scope of modern technologies in disaster management
- CO4 To understand planning, mitigation, in-crisis decision making, evacuation, response, and recovery within the leadership during an event.
- CO5 To illustrate knowledge about development of viable plans and appropriately consider management options for disaster planning and emergency management.

Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	1	1	1	-	1	1	-	-	1	1	2	1	1	-
CO2	-	1	1	1	-	2	1	-	1	-	1	3	1	-	-
CO3	-	1	1	2	2	2	2	-	-	-	1	2	1	1	1
CO4	1	3	2	1	2	2	3	-	1	3	-	2	1	1	2
CO5	2	2	2	1	-	3	2	1	1	1	3	3	2	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Singh Jagbir, Disaster Management Future challenges and opportunities, I K International Pub.
2. Pandey Mrinalini, Disaster Management 1st ed. Wiley India
3. Joseph George, Fundamentals of Remote Sensing, Universities Press.

Reference Books:

1. Natural Disaster Hotspots A Global Risk Analysis, The World Bank
2. Sahni Pardeep, Disaster Risk Reduction in South Asia, Prentice Hall of India.
3. Gupta Harsh K, Disaster Management, Universities Press
4. Modh Satish, Introduction to Disaster Management, Macmillan Pub
5. Sensarma Suman Ranjan, Disaster Risk Management Conflict And Cooperation, Concept Publishing Company
6. Modh Satish, Citizens Guide to Disaster Management, Macmillan Pub.
7. Panchal Priyank K., State Disaster Resource Network, Macmillan Pub.

8. Shah Riddhi, State Disaster Resource Network (UNDP), Macmillan Pub.
9. Sulphey M M. Disaster Management, PHI Learning
10. Sharma Sanjay K., Environment Engineering and Disaster Management, University Science

Web Materials:

1. Geneva: Sphere Project. <https://www.spherestandards.org/handbook-2018/>
2. <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>
3. <https://gidm.gujarat.gov.in/>
4. <https://ndma.gov.in/en/>
5. <https://www.undrr.org/>

List of Tutorials

Experiment No.	Name of Tutorial
1	Role of Engineers in Disaster Management
2	Study of Recent Disasters : at state level, preparation of Disaster Risk Management Plan of an Area or Sector
3	Study of Recent Disasters : at national level, preparation of Disaster Risk Management Plan of an Area or Sector
4	Study of Recent Disasters : at international level, preparation of Disaster Risk Management Plan of an Area or Sector
Global-National-State level Case Studies in Disaster Management	
1	Japan's Tohoku Earth Quake (2011) and Nepal Earthquake (2015)
2	East Africa Drought (2011)
3	Indian Ocean Earthquake (2004)(Tsunami) and Gujarat Earthquake (2001)
4	Uttarakhand Flash Floods and Kashmir Floods
5	Drought Management in Gujarat & Rajasthan
6	Landslides in Shiwalik Hills Case Study
7	Avalanches in Jammu and Kashmir: Case Studies
8	Pukhrayan train derailment 20 November 2016 and Bhopal Gas Tragedy
9	Case studies as per the interest and suggestions from the students
10	Case studies as per the interest and suggestions from the students

B. Tech. (Civil Engineering) Programme

SYLLABI (Semester – 6)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CL35I: ENVIRONMENTAL ENGINEERING- I
B. TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	1	7	5
Marks	100	50		150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Environmental Engineering	02
2	Water Demands and Sources of Water	06
3	Water Conveyance and Distribution Systems	08
4	Quality and Treatment of water	14
5	Sewage: Quality, Collection and estimation of discharge	06
6	Unit operations/ processes for sewage treatment	10
7	Design of sewage treatment units	10
8	Plumbing and House Drainage	04

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

B. Detailed Syllabus:

1	Introduction to Environmental Engineering	02 Hours	04%
1.1	Scope of Environmental Engineering, Environmental Ethics and Role of Environmental Engineer		
1.2	Necessity of planned water supply and Sewerage System		
2	Water Demands and Sources of Water	06 Hours	10%
2.1	Various types of water demands & factors affecting per capitademand, Sources of water, Impurities in water		
2.2	Variations in Demand & Design Periods		

2.3	Population Forecasting Methods, Examples		
3	Water Conveyance and Distribution Systems	08 Hours	13%
3.1	Water Intake Structures-Types and design		
3.2	Types of Conduits, Flow in pipe systems and types of pressure pipes		
3.3	Distribution System-Requirements, layouts and methods		
3.4	Distribution Reservoirs-functions, types and determination of storage capacity		
4	Quality and Treatment of water	14 Hours	23%
4.1	Water Quality Parameters and Standards for drinking water		
4.2	Layout of water treatment plant, Design period, and factors considered for selection of design period. Treatment plant site selection, factors considered, selection of treatment train		
4.3	Plain sedimentation, aeration, sedimentation tank & its design, sedimentation with coagulation, types of coagulants, optimum dose of coagulants, mixing devices, design of flocculation unit. theory of filtration, types of filters and their comparison, design of rapid sand filter, washing of filter, methods of disinfection, methods of removing hardness Computation of dose of chemicals for removal of hardness		
5	Sewage: Quality, Collection and estimation of discharge	06 Hours	10%
5.1	Characteristics - physical, chemical, biological		
5.2	Standards for effluent disposal & receiving water body		
5.3	Different types of sewers, sewerage systems, variation in sewage flow, sewer appurtenance, estimation of wastewater discharge in a sewer, separate and combined sewerage systems and design of sewers		
6	Unit operations/ processes for sewage treatment	10 Hours	17%
6.1	Layout plan and section of sewage treatment plant		
6.2	Physical unit operation screening, flow equalization, mixing, flocculation, sedimentation		
6.3	Chemical unit processes: chemical precipitation		

6.4 Biological unit processes: Aerobic attached growth and aerobic suspended growth treatment processes, anaerobic suspended growth treatment processes low cost sanitation systems, septic tanks, soak pit, stabilization ponds

7 Design of sewage treatment units **10Hours** **17%**

7.1 Design of racks, screens, grit chamber, aeration units, primary & secondary clarifiers, activated sludge plant and trickling filter units, rotating biological contactors

7.2 Sludge dewatering units, sludge digesters and drying beds

8 Plumbing and House Drainage **04Hours** **06%**

8.1 Principles of Plumbing and House Drainage, House drainage plan for residential building

8.2 Types of Traps

C. Course Outcomes:

On the completion of the course one should be able to understand

CO1 The water quality criteria and standards with their relation to public health and environment.

CO2 Water and sewage characteristics and their relation with treatment process selection.

CO3 To understand the design principles involved in treatment of water and sewage

CO4 To apply appropriate breadth and depth of skills in identification of engineering problems designed with realistic constraints and contribute to sustaining and improving community.

CO5 To improve written communication and design skills by preparing a preliminary design report of water and sewage treatment plant units.

CO6 The fundamentals of plumbing and house drainage system.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-		1
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-		1
CO3	3	3	3	-	-	-	2	-	-	-	3	-	3	2	1
CO4	-	3	3	2	1	3	3	3	2	-	3	3	3	2	3

CO5	-	-	-	2	1	1	2	2	3	3	-	3	-	-	3
CO6	3	-	-	-	-	-	1	1	-	-	1	-	3	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Book:

1. Garg, S.K., Environmental Engg. Vol. – I & II, Khanna Publications.
2. Punmia, B.C., Environmental Engg. Vol. - I & II, Laxmi Publications.
3. Peavy, Rowe and Tchobanoglous, Environmental Engg, Tata Mcgraw Hill.

Reference Books:

1. Bhole, A.G., Water Treatment Plant Design, Indian Water Works Association.
2. Dix, H.M., Environmental Pollution, Edward Arnold Publishers Ltd.
3. Mackenzie L. Davis, David, A. Cornwell, Introduction to Environmental Engineering, TataMcgraw Hill Publications.
4. Sanitary Engg. and Sewage Treatment, Manual, Ministry of Works & Housing, New Delhi
5. Chaterjee, A.K., Environmental Engg, Khanna Publishers.
6. Steel, E.W. and McGhee, T.J., Water Supply & Sewerage, McGraw-Hill College.
7. Water Supply and Treatment, Manual, Ministry of Works and Housing, New Delhi.
8. Wastewater Engineering Treatment, Disposal, Refuse: Metcalf and Eddy, Tata McGrawHill Publishers, New Delhi, 1995.
9. Introduction to Environmental Engineering :P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition
10. CPHEEO Manual on Sewage and Treatment

Web Materials:

1. <http://nptel.iitm.ac.in>
2. <http://www.epa.gov>
3. <http://www.nesc.vu>
4. <http://www.indiaenvironmentportal.org.in>
5. <http://www.filtersource.com>
6. <https://dgserver.dgsnd.gov.in>

List of Experiments

Experiment No.	Name of Experiment
A	Analysis of Water and Sewage Samples
1.	Determination of pH, Turbidity and Conductivity
2.	Determination of Solids
3.	Determination of Acidity and Alkalinity
4.	Determination of Hardness
5.	Determination of Chlorides and Residual Chlorine
6.	Determination of Dissolved Oxygen (DO) and Bio chemical Oxygen Demand (BOD)
7.	Determination of Chemical Oxygen Demand (COD)
8.	Determination of Oil and Grease
9.	Determination of Optimum Coagulant Dose by Jar Test
10.	Determination of Nitrate and Sulphate
11.	Determination of Most Probable Number (MPN)
B.	Design Problems on Water and Sewage Treatment Plant Units

CL346: GEOTECHNICAL ENGINEERING-I
B. TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	02
2	Origin & Evolution of Soil	03
3	Index Properties & Plasticity Characteristics	07
4	Soil water	06
5	Compaction	08
6	Shear Strength	10
7	Consolidation	09

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1	Introduction	02 Hours	06%
1.1	Historical Development of Soil Engineering		
1.2	Importance of Soil Engineering		
1.3	Major soil deposit in India		
2	Origin & Evolution of Soil	03 Hours	10%
2.1	Origin and General types of soils		
2.2	Geological cycle, physical and chemical agencies for soil		
2.3	Soil structure & Clay minerals		
3	Index Properties & Plasticity Characteristics	07 Hours	15%
3.1	Three phase diagram of soil		

3.2	Volumetric relationship and Weight – Volume relationships		
3.3	Determination of different index properties		
3.4	Grain size distribution by sieve analysis, Hydrometer analysis		
3.5	Atterberg's Limits and indices		
3.6	Activity, sensitivity & thixotropy of soil		
3.7	Different classification systems: Textural Classification, AASHTO classification, Unified soil classification, IS classification		
3.8	Field Identification of soil		
4	Soil water	06 Hours	14%
4.1	Types of soil water, capillary phenomena		
4.2	Concept of effective and neutral stresses		
4.3	Permeability of soil, Darcy's law, Factors affecting permeability		
4.4	Seepage velocity, Permeability of Stratified soil		
4.5	Tests for determination of coefficient of permeability in field and laboratory		
4.6	Seepage pressure, quick sand phenomenon and piping		
4.7	Introduction of flow net		
5	Compaction	08 Hours	16%
5.1	Definition and importance, factors affecting compaction, Influence of compaction on soil properties		
5.2	Laboratory compaction test, relative density and its determination		
5.3	Field compaction and its control,		
6	Shear Strength	10 Hours	20%
6.1	Definition, Mohr strength theory, Mohr-coulomb's strength theory		
6.2	Shear test based on drainage condition		
6.3	Factors affecting shear strength of granular and cohesive soil		
6.4	Direct shear test, Triaxial compression test, unconfined compression test, vane shear test		
7	Consolidation	09 Hours	19%
7.1	Compressibility of soil & its type, mechanism of consolidation		
7.2	Assumptions and Terzaghi's one dimensional consolidation theoretical equation		
7.3	One dimensional consolidation test, Co-efficient of consolidation and		

its determination, determination of pre-consolidation pressure

7.4 Consolidation settlement, rate of settlement for uniform pressure increment in a clay layer

7.5 Introduction to secondary compression

C. Course Outcomes (COs):

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

CO1 students will be able to evaluate soil properties by performing various experiments

CO2 students will be able to carry out soil classification

CO3 students will be able to solve practical problems related to permeability, seepage and consolidation settlement,

CO4 Students will be able to relate soil properties to workout theoretical soil strength with confidence.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	-	-	-	-	-	-	-	-	-	1	1	-
CO2	1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Arora, K.R., Soil Mechanics & Foundation Engineering, Standard Publication, New Delhi.
2. Punamia, B.C., Soil Mechanics & Foundation Engineering; Laxmi Publication Pvt. Ltd., Delhi.
3. Murthy, V.N.S., Soil Mechanics & Foundation Engineering, Sai Kripa Technical Consultants, Bangalore.
4. Shroff, A. V., Shah D. L., Soil Mechanics & Geotechnical Engineering, Oxford & IBH, Delhi.

Reference Books:

1. Singh Alam, Soil Engineering, Agion Publishers, Jodhpur.
2. Purshottam Raj, Geotechnical Engineering, Tata McGraw Hill Publication.
3. Purushothama, P. Raj, Soil Mechanics and Foundation Engineering, Pearson Education.

4. Singh, Alam, Soil Mechanics & Foundation Engineering, CBS Publishers & Distributors, New Delhi.
5. Taylor, D.W., Fundamentals of Soil Mechanics, Asia Publishing House, Mumbai.
6. Ranjan Gopal and Rao, A.S.R., Basic and Applied Soil Mechanics, New Age International Pvt. Ltd.
7. Braja Das, M., Principles of Geotechnical Engineering, Thomson Asia Pvt. Ltd.

Web Materials:

1. <http://edudel.nic.in>
2. <http://bis.org.in/other/quake.htm>
3. <http://www.thepeninsulaneighborhood.com/ThePlan.html>
4. http://www.historytution.com/indus_valley_civilization/town_planning.html

LIST OF EXPERIMENTS

Experiment No.	<u>Name of Experiment</u>
1	Moisture Content by Oven-drying Method
2	Specific Gravity by Pycnometer Method
3	Sieve Analysis
4	Hydrometer Analysis
5	Liquid Limit & Plastic Limit Tests
6	Shrinkage Limit Test
7	In Situ Density by Core Cutter Method
8	In Situ Density by Sand Replacement Method
9	Direct Shear Test

CL352: WATER RESOURCES ENGINEERING - I
B. TECH 6TH SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	1	7	5
Marks	100	50		150	

A. Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction to Water Resources Engineering	01
2	Surface water Hydrology	12
3	Groundwater Hydrology	08
4	Irrigation & Crop Water Requirement	03
5.	Dams	12
6.	Reservoir	04
7.	Diversion Head Works	06
8.	Spillways & Energy Dissipators	05
9.	Canal Irrigation System	09

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

B. Detailed Syllabus:

- | | | | |
|----------|---|-----------------|------------|
| 1 | Introduction to Water Resources Engineering | 01 Hours | 2% |
| 1.1 | Need of water resources projects | | |
| 1.2 | Hydrologic cycle - scope and application, Hydrologic Equation (Water Balance Equation) | | |
| 2 | Surface water Hydrology | 12Hours | 20% |
| 2.1 | Precipitation: Types, forms, measurement, estimation of missing data, mean rainfall computation | | |

- 2.2 Evaporation: Process, factors affecting, measurement of evaporation
- 2.3 Evapotranspiration: Transpiration, evapotranspiration, factors affecting, measurement of evapotranspiration
- 2.4 Infiltration: Process, infiltration rate, infiltration capacity, infiltration indices, measurement - infiltrometers
- 2.5 Runoff: Types, factors affecting, estimating volume of runoff (yield) – rainfall runoff correlation
- 2.6 Hydrograph: Components, unit hydrograph, S-Hydrograph, computation of flood
- 3 Groundwater Hydrology 08 Hours 13%**
- 3.1 Occurrence and movement of groundwater, Darcy's law, Types of aquifers, Aquifer properties
- 3.2 Hydraulics of wells under steady & introduction to unsteady condition in confined and unconfined aquifers yield of wells, pumping and recuperation tests⁴
- 3.3 Needs of ground water recharge, ground water recharge methods, Rain water harvesting
- 3.4 Occurrence and causes of saline water intrusion, Ghyben-Herzberg Relation, Upconing of saline water, Control of saline water intrusion
- 4 Irrigation & Crop Water Requirement: 03 Hours 5%**
- 4.1 Irrigation: Definition, merits, demerits
- 4.2 Irrigation methods: Detailed classification
- 4.3 Duty of water and delta, factors affecting on duty and delta, relation between duty-delta & examples
- 4.4 Irrigation efficiencies and calculation of efficiencies
- 5 Dams 12 Hours 20%**
- 5.1 Definition, classification, factors affecting selection of type of dam, Selection & investigation of site for a dam
- 5.2 Earth dams: Types, foundation requirements, causes of failure, design criteria, suitable preliminary sections, seepage line determination & analysis, stability analysis - side slope, foundation, checking of stability, seepage control measures
- 5.3 Rockfill dams: Foundation requirements, typical sections, design

consideration for a rockfill dam		
5.4 Gravity dam: Definition, forces acting on dams, load combination for design, modes of failure & criteria for structural stability, stability analysis, elementary & practical profile, design of gravity dam, openings in dams		
6 Reservoir	04 Hours	7%
6.1 Definition, types, Storage zones		
6.2 Capacity-elevation and area elevation curves of a reservoir site		
6.3 Reservoir capacity: Catchment yield and reservoir yield, fixing the reservoir capacity for the computed value of the dependable yield of the reservoir catchment, relation between the inflow, outflow and storage data for a reservoir, fixing the reservoir capacity from the annual inflow and outflow data, mass curve and demand curve		
6.4 Reservoir losses, Reservoir sedimentation and control		
7 Diversion Head Works	06 Hours	10%
7.1 Types & components of diversion head works		
7.2 Location & typical layout of diversion headworks		
7.3 Difference between dam, weir and barrage, Types of weirs		
7.4 Criteria for designing weir and barrage		
7.5 Theories of subsurface flow: Bligh's creep theory, Lane's weighted creep theory, theory of seepage flow (critical gradient), Khosla's theory		
8 Spillways & Energy Dissipators	05 Hours	8%
8.1 Spillways: Definition, location, essential requirements, components, classification		
8.2 Energy Dissipators: Formation & types of hydraulic jump; Jump Height Curve (JHC), Tail Water Rating Curve (TWRC) and alternatives of JHC & TWRC, types of energy dissipators		
9 Canal Irrigation System	09 Hours	15%
9.1 Classification of canals, alignment		
9.2 Distribution system		
9.3 Cross section and longitudinal sections of canals		
9.4 Design of unlined canal in alluvial & non-alluvial soils		

- 9.5 Design of channel using Kennedy's Garrat's diagram & Lacey's regime diagram, Canal lining
- 9.6 Cross Drainage Works: Definition, types, selection criteria
- 9.7 Outlets: Definition, requirements, types
- 9.8 Falls: Definition, necessity, location, types
- 9.9 HR & CR: Definition, functions
- 9.10 Escapes: Definition, necessity, types

C. Course Outcomes:

On the completion of the course one should be able to:

- CO1 Understand Concepts of different hydraulic structures
- CO2 Plan and design irrigation projects.
- CO3 Design channels and other irrigation structures required for irrigation, drainage, soil etc.
- CO4 Estimate the quantity of water required by crops.
- CO5 Understand types of irrigation systems and different hydraulic structures
- CO6 Develop Conservation, flood control and other water-management projects.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	3	3	2	3	3	3	-	3	3	3	3	2	3
CO3	-	-	3	3	2	3	3	3	-	3	2	3	3	2	3
CO4	3	2	-	-	-	3	-	-	-	-	-	2	2	-	1
CO5	-	3	-	-	-	-	-	-	-	-	-	-	1	-	-
CO6	-	-	3	3	2	3	3	3	2	3	2	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Subramanya, K., Engineering Hydrology, Tata McGraw Hill, New Delhi.
2. Raghunath, H.M., Groundwater, 1987, Wiley Eastern Ltd., New Delhi.
3. Garg, S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi.

Reference Books:

1. Garg, S.P., Groundwater and Tube Wells, 1993, Oxford & IBH Publishing Co.
2. Modi, P.N., Irrigation Water Resources and Water Power Engineering, Standard Book House, New Delhi.
3. Raghunath, H.M., Hydrology – Principles, Analysis and Design, 1986, Wiley Eastern Ltd.
4. Todd, D.K., Groundwater Hydrology, 1993 John Wiley & Sons.
5. Karanth, K.R., Ground Water Assessment Development and Management, Tata McGraw Hill, New Delhi.
7. Patel, A.S. and Shah, D.L., Water Management – Conservation, Harvesting & Artificial Recharge, New Age International Publishers.
9. Punmia and Pando, Lal, B.B., Irrigation and Water Engineering, Standard Publishers Distributors, New Delhi.
10. Michael, A.M., Irrigation - Theory and Practice, Vikas Publishing House, New Delhi.
11. Arora, K.R. Irrigation, Water Power and Water Resources Engineering, Standard Publishers Distributors, New Delhi.

Web Materials:

1. <http://nptel.iitm.ac.in>
2. http://www.groundwatermanagement.org/module2_000.pps
3. <http://www.uiowa.edu/~c012003a/14.%20Groundwater.pdf>
4. <http://www.authorstream.com/presentation/brod-17752-lect-18-groundwater->
5. <http://www.ngwa.org/public/gwbasics/index.aspx>

CL353: TRANSPORTATION ENGINEERING- I
B TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	1	7	5
Marks	100	50	0	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	04
2	Traffic Engineering	10
3	Highway Geometric Design	10
4	Highway Materials and Construction	09
5	Highway Pavement Design	13
6	Highway Drainage, Maintenance, Economics and Arboriculture	10
7	Overlay Design and Construction	04

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

B. Detailed Syllabus:

- | | | | |
|----------|--|-----------------|------------|
| I | Introduction | 04 Hours | 06% |
| 1.1 | Role and modes of Transportation, Scope of Transportation Engineering | | |
| 1.2 | Highway Planning and Development in India | | |
| 1.3 | Classification of Roads, Highway Alignment and Surveys: Introduction, Ideal Requirement of Alignment, Factors controlling Alignment, Engineering Surveys, Drawing and Reports, Highway Project | | |

2	Traffic Engineering	10 Hours	18%
2.1	Introduction to Traffic Engineering		
2.2	Traffic Surveys: Traffic Volume Studies, Speed Studies, Traffic Density & Capacity, Relations between traffic parameters, Level of service, Passenger car unit, Parking studies, Accident Studies		
2.3	Traffic Operations: Traffic Regulations, Traffic Control Devices (Signs, Signals and Markings) with its design		
2.4	Highway Intersection: At grade & Grade separated intersections, Rotary intersection, IRC Recommendations , Highway Lightning		
3	Highway Geometric Design	10 Hours	16%
3.1	Introduction		
3.2	Highway Cross-section Elements		
3.3	Sight Distance		
3.4	Design of Horizontal Alignment		
3.5	Design of Vertical Alignment		
4	Highway Materials and Construction	04 Hours	14%
4.1	Introduction		
4.2	Aggregates and Test on Aggregates		
4.3	Bitumen and Test on Bitumen		
4.4	Test on Soil: CBR Test		
4.5	Bituminous Materials: conventional and modified binders, production, types and grade , physical and chemical properties and uses Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen Introduction to emulsified bitumen and its characterization; Long term and short term ageing and its effect on bitumen performance		
4.6	Bituminous Mix design ,Desirable properties of bituminous mixes, Modified Marshall"s specifications, Introduction to super pave mix design procedure		
4.7	Highway Construction: Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavement and Cement		

	Concrete Pavement		
5	Highway Pavement Design	13 Hours	22%
5.1	Introduction		
5.2	Types of Highway Pavement: Flexible pavement & rigid pavement, their components & its functions.		
5.3	Design Factors		
5.4	Design of Flexible Pavement: CBR Method, IRC Guidelines		
5.5	Design of Rigid Pavement: IRC method, Westergaard theory, loads & temperature stresses.		
6	Highway Drainage, Maintenance, Economics and Arboriculture	10 Hours	16%
6.1	Highway Drainage: Introduction, Importance of Highway Drainage, Surface Drainage, Sub-surface Drainage, Drainage of slopes and erosion controls		
6.2	Highway Maintenance: Pavement Failures, Maintenance Techniques, Strengthening of existing pavements.		
6.3	Highway Economics and Finance: Introduction, Methods of Economic Evaluation of highway projects: Annual cost method, Rate of return method & benefit- cost ratio method, Highway Project administration and Finance: Public Private Partnership		
6.4	Highway Arboriculture: Environmental Factors affecting highway planning, Road Side Development, Planning Plantation of trees, Species and their selection, Care of trees		
7	Overlay Design and Construction	04 Hours	08%
7.1	Need, Types, Overlay design methods for flexible pavements by conventional design method, Benkelman beam method, Falling Weight Deflection Method, I.R.C. Guidelines & Asphalt Institute Method.		
7.2	Overlay Design Methods for Rigid Pavements, Flexible overlays over rigid slabs		

C. Course Outcomes:

The course content should be taught and learning imparted with the aim to develop required knowledge and skills so that they are able to acquire following competency:

CO1	To design highway pavement geometrics
CO2	To understand the procedure to collect the traffic data for design and the need of traffic management
CO3	Test the highway material as per IS recommendations
CO4	Carryout preliminary design of flexible and rigid pavement as per IRC
CO5	To understand the concept for providing highway drainage, maintenance and arboriculture.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	1	2	2	2	1	-	-	2	1	-	-	2	1	1
CO2	2	1	1	3	2	1	-	-	2	2	1	-	2	1	2
CO3	1	-	-	3	1	1	1	1	2	2	-	-	1	1	1
CO 4	3	1	1	3	2	-	1	1	2	1	-	1	2	1	3
CO5	-	-	1	1	-	1	2	-	-	-	-	-	-	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Khanna, S.K. & Justo, C.E.G., Highway Engineering, NemChand & Bros, Roorkee (U.A).
2. Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi.
3. Kadiyali, L.R. & Lal, N.B., Principles & Practices of Highway Engineering, Khanna Publishers, New Delhi.

Reference Books:

1. Sharma, S.K., Principles, Practice and Design of Highway Engineering, S. Chand & Co., New Delhi.

Web Materials:

1. <http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Transportation%20Engg%20I/TOC.htm>

Other Materials:

1. IRC – 37 “Guidelines for Design of flexible Pavements”, IRC, New Delhi, 2001.
2. IRC – 67 “Code of Practice for Road Signs”, IRC, New Delhi – 2001.
3. IRC: 58, 2002: “Guidelines for the Design of Plain Jointed Rigid Pavements for Highways”, IRC, N. Delhi, December, 2002.
4. IRC:70, 1977: “Guidelines on Regulation and Control of Mixed Traffic in Urban Areas”
5. IRC:106, 1990: “Guidelines for Capacity of Urban Roads in Plain Areas”
6. IRC SP 30: “Manual of Economic Evaluation of Highway Projects in India”, IRC, New Delhi, 2009.
7. IRC SP 41: “Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas”, IRC, New Delhi, 1994.
8. Khanna S. K. & Justo C. E. G., “Highway Material Testing (Laboratory Manual), Nem Chand & Bros, Roorkee
9. IRC 81: Guidelines for strengthening of flexible Road Pavement using Benkleman Beam Deflection Technique.

LIST OF EXPERIMENTS

Experiment No.	Name of Experiment
Test on Subgrade Soil	
1	California Bearing Ratio Test
Tests on Aggregates	
2	Aggregate Crushing Test
3	Aggregate Impact Test
4	Los Angeles Abrasion Test
5	Shape Tests
6	Specific Gravity & Water Absorption Test

Tests on Bitumen	
7	Penetration Test
8	Ductility Test
9	Flash & Fire Point Test
10	Softening Point Test
11	Specific Gravity Test
12	Viscosity Test

HSI32.02 A: CONTRIBUTORY PERSONALITY DEVELOPMENT
B.TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	--	30/15	--	30/15	02
Marks	--	100	--	100	

Pre-requisite courses:

- Communication and Soft Skills

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Concept of Personality	06
2.	Soft Skills and Personality Development	08
3.	Developing Contributory Personality	06
4.	Life skills and Personality Development	06
5.	Contemporary Issues in CPD	04
	Total hours (Theory) :	--
	Total hours (Practical) :	30
	Total hours :	30

B. Detailed Syllabus:

- | | | |
|--|-----------------|------------|
| 1. Concept of Personality | 06 Hours | 20% |
| 1.1 Meaning of Personality, Types of Personality, Factors contributing to Personality, Personality Traits, Personality Profiling | | |
| 2. Soft Skills and Personality Development | 08 Hours | 26% |
| 2.1 Positive Thinking and Mind Set, Leadership, Assertiveness and Negotiation Skills, Self-Management, Interpersonal Skills, Being a Team Player | | |

3. **Developing Contributory Personality** 06 Hours 20%
- 3.1 Concept of Contributory Personality, Characteristics of a Contributor, The Contributor's Vision of Success & Career, The Scope of Contribution in a field, Embarking on the Journey to Contributor ship, Developing Contributor Personality, Reviewing Some Contributors Personalities
4. **Life skills and Personality Development** 06 Hours 20%
- 4.1 Concept of life skills, Self-awareness, Empathy, Decision Making, Problem Solving
5. **Contemporary Issues in CPD** 04 Hours 14%
- 5.1 Contemporary Trends and Practices in Contributory Personality Development, Case Study & Presentations

C. Course Outcome (COs):

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

- CO1 Identify one's individual personality strengths and challenges.
- CO2 Develop more assertive and optimistic attitude towards work and life.
- CO3 Develop quintessential soft skills to groom one's personality.
- CO4 Identify traits of contributor personality.
- CO5 Contribute to self, society, nation, and globe.
- CO6 Develop skills of global citizenship to perform societal responsibilities.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO3	-	-	-	-	-	1	-	-	3	1	2	1	1	-
CO4	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	2	2	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	2	2	-	-	-	-	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

D. Recommended Study Material:

Text book:

1. Personality Development & Soft Skills, Oxford University Press
2. Soft Skills, Bookboon
3. Personality Development, Swami Vivekananda; Advaita Ashrama

Reference book:

1. Contributor Personality Program Workbook (Volume 1,2),
2. Contributor Personality Program ActivGuide, Illumine Knowledge Pvt. Ltd

Web material:

1. <https://www.coursera.org/learn/wharton-success>
2. <https://www.coursera.org/learn/personality-types-at-work>
3. <https://www.coursera.org/learn/self-awareness>

CL376: BUILDING REPAIR AND REHABILITATION
B. TECH 6th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - II

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Maintenance of Building	04
2	Deterioration and Durability Aspects	10
3	Conditional/damage assessment & Evaluation of structures	08
4	Materials and Techniques for Repair	08
5	Rehabilitation and Retrofitting Methods	10
6	Demolition and Dismantling Techniques	05

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

- | | | | |
|----------|--|-----------------|------------|
| 1 | Maintenance of Building | 04 Hours | 09% |
| 1.1 | Introduction | | |
| 1.2 | Objectives | | |
| 1.3 | Phases of Maintenance | | |
| 1.4 | Common Defects In Buildings And Measures To Prevent And Control The Same | | |
| 1.5 | Building Failures- Causes And Effects | | |
| 1.6 | Cracks In Buildings | | |

<p>2 Deterioration and Durability Aspects</p> <p>2.1 <u>Deterioration</u>: Types of deterioration – Signs, causes & symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability & micro-structure of concrete</p> <p>2.2 Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, Efflorescence, exposure to severe environment like marine exposure</p> <p>2.3 Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack</p> <p>2.4 Deterioration due to water leakage, fire – detection & mitigation of the same. Deterioration due to ageing, inadequate maintenance, Design & construction deficiencies, overloading etc.</p> <p>2.5 Visual deterioration of structures- Types of cracks, causes & characteristics of cracking in various structural components like beam, column, slab, masonry walls. Measurement of cracks, interpretation of the cause of particular type of crack</p> <p>2.6 <u>Durability</u>: Life Expectancy of Different Types of Buildings – Influence of Environmental Elements Such as Heat, Moisture, Precipitation and Frost on Buildings- Design and Construction Errors, Corrosion Mechanism</p> <p>2.7 Effect of Biological Agents like fungus, moss, plants, trees, algae, - Termite Control and Prevention</p> <p>2.8 Chemical Attack on Building Materials and Components</p> <p>2.9 Aspects of Fire and Fire Prevention on Buildings</p> <p>2.10 Impact of Pollution on Buildings</p>	<p>10 Hours</p> <p>22%</p>
<p>3 Conditional/damage assessment & Evaluation</p> <p>3.1 Conditional evaluation – Importance, objective & stages, Conditional/damage assessment procedure, Preliminary & Detailed investigation – Scope, Objectives, Methodology & Rapid visual inspection of structures</p>	<p>08 Hours</p> <p>18%</p>

- 3.2 Damage Assessment allied Tests (Destructive, Semi-destructive, Non-destructive)
- 3.3 Non-destructive Evaluation Tests - Concrete Strength Assessment Chemical Tests, Fire Damage Assessment, Structural Integrity/Soundness Assessment
- 3.4 Interpretation & Evaluation of Test Result Data
- 4 Materials and Techniques for Repair 08 Hours 18%**
- 4.1 Essential Parameters for Repair Materials
- 4.2 Materials for Repair
- 4.2.1 Premixed cement concrete/mortars
- 4.2.2 Polymer Modified Mortars and Concrete (PMM/PMC)
- 4.2.3 Epoxies and Epoxy Mortars/Concretes
- 4.2.4 Polyester Resins
- 4.2.5 Sulphur infiltrated concrete
- 4.2.6 Ferro cement
- 4.2.7 Fibre reinforced concrete
- 4.2.8 Foamed concrete
- 4.2.9 Dry pack
- 4.2.10 Vacuum concrete
- 4.2.11 Surface Coatings
- 4.3 Guniting, Grouting, Shotcrete and Epoxy injection
- 5 Rehabilitation and Retrofitting Methods 10 Hours 22%**
- 5.1 Important factors to be considered for selection of repair methods.
- 5.2 Repair Stages
- 5.3 Repair Methods
- 5.4 Repair of stone, brick and block masonry (Cracks, dampness, efflorescence, joint separation, etc.), Flooring, Roofs (sloping, flat, pitched, etc.)
- 5.5 Repair of Concrete members due to (i) Steel Corrosion (ii) Lack of Bond (iii) shear, tension, torsion, compression failure
- 5.6 Repair of leakage due to rain water

5.7 Strengthening of Earthquake Damage Buildings

6 Demolition and Dismantling techniques

05 Hours

11%

6.1 Engineered demolition techniques for Dilapidated structures

6.2 Safety measures during demolition operation

6.3 Dismantling of buildings and reuse of materials/fittings from environmental and financial point of view

6.4 Case studies

C. Course Outcomes (COs):

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

CO1 Understand the types of requirement of maintenance in building and able to assess the quality aspects of existing building.

CO2 Identify and define concepts associated with deterioration of concrete structures, damage assessment or inspection of a building showing signs of deterioration and should be able to detect the possible cause/source of deterioration with appropriate techniques.

CO3 Develop a knowledge of the concrete repair process with variety of repair materials and techniques. Understand and apply rehabilitation and retrofitting processes.

CO4 Gain knowledge regarding dismantle and demolish structures which cannot be repaired in an environment friendly, with maximum saving of materials and in a safe way.

Course Articulation Matrix:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
CO3	-	-	-	2	-	-	-	-	-	-	-	-	1	-	1
CO4	-	-	-	-	-	-	1	-	-	-	-	-	1	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. P.C.Varghese , Maintenance, Repair & Rehabilitation and Minor Works of Buildings, PHI learning.

2. R.T.Allen and S.C.Edwards, " Repair of Concrete Structures ", Blakie and Sons, UK, 1987.
3. A.R. Santhakumar, "Concrete Technology", 2012 Oxford University Press ,2006.
4. V. M. Malhotra, Nicholas J. Carino 2004 "Handbook on Nondestructive Testing of Concrete".
5. Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
6. R.Dodge Woodson., Concrete Structures: Protection, Repair and Rehabilitation, Elsevier, 2009.
7. Xilin Lu ,”Retrofitting Design of Building Structures”,Science Press,2010.
8. Structural Condition assessment by Robert T. Ratay.
9. IS 13935 : 2009, Seismic Evaluation, Repair And Strengthening of Masonry Buildings — Guidelines

Reference Books:

1. A.C. Panchdhari, "Maintenance of Buildings", New Age International.
2. Santhakumar, A.R., Training Course notes on Damage Assessment and repairs in Low Cost Housing, "RHDC – NBO" Anna University, July 1992.
3. Concrete Technology by M.L.Gambhir, Tata McGraw-Hill Education.
4. R.T.Allen and S.C.Edwards, Repair of Concrete structures, Blakie and Sons, UK, 1987
5. M.S.Shetty, Concrete Technology – Theory and Practice, S.Chand and Company, New Delhi, 1992.
6. Concrete Structures, Protection, Repair and Rehabilitation by R.Dodge Woodson.
7. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

Web Materials:

1. cpwd.gov.in/Units/handbook.pdf
2. www.bis.org.in/sf/nbc.htm
3. <http://www.civilengineeringnews.tk/2014/07/methods%20-of-demolition-of-%20building.html>
4. <http://www.indianconcreteinstitute.org/repair-and-rehabilitation.html>

TERM WORK

- 1) Study of rehabilitation/retrofitting of RCC/Masonry buildings covering (a) damage assessment by visual inspection and using various techniques including NDT (b) one/two alternatives for rehabilitation/retrofitting (considering strength criteria & serviceability criteria).
- 2) Case study of construction and design failures.
- 3) Market survey for material for repairs.
- 4) Case study of repairing/rehabilitation structures and retrofitting of EQ damage/deficit structure.
- 5) Presentations / finding engineering applications /preparation of learning material based on the syllabus.

CL377: ADVANCED SURVEY
B. TECH 6th SEMESTER (CIVIL ENGINEERING)
PROGRAMME ELECTIVE - II

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Tacheometric Surveying	09
2	Geodetic Surveying	07
3	Trigonometric Levelling	07
4	Theory of Errors	06
5	Field Astronomy	04
6	Aerial photogrammetry	06
7	Total Station and GPS	06

Total Hours (Theory): 45
Total Hours (Lab): 30
Total Hours: 75

B. Detailed Syllabus:

- | | | | |
|----------|---|-----------------|------------|
| 1 | Tacheometric Surveying : | 09 Hours | 19% |
| 1.1 | Introduction | | |
| 1.2 | Tacheometric Systems – Tangential, Stadia and substense methods | | |
| 1.3 | Stadia systems – horizontal and inclined sights – vertical and normal staff – fixed and movable hair – stadia constants | | |
| 1.4 | Field work in tacheometry, anallatic lens – subtense bar – Self reducing tacheometers | | |
| 1.5 | Errors and precisions | | |
| 2 | Geodetic Surveying | 07 Hours | 15% |
| 2.1 | Principle and Classification of triangulation system | | |

2.2	Selection of base line and stations		
2.3	Orders of triangulation		
2.4	Triangulation figures- Horizontal and vertical control		
2.5	Station marks and signals- marking signals		
2.6	Extension of base, Reduction of Centre, Selection and marking of stations		
3	Trigonometric Levelling	07 Hours	15%
3.1	Introduction		
3.2	Methods of trigonometric levelling: Base of object accessible, base of object inaccessible – same vertical plane, base of object inaccessible – not in same vertical plane		
3.3	Determination of height of elevated object above ground when its base & top are visible but not accessible		
4	Theory of Errors	06 Hours	13%
4.1	Introduction		
4.2	Types and sources of errors & definitions		
4.3	Laws of accidental errors, laws of weights, theory of least squares		
4.4	Rules for giving weights and distribution of errors to the field observations		
5	Field Astronomy	04 Hours	10%
5.1	Introduction & purposes, astronomical terms		
5.2	Determination of azimuth, latitude, longitude and time corrections to the observations		
6	Aerial photogrammetry	06 Hours	14%
6.1	Photogrammetric terms, Applications, Type of photographs, floating marks		
6.2	Scale of a vertical and oblique photographs, heights and tilt distortions		
6.3	Flight planning, Stereoscopy, base lining		
6.4	Developments in photogrammetry, Photomaps and mosaics		
6.5	Photographic interpretations, Parallax bar		
7	Total Station and GPS	06 Hours	14%
7.1	Digital theodolite, Electronic Distance Measurement, Total		

Station: Introduction, principle and uses

- 7.2 Remote sensing: Principle of Remote sensing, EMR, types, resolutions, types of satellites, type of sensors, visual and digital image processing and its applications
- 7.3 Global Positioning System: Definition, Principles of GPS and applications.
- 7.4 Introduction and principle of GIS, Applications of GIS in Civil Engineering

C. Course Outcomes (COs):

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

- CO1 Conduct tacheometry and geodetic survey.
- CO2 Apply principles of theory of errors for correction of measurements.
- CO3 Apply knowledge of astronomy for solving civil engineering problems.
- CO4 Explain use of aerial camera, aerial photographs and procedure of aerial survey.
- CO5 Utilize stereoscope and parallax bars, total station and other modern survey instruments.
- CO6 Apply GIS in solving engineering problems.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	2	2	1	1	2	2	2	1	3	2	2
CO2	3	1	-	-	1	-	-	-	-	-	-	1	1	-	-
CO3	3	2	1	-	2	1	1	-	2	1	1	2	1	1	2
CO4	3	3	2	2	3	2	1	1	1	2	1	2	2	3	2
CO5	2	1	2	2	3	3	2	2	2	2	2	3	3	3	3
CO6	2	3	3	3	3	3	3	3	3	2	2	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Duggal, S. K., Surveying Vol. I & II, Tata McGraw Hill Publication, New Delhi.
2. Subramanian, R., Surveying & Levelling, Oxford University Press, New Delhi.

Reference Books:

1. Surveying Vol. I, II and III by Dr. B.C. Punamia, Laxmi Publishers. New Delhi
2. Surveying and Levelling Vol. I and II by T.P. Kanetkar and S.V. Kulkarni, Pune Vidhyarthi Gruh
3. Surveying Vol. I, II and III by Dr. K.R. Arora, Standard Book House. New Delhi
4. Surveying Vol. I and II by S. K. Duggal, Tata Mcgraw Hill, New Delhi
5. Surveying and Levelling by N.N. Basak, Tata Mcgraw Hill, New Delhi
6. Surveying and Levelling by R. Agor, Khanna Publishers, New Delhi
7. Advanced Surveying by R. Agor, Khanna Publishers, New Delhi
8. Fundamentals of Surveying by Roy, S.K., Prentice Hall India, New Delhi
9. Surveying and Leveling by Subramanian, R., Oxford University Press, New Delhi
10. Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi.
11. Remote sensing and Image interpretation by T.M. Lillesand., R.W. Kiefer., and J.W. Chipman, 5th edition, John Wiley and Sons India
12. Surveying theory and practice 7th Edition by James M Anderson and Adward M. Mikhail Tata McGraw Hill Publication.
13. Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India, 2007.

Web Materials:

1. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IITROORKEE/SURVEYING/home.htm>
2. <http://nptel.iitm.ac.in/video.php?subjectId=105104101>
3. http://en.wikipedia.org/wiki/Geographic_information_system
4. <http://www.naicc.org/meeting/2009/GPSRemoteSensing.pdf>

LIST OF EXPERIMENTS

Experiment No.	Name of Experiment
1	Introduction to Tacheometry
2	Determination of multiplying and additive constants of a Tacheometer
3	Use of (i) Tacheometer, (ii) Total Station for determination of Reduced levels and Horizontal distances of various points in the field
4	Project: Tacheometric Survey Project
5	Use of different Softwares for surveying
6	Extension of Baseline using Theodolite
7	Remote Sensing
8	Applications of GIS Software's
9	Total Station Surveying – Measurements of Distances and angles, Slope distances, Height, Traversing.
10	Use of Stereoscope for 3-D Viewing, Height determination from a Stereo pair using the Parallax bar

CL378: STRUCTURAL ANALYSIS-III
B TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Beams Curved in Plan	06
2	Cable and Suspension Bridge	04
3	Plastic Theory of Structures	08
4	Column Analogy	06
5	Approximate analysis of Indeterminate Structures	06
6	Matrix Method of Structural Analysis – System Approach	15

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1	Beams Curved in Plan	06 Hours	13 %
1.1	Uses of curved beam		
1.2	Types of internal forces		
1.3	Analysis of curved beam fixed at ends for point load, uniformly distributed load		
1.4	Analysis of closed circular beam supported symmetrically		
2	Cable and Suspension Bridge	04 Hours	09%
2.1	Introduction: Cables and cable bridge		
2.2	General cable theorem		
2.3	Cable under uniformly distributed loads		
2.4	Suspension bridge		
2.5	Suspension bridge with three-hinged stiffening girder		

3	Plastic Theory of Structures	08 Hours	18%
3.1	Concept, assumptions, upper and lower bound theorems		
3.2	Shape factor for different cross sections		
3.3	Collapse load, load factor, plastic modulus of section, plastic moment of resistance		
3.4	Computation of collapse load for fixed beam, continuous beam and plane frame subjected to various load cases		
4	Column Analogy	06 Hours	13%
4.1	introduction		
4.2	Sign convention		
4.3	Analysis of fixed beam and propped cantilever beam		
4.4	Stiffness and carry-over factors for non-prismatic members		
5	Approximate analysis of Indeterminate Structures	06 Hours	13%
5.1	Introduction		
5.2	Portal method		
5.3	Cantilever method		
5.4	Substitute Frame Method		
6	Matrix Method of Structural Analysis – System Approach	15 Hours	34 %
6.1	Introduction to flexibility and stiffness method		
6.2	Flexibility and stiffness coefficient		
6.3	Application of flexibility and stiffness method system approach to analysis of beams, plane frame and plane truss		

C. Course Outcomes:

On the completion of the course the students will be able to:

- CO1 Recognize the importance of structural analysis and the tools available to determine the response of a structural system to external loads.
- CO2 Identify and formulate an engineering problem and to develop a solution.
- CO3 Recognize the need for technical updating on a continuing basis, since the course emphasizes on the changing nature of software.
- CO4 Use various approximate methods for analysis of indeterminate structures

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	1	1	-	-	-	-	-	-	-	1	-	-
CO2	3	2	3	-	1	-	-	-	-	-	-	-	1	-	-
CO3	-	-	1	2	2	1	-	-	-	-	1	-	2	-	1
CO4	2	2	1	1	2	-	-	-	-	-	-	-	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

E. Recommended Study Material:

Text Books:

1. Junarkar, S.B. & Shah, H.J., Mechanics of Structures Vol-I & II, Charotar Publishing House
2. Negi, L.S. and Jangid, R.S., Structural Analysis, Tata McGraw Hill
3. Vazirani, V.N. and Ratwani, N.M., Analysis of Structures, Khanna Publishers
4. Weaver William and Gere James, Matrix Analysis of Framed Structures, CBS Publishers
5. R.S. Khurmi and N. Khurmi, Theory of structures, S. Chand

Reference Books:

1. Gere & Timoshenko, Mechanics of Materials, CBS Publishers & Distributors, Delhi
2. Hibbler, R.C., Structural Analysis, Pearson Education
3. Wang, C.K., Intermediate Structural Analysis, Tata McGraw Hill
4. Reddy, C.S., Basic Structural Analysis, Tata McGraw Hill
5. Jangid, R.S., Structural Analysis, Tata McGraw Hill
6. Devdas Menon., Structural Analysis, Alpha Science
7. William M.C. McKenzie, Examples in Structural Analysis, Second Edition, CRC Press

Web Materials:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New_index1.html
2. <http://www.nptelvideos.in/2012/11/structural-analysis-ii.html>

3. <http://nptel.ac.in/courses/105106050/2>
4. [http://nptel.iitg.ernet.in/Civil_Eng/IIT%20Delhi/Structural%20Analysis%201%20\(Video\).htm](http://nptel.iitg.ernet.in/Civil_Eng/IIT%20Delhi/Structural%20Analysis%201%20(Video).htm)
5. <http://freevidelectures.com/Subject/Civil-Engineering>
6. <http://freevidelectures.com/Course/3015/Advanced-Structural-Analysis>

LIST OF EXPERIMENTS

Experiment No.	Name of Experiment
1	Simple suspension bridge
2	Plastic bending of beams
3	Plastic bending of portals
4	Redundant truss
5	Beam Apparatus

CL379: TOWN & URBAN PLANNING
B TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Town Planning	06
2	Ancient System of Town Planning	04
3	Surveys	04
4	Zoning	05
5	Housing and Slums	08
6	Development Plan	05
7	Planning Concepts	08
8	Planned Cities of India	05

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

- | | | | |
|----------|---------------------------------------|-----------------|------------|
| 1 | Introduction to Town Planning | 06 Hours | 13% |
| 1.1 | Objects & importance of town planning | | |
| 1.2 | Principles of town planning | | |
| 1.3 | Origin of Towns | | |
| 1.4 | Growth of Towns | | |
| 1.5 | Stages in Town Development | | |
| 1.6 | Distribution of land uses | | |
| 1.7 | Forms of planning | | |

2	Ancient System of Town Planning	04 Hours	9%
2.1	Town Planning in Ancient India		
2.2	Planning thought behind Fatehpur Sikri, Shahjahanabad, Jaipur and Delhi		
2.3	Indus Valley Civilization		
3	Surveys	04 Hours	9%
3.1	Necessity of surveys		
3.2	Collection of Data and Methods Adopted to Collect Data		
3.3	Types and Uses		
4	Zoning	05 Hours	11%
4.1	Objects and Principles of Zoning		
4.2	Advantages and Importance of Zoning		
4.3	Aspects of Zoning, Transition Zone		
4.4	Maps for Zoning		
5	Housing and Slums	08 Hours	18%
5.1	Importance of housing, its demand		
5.2	Requirements of residential buildings		
5.3	Design of residential areas		
5.4	Low cost housing, Laurie Baker's work and ideology		
5.5	Slums – Causes, Characteristics, Effects		
5.6	Slum clearance, Works of Improvement, Re-housing		
5.7	Prevention of slum formation		
6	Development Plan	05 Hours	11%
6.1	Objects and Necessity of development plan		
6.2	Stages of preparation of development plan, Data to be collected		
6.3	Features of Development Plan		
7	Planning Concepts	08 Hours	18%
7.1	Land use planning, Neighbourhood planning		
7.2	Protective strips, green belt		
7.3	Radburn Layout		
7.4	Urban Roads – Requirements, Classification, Types of Street Systems, Ring Roads		
7.5	Geddesian Triad, Ekistics		

- 8 **Planned Cities of India** 05 Hours 11%
- 8.1 Chandigarh, Contribution of Le Corbusier to Town Planning
- 8.2 Gandhinagar

C. Course Outcomes:

On the successful completion of this course, the students will be able to:

- CO1 Have a proper understanding of history of town planning, ideas developed in the past and its relevance in today's world.
- CO2 Understand procedure involved in making development plans and various concepts, and issues of town planning.
- CO3 Understand the importance of housing and its cost effectiveness.
- CO4 Understand the causes of slum formation and measures needed to prevent it.
- CO5 Understand the ideology behind different planned cities.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	1	1	-	-	-	-	-	-	-	-	1	-	-
CO3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation “-”

D. Recommended Study Material:

Text Books:

1. Rangwala, S.C., Town Planning, Charotar Publishing House, Anand.
2. Hiraskar, G.K., Town Planning, Dhanpatrai & Sons, New Delhi.
3. A. Bandopadhyay, Text book of Town Planning, Books and Allied, Calcutta 2000

Reference Books:

1. Mathur, G.C., Low Cost Housing in Developing Countries, South Asia Books
2. K. S. Rame Gowda, Urban and regional planning: principles and case studies, Prasaranga, University of Mysore, 1972

3. John Ratcliffe, An Introduction to Town and Country Planning, Hutchinson 1981
4. Kevin A. Lynch, The Image of the City, MIT Press
5. Alex Krieger and William S. Saunders, Urban Design, University of Minnesota Press

Web Materials:

1. <https://townplanning.gujarat.gov.in/>
2. <http://www.udd.gujarat.gov.in/ctp.php>
3. http://hcp.co.in/file_manager/publications/Town-Planning-of-Gujarat_Research-Paper.pdf
4. <https://www.planetizen.com/>
5. <http://www.itpi.org.in/>

LIST OF TUTORIALS

Experiment No.	Name of Tutorials
1	Origin and Growth of Towns
2	Ancient System of Town Planning
3	Surveys
4	Zoning
5	Housing and Slums
6	Development Plan – Case study of Different cities
7	Planning Concepts
8	Planned Cities of India
9	City planning case studies from around the world

CL380: CONSTRUCTION TECHNOLOGY
B. TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical/Tutorial	Total	Credit
Hours/week	3	2	5	4
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Min. No. of Hours
1	Introduction to Construction Equipment & Fundamental of Moving Earth	09
2	Excavating Equipment	06
3	Handling and Hauling Equipment	06
4	Overview of Other Construction Equipment	06
5	Procurement and Planning of Construction Equipment	04
6	Ground Water Control During Excavation	06
7	Latest Building Material and Technology	08

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

- | | | | |
|-----|---|----------|-----|
| 1 | Introduction to Construction Equipment & Fundamental of Moving Earth | 09 Hours | 21% |
| 1.1 | Contribution and Importance of construction equipment | | |
| 1.2 | Classification of Equipment, Selection of construction equipment | | |
| 1.3 | Soil Fundamentals, Weight-Volume Relations of Materials | | |
| 1.4 | Machine power, coefficient of traction, rim pull and available pull and drawbar pull, Effect of grade & altitude on power | | |
| 2 | Excavating Equipment | 06 Hours | 13% |
| 2.1 | Features of excavating equipment | | |

2.2	Production/Output analysis and Suitability of Power Shovel, Dragline, Backhoe, Clamshells		
3	Handling and Hauling Equipment	06 Hours	13%
3.1	General		
3.2	Tractor, Dumper, Bulldozer, Ripper, Scraper, Truck		
4	Overview of Other Construction Equipment	06 Hours	13%
4.1	Hosting Equipment		
4.2	Conveying Equipment		
4.3	Drilling Equipment		
4.4	Pumping Equipment		
4.5	Compacting Equipment		
5	Procurement and Planning of Construction Equipment	04 Hours	09%
5.1	Procurement criteria		
5.2	Equipment cost		
5.3	Replacement analysis		
6	Ground Water Control During Excavation	06 Hours	13%
6.1	Importance, selection of method for ground water control during excavation		
6.2	Well point system, Dewatering Systems etc.		
6.3	Grouting-preparation of grouting, material and equipment used.		
7	Latest Building Material and Technology	08 Hours	18%
7.1	Introduction		
7.2	Building Material from Waste: Recycle Concrete Aggregates, Paper as building material, Composite: Matrices and Reinforcement		
7.3	Introduction to Advance Techniques used in Construction: Slip		

Formwork, Jump Formwork, Tunnel Formwork, Trenchless
Technology for excavation, Shotcreting

C. Course Outcomes (COs):

On the successful completion of this course:

- CO1 The students will be able to estimate earthwork for various construction projects.
- CO2 The students will be able to plan and select suitable construction equipment for different construction activities.
- CO3 The students will acquire ability to do planning for construction operations based on equipment productivity.
- CO4 The students will be able to analyse various financial aspects involved in the use of construction equipment.
- CO5 Students will have an understanding on various systems and techniques used in ground water control during excavation.
- CO6 Students will be familiar with some of the latest materials and systems used in construction.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	3	3	1	-	-	-	2	3	2	3	3	2	2
CO2	3	-	-	2	-	2	2	1	3	2	2	1	3	1	2
CO3	3	1	2	2	3	2	-	1	3	3	2	1	3	-	3
CO4	3	-	-	2	1	2	-	2	3	3	3	-	3	-	3
CO5	3	3	2	3	3	2	2	-	3	2	3	1	2	1	1
CO6	3	1	-	-	3	-	-	-	3	3	1	-	1	-	1

D. Recommended Study Material:

Text Books:

1. Peurifoy, L., Schexnayder, C.J. and Shapira, A., Construction Planning, Equipment and Methods, McGraw Hill, New Delhi, 8th Edition, 2010.
2. Roy Chudley, Roger Geeno, "Advanced Construction Technology" Latest Edition
3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers Delhi, 2008

Reference Books:

1. Jha, Kumar Neeraj, "Construction Project Management: Theory and Practice", Pearson Education India, 2011

2. Seetharaman, S., Construction Engineering & Management, Umesh Publications, 2007.
3. Kotadia, A.S., "Construction Management and equipments", Mahajan Publishing House, 8th Edition, 2010
4. Sharma, S.C., Construction Equipment & Management, Khanna Publications, New Delhi, 1988.
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.
6. Sahu, G.C. and Jena, Joygopal, "Building Materials and Construction", McGraw Hill Education, Latest Edition
7. Punmia, B. C., Jain, Ashok Kumar, "Soil Mechanics and Foundations", Laxmi Publication, 16th edition.

Web Materials:

1. <http://nptel.ac.in/courses/105103023/>
2. <https://www.youtube.com/watch?v=XEAc1IFHzpY>
3. <https://www.youtube.com/watch?v=pN2Th96poHQ>
4. <https://www.youtube.com/watch?v=D0DCtN0SXGQ>
5. <https://www.youtube.com/watch?v=pBJfKHRzDEM>

LIST OF PRACTICAL/TUTORIAL

Sr. No.	Name of Tutorials
1.	Estimating Earth Work For Construction Projects
2.	Machine Power
3.	Owning Operating Cost
4.	Output Analysis of Equipment
5.	Replacement Analysis of Equipment
6.	Excavating Equipment-Basic parts, selection and operation
7.	Handling and Hauling Equipment- Basic parts, selection and operation
8.	Conveying Equipment and Drilling Equipment- Basic parts, selection and operation
9.	Ground Water Control During Excavation
10.	Latest Building Material and Technology

**CL383: INSTRUMENTATION & SENSOR TECHNOLOGIES FOR CIVIL
ENGINEERING APPLICATIONS
B TECH 6th SEMESTER (CIVIL ENGINEERING)**

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	03	02	05	04
Marks	100	50	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Fundamentals of Measurement, Sensing and Instrumentation	10
2	Sensor Installation and Operations	10
3	Data Analysis and Interpretation	12
4	Frequency Domain Signal Processing and Analysis	13

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

- | | | | |
|----------|---|-----------------|-------------|
| 1 | Fundamentals of Measurement, Sensing and Instrumentation | 10 Hours | 22 % |
| 1.1 | Definition of measurement and instrumentation, physical variables, common types of sensors. | | |
| 1.2 | Describe the function of these sensors; | | |
| 1.3 | Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations; | | |
| 2 | Sensor Installation and Operations | 10 Hours | 22 % |
| 2.1 | Predict the response of sensors to various inputs;
Construct a conceptual instrumentation and monitoring | | |

- program
- 2.2 Describe the order and methodology for sensor installation
Differentiate between types of sensors and their modes of operation and measurement
- 2.3 Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty
- 3 Data Analysis and Interpretation** **12 Hours 27 %**
- 3.1 Fundamental statistical concepts, Data reduction and interpretation, Piezometer, Inclinator, Strain gauge, etc.
- 3.2 Time domain signal processing, Discrete signals, Signals and noise
- 3.3 Examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)
- 4 Frequency Domain Signal Processing and Analysis** **13 Hours 29 %**
- 4.1 Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data;
- 4.2 Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis,
- 4.3 Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

C. Course Outcomes (COs):

On the completion of the course one should be able to

- CO1 Analyze the errors during measurements
- CO2 Specify the requirements in the calibration of sensors and instruments
- CO3 Describe the noise added during measurements and transmission
- CO4 Describe the measurement of electrical variables
- CO5 Describe the requirements during the transmission of measured signals and construct Instrumentation/Computer Networks
- CO6 Suggest proper sensor technologies for specific applications and design and set up measurement systems and do the studies

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	2	2	-	-	-	-	1	1	1	1	1
CO2	3	2	2	1	2	2	-	-	-	-	1	1	1	1-	1
CO3	3	2	2	1	2	2	-	-	-	-	1	1	1	1	1
CO4	3	2	2	1	2	2	-	-	-	-	1	1	1	1	1
CO5	3	2	2	1	2	2	-	-	-	-	1	1	1	1	1
CO6	3	2	2	1	2	2	-	-	-	-	1	1	1	1	1

D. Recommended Study Material:

Text Books:

- Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
- David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press
- S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
- Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

List of Experiments

Experiment No.	Name of Experiment
1.	Instrumentation of typical civil engineering members/structures/structural elements
2.	Use of different sensors, strain gauges, inclinometers,

3.	Performance characteristics
4.	Errors during the measurement process
5.	Calibration of measuring sensors and instruments
6.	Measurement, noise and signal processing
7.	Analog Signal processing
8.	Digital Signal Processing
9.	Demonstration & use of sensor technologies