ACADEMIC REGULATIONS & SYLLABUS

Faculty of Technology & Engineering

Bachelor of Technology Programme
(Third Year Civil Engineering)
Effective From 2018-19

Education Campus – Changa, (ECC), hitherto a conglomerate of institutes of professional education in Engineering, Pharmacy, Computer Applications, Management, Applied Sciences, Physiotherapy and Nursing, is one of the choicest destinations by students. It has been transformed into **Charotar University of Science and Technology (CHARUSAT)** through an Act by Government of Gujarat. CHARUSAT is permitted to grant degrees under Section-22 of UGC- Govt. of India.

The journey of CHARUSAT started in the year 2000, with only 240 Students, 4 Programmes, one Institute and an investment of about Rs. 3 Crores (INR 30 million). At present there are seven different institutes falling under ambit of six different faculties. The programmes offered by these faculties range from undergraduate (UG) to Ph.D degrees including M.Phil. These faculties, in all offer 64 different programmes. A quick glimpse in as under:

Faculty	Institute	Programmes Offered
Faculty of Technology & Engineering	Charotar Institute of Technology	B. Tech M. Tech MTM Ph.D.
Faculty of Pharmacy	Ramanbhai Patel College of Pharmacy	B. Pharm M. Pharm MPM PGDCT/ PGDPT Ph.D.
Faculty of Management Studies	Indukaka Ipcowala Institute of Management	M.B.A PGDM Dual Degree BBA+MBA Ph.D.
Faculty of Computer Applications	Smt. Chandaben Mohanbhai Patel Institute of Computer Applications	M.C.A/MCAL M.Sc. (IT) Dual Degree BCA+MCA Ph. D

Faculty of Applied Sciences	P. D. Patel Institute of Applied Sciences	M.Sc. Dual Degree B.Sc. + M.Sc. Ph.D.
Faculty of Medical Sciences	Ashok and Rita Institute of Physiotherapy Manikaka Topawala Institute of Nursing Charotar Institute of Paramedical Sciences	B.PT M.PT Ph.D. B.Sc. (Nursing) M.Sc. PGDHA PGDMLT GNM Ph.D.

The development and growth of the institutes have already led to an investment of over Rs. 125 Crores (INR 1250 Million). The future outlay is planned with an estimate of Rs. 250 Crores (INR 2500 Million).

The University is characterized by state-of-the-art infrastructural facilities, innovative teaching methods and highly learned faculty members. The University Campus sprawls over 105 acres of land and is Wi-Fi enabled. It is also recognized as the Greenest Campus of Gujarat.

CHARUSAT is privileged to have 360 core faculty members, educated and trained in IITs, IIMs and leading Indian Universities, and with long exposure to industry. It is also proud of its past students who are employed in prestigious national and multinational corporations.

From one college to the level of a forward-looking University, CHARUSAT has the vision of entering the club of premier Universities initially in the country and then globally. High Moral Values like **Honesty, Integrity and Transparency** which has been the foundation of ECC continues to anchor the functioning of CHARUSAT. Banking on the world class infrastructure and highly qualified and competent faculty, the University is expected to be catapulted into top 20 Universities in the coming five years. In order to align with the global requirements, the University has collaborated with internationally reputed organizations like Pennsylvania State University – USA, University at Alabama at Birmingham – USA, Northwick Park Institute –UK, ISRO, BARC, etc.

CHARUSAT has designed curricula for all its Programmes in line with the current international practices and emerging requirements. Industrial Visits, Study Tours, Expert Lectures and Interactive IT enabled Teaching Practice form an integral part of the unique CHARUSAT pedagogy.

The Programmes are credit-based and have continuous evaluation as an important feature. The pedagogy is student-centered which augurs well for self-learning and motivation for enquiry and research, and contains innumerable unique features like:

- Participatory and interactive discussion-based classes.
- Sessions by visiting faculty members drawn from leading academic institutions and industry.
- Regular weekly seminars.
- Distinguished lecture series.
- Practical, field-based projects and assignments.
- Summer training in leading organizations under faculty supervision in relevant Programmes.
- Industrial tours and visits.
- Extensive use of technology for learning.
- Final Placement through campus interviews.

Exploration in the field of knowledge through research and development and comprehensive industrial linkages will be a hallmark of the University, which will mould the students for global assignments through technology-based knowledge and critical skills.

The evaluation of the student is based on grading system. A student has to pursue his/her Programme with diligence for scoring a good Cumulative Grade Point Average (CGPA) and for succeeding in the chosen profession and life.

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)
CHARUSAT Campus, At Post: Changa – 388421, Taluka: Petlad, District: Anand
Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in
www.charusat.ac.in

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 Exam per course	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 $= \Sigma C_i G_i / \Sigma C_i$ 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 $= \Sigma C_i G_i / \Sigma C_i$ 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
First class	:	CGPA ≥ 6.0
Second Class	:	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.

Annexure – 1

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

Level	Course Code	Course Title	Teaching Scheme							Examination Scheme				Total
			Contact Hours			Credit				Theory		Practical		
			Theory	Practical	Total	Theory	Practical	Project	Total	Internal	External	Internal	External	
Level 3	HS124.01 A	Professional Communication	2		2				2			30	70	100
	MA341/342	Numerical Analysis/Probability & Statistics	3	2	5	3	1		4	30	70	25	25	150
	CL341	Structural Analysis-II	4	2	6	4	1		5	30	70	25	25	150
	CL342	Concrete Technology	4	2	6	4	1		5	30	70	25	25	150
	CL343	Building Planning	3	4	7	3	2		5	30	70	50	50	200
	CL344	Summer Internship - I	0	3	3	0	0	3	3			75	75	150
	CL371-CL375	Programme Elective-I	3	2	5	3	1		4	30	70	25	25	150
					34				28					1050
	HS125.01 A / HS130 A	Society, Governance and International Studies / Law & Justice	2		2				2	30	70			100
		OR												
	HS134 A	Contributor Personality Development										30	70	
	CL345	Environmental Engineering-I	4	2	6	4	1		5	30	70	25	25	150

CL346	Geotechnical Engineering-I	3	2	5	3	1		4	30	70	25	25	150
CL347	Water Resources Engineering-I	4	2	6	4	1		5	30	70	25	25	150
CL348	Transportation Engineering-I	4	2	6	4	1		5	30	70	25	25	150
CL376-CL379	Programme Elective-II	3	2	5	3	1		4	30	70	25	25	150
	Assignment Practices/Student counselling/Remedial classes/Library/Sports/Extra-curricular & co-curricular			3									
				33				25					850

Contents

B. Tech. (Civil Engineering) Programme

SYLLABI
(Semester – 5)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

Credits and Hours:

Credits	Teaching Scheme	Evaluation Scheme				
	Contact Hours/Week	Theory		Practical		Total
		Internal	External	Internal	External	
02	02	_	_	30	70	100

A. Course Objectives

- To hone and sharpen Professional Communication Skills of students

- To prepare globally and multi-culturally competent communicators and professionally compatible cadre of future professionals

- To equip and empower students to qualify and successfully clear all the phases of selection procedure for on and off campus interviews

B. Course Outline

Module No.	Title/Topic	Classroom Contact Sessions
1	**An Introduction Professional Communication**	04
	• Concept & Applications of Professional Communication	
	• Principles of Professional Communication	
	• Communication networks: personal sanctum, professional sanctum, inner circle, and outer circle; managing the networks	
	• Communication strategies: communicator, audience, message, channel choice, culture	
2	**Professional Communication and Rhetorics**	04
	• Concepts of "Communication" and "Professional Communication" and "Rhetorics"	
	• Orientation towards the Concepts of Professional Communication and Rhetorics (Speaking)	

	• Importance of Ethos, Logos, and Pathos in Professional Communication	
	• Principles of Professional Communication (visual, oral and non-verbal)	
3	**Cross-cultural Communication and Globalization**	04
	• Basic Concepts: Culture, Globalization and Cross-cultural Communication	
	• Communicating with People of Different Cultures	
	• Conflicts in Cross-cultural Communication and Tactics / techniques to resolve them	
4	**Written Professional Communication**	06
	• Importance of Written Professional Communication	
	• Letter Writing, E-mail Writing, Report Writing	
	• Resume Building	
5	**Academic Writing**	06
	• Importance of Academic Writing	
	• Research Paper Writing	
	• Article/ Review Writing	
	• Reference and Citation	
6	**Effective Presentation Strategies**	06
	• Why and How in Presentation	
	• Audience Analysis and Supporting Material	
	• Presentation Mechanics and Presentation Process	
	• Managing Yourself during Q and A Session	
	• Fundamentals of Persuasions	
	Total	30

C. Pedagogy

Teaching will be facilitated by reading material, discussions, task-based learning, projects, assignments and interpersonal activities like group work, independent and collaborative study projects and presentations, etc.

D. Evaluation

Internal Evaluation

Students' performance in the course will be evaluated on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Assignment	02	05	10
2	Project	01	15	15
3			Attendance	05
			Total	30

External Evaluation

University Practical Examination will be for 70 marks to be conducted at the end of the semester. Details are:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Practical / Viva	01	70	70
			Total	70

E. Learning Outcomes

After successfully passing through this course, the students would have –

- Gained thorough understanding and proficiency in various Professional Communication Skills.
- Developed awareness and competence in cross-cultural communication in their personal, academic and professional environments.
- Been empowered and confident to prepare impressive RESUMEs, and crack further phases of interview successfully.

F. Reference Books

1) Eckhouse, B. E. (1999). Competitive Communication: A Rhetoric for Modern Business. Oxford University Press. (for Module - II)

2) Koneru, A. (2008). Professional Communication. New Delhi: Tata Mcgraw-Hill. (for ModuleI & III)

3) Meenakshi Raman, P. S. (2006). Business Communication. Meenakshi Raman, Prakash Singh. (for module I and IV)

4) Parul Popat, K. K. (2015). Communication Skills. New Delhi: Pearson. (for Module V & VI)

5) Sanjay Kumar, P. L. (2015). Communication Skills. Oxford University Press India. (for Module I, III and V)

MA341: NUMERICAL ANALYSIS
B TECH 5th SEMESTER (CIVIL ENGINEERING)

Credit and Hours:

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

A   Objective of the Course:

- This course is the foundation courses for Finite Element Methods, Finite Volume Methods and related courses of higher semesters in Civil Engineering.
- To develop more efficient and fast convergence algorithms and find better ways to control the source of errors.

The objectives of the course are to:

1. Understand the concepts of number presentation in digital computer and related computations,
2. Understand the concepts of error in numerical computations, determine numerical solution of equation
3. Understand the concepts of numerical integration and differentiation.
4. Understand the concepts of numerical solution of differential equations.

B   Outline of the Course:

Sr. No	Title of Unit	Minimum number of Hours
1	Numerical Analysis and Computers	05
2	Approximate solutions of nonlinear equations and system of linear equations	07
3	Numerical Integration and Differentiation	07
4	Interpolation and Polynomial Approximation	08
5	Numerical Solution of Ordinary Differential equations	08
6	Numerical Solution of Ordinary and Partial Differential equations	10

Total hours (Theory): 45

Total hours (Lab): 30

Total Hours: 75

C   Detailed Syllabus:

1	**Numerical Analysis and Computers**	**05 Hours**	**12%**
1.1	Concepts and definitions		
1.2	Representation of numbers in computers, types of errors		
1.3	Basic sources of errors, significant digits		
1.4	Computer arithmetic, errors in computations with digital computers.		
2	**Approximate solutions of nonlinear equations and System of linear equations**	**07 Hours**	**16%**
2.1	Bisection method, Method of False position, Method of Iteration.		
2.2	Newton-Raphson method for single variable		
2.3	Convergence criteria and rate of convergence and error estimates for these methods.		
2.4	Direct Method: Gauss Jordan method, Crout's LU-factorization methods.		
2.5	Indirect methods: Gauss Seidel and Jacobi's methods.		
3	**Numerical Integration and Differentiation**	**07 Hours**	**16%**
3.1	Composite Quadrature (Newton-Cotes Quadrature)		
3.2	Romberg Integration and Gaussian Quadrature		
3.3	Remainder terms, error bounds and estimates of these rules		
3.4	Numerical Differentiation		
4	**Interpolation and Polynomial Approximation**	**08 Hours**	**18%**
4.1	Finite differences and associated operators		
4.2	Newton's difference interpolation		
4.3	Lagrange interpolation, Hermite interpolation		
4.4	Error estimates of these formulae		
5	**Numerical Solution of Ordinary Differential equations**	**08 Hours**	**18%**
5.1	Euler and Modified Euler Method, Runge -Kutta methods		
5.2	Wilson-Theta Method, Newmark Beta Method		

| 6 | Numerical Solution of Partial Differential equations | 10 Hours | 20% |

6.1 Finite difference approximations to derivatives

6.2 Solution of Laplace Equation by Gauss Jacobi and Gauss Seidel
Method

6.3 Solution of Heat Equation in One dimension

6.4 Solution of Wave Equation in One dimension

D Methods and Pedagogy:

- At the starting of the course, delivery pattern and prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of Multi-Media projector, Black board, OHP etc.

- Attendance is compulsory in lectures and laboratory.

- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.

- Surprise tests/Quizzes/Seminar/ Assignments will be conducted as a part of internal theory evaluation.

- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures using MATLAB.

- Experiments/Tutorials related to course content will be carried out in the laboratory.

- In the lectures and laboratory discipline and behavior will be observed strictly.

E Student Learning Outcomes / Objectives:

- At the end of course students will be able to grasp, analyze, formulate and solve Numerical problems related to Civil Engineering.

- At the end of the course the students will be able to frame the fundamental algorithms/programming of Numerical analysis via programming language (MATLAB).

F Recommended Study Material:

Text Books:

1) Sastry, S. S. Introductory methods of numerical analysis. PHI Learning Pvt. Ltd., 2012.

2) Chowdhury, Indrajit, and Shambhu P. Dasgupta. Dynamics of Structure and Foundation-A Unified Approach: 1. Fundamentals. Vol. 1. CRC Press, 2008.

3) Dukkipati, Rao V., M. Ananda Rao, and Rama B. Bhat. Computer aided analysis and design of machine elements. New Age International, 2006.

4) Chapra, Steven C., and Raymond P. Canale. Numerical methods for engineers. Vol. 2. New York: McGraw-Hill, 2012.

Reference Books:

1) Rajaraman, Vaidyeswaran. Computer oriented numerical methods. PHI Learning Pvt. Ltd., 1993.

2) Grewal, B. S., & Grewal, J. S. Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB. Khanna, 2014.

3) Dukkipati, Rao V. MATLAB: An Introduction with Applications. New Age International, 2010.

4) Gilat, Amos. MATLAB: An introduction with Applications. John Wiley & Sons, 2009.

5) Fausett L V. Applied numerical analysis using MATLAB. Pearson; 2008.

Reading Materials, web materials with full citations:

1) http://numericalmethods.eng.usf.edu

2) http://mathworld.wolfram.com/

3) http://nptel.ac.in

Credit and Hours:

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

A Objective of the Course:

- This course is applied in nature and useful in courses like Structural Engineering, Hydrology and Water Resource Engineering, Hydrology, Geotechnical Engineering and other courses of higher semesters in Civil Engineering.

- The experimental data collection of above listed courses as real life applications involve uncertainties and variations which needs to be explained.

The objectives of the course are to:

1. Understand the concepts of uncertainty and solving probability problems ,
2. Understand the concepts of statistical inference
3. Understand the concepts of least squares method in regression.
4. Understand the concepts of stochastic time series.

B Outline of the Course:

Sr. No	Title of Unit	Minimum number of Hours
1	Basic Probability Concepts	06
2	Random Variables	07
3	Special Probability Distributions	08
4	Elementary Statistical Inference	06
5	Regression Analysis	08
6	Time Series Analysis	10

Total hours (Theory): 45

Total hours (Lab): 30

Total Hours: 75

C   Detailed Syllabus:

1	**Basic Probability Concepts**	**06 Hours**	**14%**
1.1	Set Theory, Sample Space and Events		
1.2	Probability Set Function,		
1.3	Conditional Probability and Baye's Theorem		
1.4	Independence		
2	**Random Variables and Probability distribution**	**07 Hours**	**16%**
2.1	Discrete and Continuous random variables.		
2.2	Transformations		
2.3	Expectations of a random variable		
2.4	Distributions of two random variables and expectation		
2.5	Transformation and bivariate random variables, conditional distributions and expectation		
2.6	Independent random variable, Linear combinations of random variable		
3	**Special Probability Distributions**	**08 Hours**	**18%**
3.1	Discrete Probability distributions Binomial, Poisson, Geometric and Negative binomial		
3.2	Continuous Probability distribution Uniform, Exponential, Gamma and Normal distribution		
3.3	Sampling distributions: t F and Chi-square distribution		
4	**Elementary Statistical Inference**	**06 Hours**	**14%**
4.1	Confidence Intervals and Hypothesis Testing: Mean, Variance and Proportion		
4.2	Confidence Intervals and Hypothesis Testing: Difference of Two Means, Variances and Difference of Two Proportions		
5	**Regression Analysis**	**08 Hours**	**18%**
5.1	Simple Linear Regression: Fitting a straight line using least squares		
5.2	Tests of significance and confidence intervals		

5.3 Checking the straight line fit

5.4 Multiple Regression: Formulation of the model

5.5 Linear least squares solutions using the matrix method.

5.6 Model diagnostics

| 6 | **Time Series Analysis** | 10 Hours | 20% |

6.1 Introduction to Stochastic and Deterministic Dynamic Mathematical Models

6.2 Stationary and Non-stationary Stochastic Models for Forecasting and Control

6.3 Autocorrelation Function and Spectrum of Stationary Processes

6.4 Estimation in the time-domain

6.5 Stationary processes in the frequency domain

D Methods and Pedagogy:

- At the starting of the course, delivery pattern and prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of Multi-Media projector, Black board, OHP etc.

- Attendance is compulsory in lectures and laboratory.

- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.

- Surprise tests/Quizzes/Seminar/ Assignments will be conducted as a part of internal theory evaluation.

- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures using MATLAB.

- Experiments/Tutorials related to course content will be carried out in the laboratory.

- In the lectures and laboratory discipline and behavior will be observed strictly.

E   Student Learning Outcomes / Objectives:

- At the end of course students will be able to grasp, analyze, formulate and solve problems related to probability and probability distribution, regression and time series analysis as an application to various courses of Civil Engineering.

- At the end of the course the students will be able to frame the fundamental algorithms/programming of Statistical Techniques using programming language (MATLAB).

F   Recommended Study Material:

Text Books:

1) Kottegoda, Nathabandu T., and Renzo Rosso. Applied statistics for civil and environmental engineers. Malden, MA: Blackwell, 2008.

2) Johnson, Richard A. Miller and Freund" s Probability and Statistics for Engineers. Prentice Hall, 1994.

3) Ang, Alfredo Hua-Sing, and Wilson H. Tang. Probability Concepts in Engineering Planning and Design: Emphasis on Application to Civil and Environmental Engineering. Wiley, 2007.

4) Chatfield, Chris. The analysis of time series: an introduction. CRC press, 2016.

Reference Books

1) Benjamin, Jack R., and C. Allin Cornell. Probability, statistics, and decision for civil engineers. Courier Corporation, 2014.

2) Hogg, Robert V., and Elliot A. Tanis. Probability and statistical inference. Vol. 993. New York: Macmillan, 1977.

3) Box, G.E., Jenkins, G.M., Reinsel, G.C. and Ljung, G.M., 2015. Time series analysis: forecasting and control. John Wiley & Sons.

4) Draper, Norman R., and Harry Smith. Applied regression analysis. John Wiley & Sons, 2014.

5) Walpole, Ronald E., et al. Probability and statistics for engineers and scientists. Vol. 5. New York: Macmillan, 1993.

6) Shaw, E.M., Beven, K.J., Chappell, N.A. and Lamb, R., 2010. Hydrology in practice. CRC Press.

7) Gilat, Amos. MATLAB: An introduction with Applications. John Wiley & Sons, 2009.

Reading Materials, web materials with full citations:

NPTEL Courses:

1) Stochastic Hydrology: nptel.ac.in/courses/105108079/
2) Probability Methods in Civil Engineering: nptel.ac.in/courses/105105045/

Credits and Hours:

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

A. **Objectives of the Course:**

The main objectives of the course are:

- To understand the concept of analysis of indeterminate structures by various classical methods
- To identify and formulate an engineering problem and to develop a solution
- To understand the influence line concepts for indeterminate structures
- To know about the concept of strain energy and principle of virtual work
- To provide basic knowledge of Matrix method

B. **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

C. 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

D. **Instructional Method and Pedagogy:**

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.

- Surprise tests/Quizzes/Seminar will be conducted as per pedagogy as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. **Students Learning Outcome:**

On the completion of the course the students will be able to:
- Identify the fundamentals of structure and various methods of Analysis
- Recognize the role of professional societies in developing new structural software and updating current knowledge
- Identify and formulate an engineering problem and to develop a solution
- Use various classical methods for analysis of indeterminate structures
- Demonstrate the concepts of qualitative influence line diagram for rigid jointed structures having higher degree of statically indeterminacy.
- Apply the basic concepts of matrix methods in structural analysis

F. **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

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

CL342: CONCRETE TECHNOLOGY
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. Objectives of the Course:

The main objectives of the course are:

- To understand the properties of ingredients of concrete
- To study the behavior of concrete at its fresh and hardened state
- To study about the concrete design mix
- To know about the procedures in concreting
- To understand special concrete and their use

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	02
2	Cement	08
3	Aggregate	08
4	Admixtures	08
5	Fresh Concrete	08
6	Harden Concrete	08
7	Selection of Concrete Mix Proportion (Mix Design)	08
8	Special Concrete	06
9	Non-Destructive testing of Concrete	04

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	Introduction	02 Hours	05%

1.1 Ingredients of concrete

1.2 Strength development

1.3 Different types of concrete

1.4 New developments and future trends

2	Cement	08 Hours	13%

2.1 History of Portland cement

2.2 Manufacture 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	08 Hours	13%

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   08 Hours   13%

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   08 Hours   13%

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   08 Hours   13%

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   Microcraking , Creep and Shrinkage

6.6   Aggregate cement paste interface

6.7   Maturity of concrete

7   Selection of Concrete Mix Proportions (Mix Design)   08 Hours   13%

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** | 06 Hours | 10% |

8.1 High performance concrete

8.2 Lightweight aggregate

8.3 High strength concrete

8.4 Polymer concrete

8.5 Fiber reinforce concrete

8.6 Ready mix concrete

8.7 Mass concrete

8.8 Self-compacting concrete

| 9 | **Non-Destructive testing of Concrete** | 04 Hours | 07% |

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

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures and laboratory.

- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.

- Assignments/Surprise tests/Quizzes/Seminar will be conducted as a part of internal theory evaluation.

- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

E. **Students Learning Outcome:**

On the completion of the course

- The students will be able to: test all the concrete materials as per IS code.

- The students will understand concrete mix design using ACI and IS code methods.

- The students able to determine the properties of fresh and hardened of concrete.

- The students have knowledge of special concretes and their specific applications.

- The students can ensure quality control while testing/ sampling and acceptance criteria

F. **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, Prentica 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/

LIST OF EXPERIMENTS

Experiment No.	Name of Experiment
1	Determination of Standard Consistency of Cement Paste
2	Determination of Initial and Final Setting Time of Ordinary Portland cement
3	Determination of Soundness of Cement with the Le-Chatelier Apparatus
4	Determination of Compressive Strength of Cement
5	Sieve Analysis of Coarse and Fine Aggregates
6	Flakiness Index and Elongation Index of Course Aggregate
7	To Measure the Workability of the Concrete by Slump Method
8	To Measure Workability of Mix by Using Compaction Factor Apparatus
9	To Measure Workability of Mix by Vee Bee Consistometer
10	Determination of Compressive Strength of Concrete Cubes
11	Determination of Flexural Strength of Concrete (Modulus of rupture)
12	Determination of Tensile Strength of Concrete by Split Cylinder Test
13	Ultrasonic Pulse Test

CL 343: BUILDING PLANNING
B. TECH 5ᵗʰ SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	3	4	7	5
Marks	100	100	200	

A. Objectives of the Course:

The main objectives of the course are:

- To introduce and expose students to the complex inter-relationship between man and the built environment
- To introduce various aspects of principles of planning and architecture in building design and understand planning and drawing of buildings
- To familiarize with local building byelaws and provisions of National Building Code in respect of building and town planning
- To make the students familiar with different types of plumbing and electric fittings and layout
- To enable students to appreciate various architectural forms and shapes with the help of perspective views
- To provide the basic knowledge of Town Planning and the principles involved

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Building Drawing	03
2	Building Byelaws	07
3	Planning of Residential Buildings	15
4	Building Services	06
5	Perspective Drawing	08
6	Introduction to Town Planning	06

Total Hours (Theory): 45

Total Hours (Lab): 60

Total Hours: 105

C. 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	07 Hours	16%
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	15 Hours	33%
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	Building Services	06 Hours	13%
4.1	Water supply and Drainage – water distribution systems, materials used for plumbing, drainage systems		

4.2	Electrification – distribution of electrical energy, accessories of electrical installation, purpose of earthing		
4.3	Working drawing of a building – Electrical layout, Water supply and drainage layout		
5	**Perspective Drawing**	08 Hours	18%
5.1	Introduction & technical terms		
5.2	Classifications, elements of perspective		
5.3	Examples		
6	**Introduction to Town Planning**	06 Hours	13%
6.1	History, ancient planning in India		
6.2	Objects & importance of town planning		
6.3	Principles of town planning		
6.4	Horizontal growth, vertical growth		
6.5	Satellite town, ribbon development, concentric growth		

D. **Instructional Method and Pedagogy:**

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar will be conducted as per pedagogy as a part of internal theory evaluation.
- The course includes tutorial / drawing practice, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Theoretical concepts will be supported by different models and charts in the tutorial.

E. **Learning Outcomes:**

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

- Utilize basic principle of planning and architecture in design of various types of building.
- Understand local building bye-laws and provisions of National Building Code in respect of building and town planning.
- Utilize the knowledge of different types of plumbing and electric fitting and laying procedure.
- Understand perspective drawing and represent various forms in perspective view.
- Have basic understanding of Town planning and its history.

F. **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=EIDXE28_8eQ
3) https://www.youtube.com/watch?v=VYiVjVulnm4
4) https://www.youtube.com/watch?v=bCn0X9RRjN0&list=PL060E3l66E87E1FD5

5) https://www.designingbuildings.co.uk/wiki/Types_of_drawings_for_building_design
6) http://freevideolectures.com/Course/86/Building-Materials-and-Construction/31

LIST OF TUTORIALS

Sr. No.	Details
1	Conventional Signs & Symbols (Copying exercise)
2	Plan, Sectional Elevation, Front Elevation and site plan for a small house (One Room and Verandah) (Copying exercise)
3	Plan for Three bed room House in Hot and Arid zone
4	Plan for Three bed room House in Hot and humid zone
5	Plan, Sectional Elevation, Front Elevation and site plan for Duplex Type House
6	Model Making
7	Design of houses with given functional requirements and climatic data
8	Perspective Drawing: One Point Perspective Problem
9	Perspective Drawing: Two Point Perspective Problem

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. **Objective of the Course:**

Summer internships are required to be carried out in order to help students to find and know the application of their theoretical knowledge, enhance their industry experience, get familiar with the industry culture and work ethics.

The main objectives for offering the internship to the students are:

- To get perspective and experience of the their field

- To make them industry ready

- To get familiar with modern tools and technologies

- To enhance their technical writing skills in reporting as per the industry standards

- To get them involved in design, development and testing practices followed in the industry

- To enhance their soft-skills, presentation skills, interpersonal skills, documentation skills and office etiquettes required to sustain in industry environment

- To participate in teamwork and preferably as part of a multi-disciplinary team

- To understand the professional and ethical responsibilities of an engineer

- To make them more productive, consistent and punctual

- To make them aware about industry best practices, processes and regulations

B. **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.

C. **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.

D. **Learning Outcomes:**

After completion of the course, students will be able:

- To apply knowledge and skills learned in company/industry/organization to real-world problems with confidence

- To solve engineering problems

- To function in a team work

- To work with teammates from other disciplines

- To use experience related to professional and ethical issues in the work environment

- To explain the impact of engineering solutions, developed in a project, in a global, economic, environmental, and societal context

- To finds relevant sources (e.g., library, Internet, experts) and gather information

- To demonstrates knowledge of contemporary issues related with engineering in general

- To use new tools and technologies

Credits and Hours:

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

A. **Objectives of the Course:**

The objectives of the course are:

- To make students capable of applying engineering fundamentals and economic aspects on planning, selection and operation of construction equipment.

- To make student to able to demonstrate an operations and productivity of construction equipment.

- To analyze major excavating and material handling equipment for construction planning operations.

- To make the students familiar with the operations, systems and techniques used in ground water control during excavation.

- To equip students with adequate knowledge on the recent developments in the area of construction material and technology.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum Number 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

C. 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		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar will be conducted as per pedagogy as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Theoretical concepts will be supported by charts in the laboratory.
- Field Visits of construction industry and related construction equipment will be arranged during semester.

E. **Learning Outcomes:**

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

- The students will be able to plan and select suitable construction equipment for different construction activities.

- The students will acquire ability to do planning for construction operations based on equipment productivity.

- Students will have an understanding on various systems and techniques used in ground water control during excavation.

- Students will be familiar with materials and systems used in the temporary supporting structures/systems used at construction sites.

F. **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=XEAc11FHzpY
3) https://www.youtube.com/watch?v=pN2Th96poHQ
4) https://www.youtube.com/watch?v=D0DCtN0SXGQ
5) https://www.youtube.com/watch?v=pBJfKHRzDEM
6) https://www.youtube.com/watch?v=RB91Sm-kGJ8

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

Credits and Hours:

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

A. **Objective of the Course:**

This course covers the advanced topics of Fluid Mechanics. The principles and application of the core branch of civil engineering is covered. The objectives of the course are to:

- Understand the different flow regimes like laminar, turbulent, submerged flow, and open channel flow.

- How to use the commercial pipes for pipe systems.

- Determine the water profiles and energy dissipation for non-uniform flow in open channel flow.

- Provide insights to various forces acting on submerged objects.

- Study functioning of various pumps and turbines.

- Develop insight for many complex flow problems by establishing functional relationship.

B. **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

C. 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, Poiseulle flow

2.3 Couette flow

2.4 Laminar flow in pipe

2.5 Boundary Layer, Developments of boundary layer along flat plate, 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,		

D. **Instructional Methods and Pedagogy:**

- At the starting of the course, delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of Multi-Media projector, Black Board, OHP etc.

- Attendance is compulsory in lectures and laboratory.

- Internal exams/Unit tests/Surprise tests/Quizzes/Seminar/Assignments etc. will be conducted as a part of continuous internal theory evaluation.

- The course includes a laboratory, where students will get opportunities to build appreciation for the concepts being taught in lectures.

- Experiments/Tutorials related to course content will be carried out in the laboratory.

- In the lectures and laboratory discipline and behavior will be observed strictly.

- Industrial visits will be organized for students to explore industrial facilities. Students are required to prepare a report on industrial visit and submit as a part of the assignment.

E. **Student Learning Outcomes:**

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

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

F. **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

CL 373: AIR POLLUTION AND CONTROL
B TECH 5th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Objectives of the Course:

The main objectives of the course are:

- To have the knowledge of mathematics, science and engineering to identify and to solve the problem of air pollution
- To emphasis on the principles underlying the understanding of ambient air pollution, sources, effects and air pollution problems in India
- To learn the fundamental concepts about sources of air pollution, basic meteorological processes and technology for air pollution control and odour control
- To understand the health problems, risk assessment, global atmospheric changes and reasons for environment degradation due to air pollution

B. 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

C. 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, Headley 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		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector and black board.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignment / Surprise tests/ Quizzes/ Seminar will be conducted as a part of internal theory evaluation.

- The course includes a laboratory, where students have an opportunity to build an illustration for the concepts being taught in lectures.
- Experiments/ Tutorials related to course content will be carried out in the laboratory or field as per the need.
- A field visit related to the Air pollution and control will be carried out for further understanding of the subject. Report will be prepared by the students for the same.

E. **Student Learning Outcomes:**

On the successful completion of this course,
- The students will be able to classify the sources of air pollution, describe effects, various methods and equipment available for controlling air pollution.
- The students will recognize the diverse knowledge of air pollution control practices applied to real life problems.
- 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.

F. **Recommended Study Material:**

Text Books:
1) 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://cpcbenvis.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)

Credits and Hours:

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

A. Objective of the Course:

The main objectives of the course are:

- To make students aware about Architectural Design process with facilities and its importance
- To explain various parameters to make Sustainable Infrastructure
- To make students aware about Architectural planning and design
- To make students aware about application of various Engineering principles in the process of architectural designing and its importance

B. 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

C. 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

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Field case studies based on such principles, selection of site as well as materials and teaching case wise solutions with proposals.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Tutorials will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. **Students Learning Outcomes:**

On successfully completion of the course, students will be able to

- Architectural design of facilities,
- Use basic architectural principles in the design of buildings, interior spaces and sites,
- Understanding of 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,
- Read architectural drawings and make technically precise drawings.

F. **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)

CL 375: BUILDING SERVICES
B. TECH 5TH SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Objective of the Course:

The objectives of the course are:

- To understand the basic principles, installations, operations and maintenance of building services
- To identify building services equipment and explain its function
- To describe how building services are integrated into a building
- To determine how building performance and regulatory requirements affect the design and commissioning of building services

B. 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

C. 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 absolvents, 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)

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Theoretical concepts will be made clearer by discussing case studies of multi-storey buildings and lessons from those experiences.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignment work will be given based on various aspects related to building services and will be evaluated at regular interval as a part of internal theory evaluation.
- Surprise tests/Quizzes/Seminar will be conducted as a part of internal theory evaluation.
- Experiments/Tutorials related to course content will be carried out in the laboratory.
- Photographs /videos etc. related to the building services will be shown.
- Site visits to building complexes under construction will be arranged to show different building services being installed.
- Students will be asked to give presentation of subjects related to latest trends in building services.

E. **Students Learning Outcomes:**

On successful completion of this course

- The students will acquire competencies to plan various types of services required for different types of building.
- Students will be able to manage building services provisions in big construction sites.
- Students will be able to synchronize the construction activities with installation of building services.
- 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.
- Students will gain technological solution alternatives and knowledge of equipment in the market for ventilation, heating, cooling techniques, building service systems.

F. **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
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

<div align="center"><u>**LIST OF PRACTICALS / EXERCISE**</u></div>

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	

B. Tech. (Civil Engineering) Programme

SYLLABI
(Semester – 6)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

HS125.01 A: SOCIETY, GOVERNANCE AND INTERNATIONAL STUDIES
B TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Credits	Teaching Scheme	Evaluation Scheme				
	Contact Hours/Week	Theory		Practical		Total
		Internal	External	Internal	External	
02	02	30	70	_	_	100

A. Course Objectives

To facilitate learners to:

- Develop a familiarity with the mechanics of critical thinking and logic

- Understand basic concepts of critical thinking and logic

- Explore and understand critical thinking and logic in context of professional, social and personal spectrum

- Explore an application critical thinking and logic in personal, social, academic, global and profession life.

B. Course Outline

Module No.	Title/Topic	Classroom Contact Hours
1	**Fundamental Concepts** • Civil Society • Governance • Democracy • Citizenship • Globalization • International Studies	04
2	**Self, Citizenship, and Social Responsibility** • Aspects of Self & Citizenship • Aspects of Self, Citizenship and Social Responsibility	06
3	**Governance & Society** • Concept of Governance and Government : the Relationship	06

	• Role of Civil Society in Effective Governance		
	• The System of Democratic Governance: the features of Effective Democratic Governance		
4	**International Studies**		08
	• Study of International Organizations		
	• International Laws		
	• Concept of Human Rights		
	• Concept of Multiculturalism		
	• Globalization and Communication		
	• Concept and Methods of International Relationship		
5	**Society, Governance and International Studies & Contemporary Issues**		06
	• Sustainable Living		
	• Peace & Conflict		
	• Contemporary Global Trends		
	• Contribution and Creativity		
	• Case Studies		
		Total	**30**

C. **Instruction Methods and Pedagogy**

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

D. **Evaluation**

Internal Evaluation

The students' performance in the course will be evaluated (30 marks for theory) on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Assignment	02	07	14
2	Project	01	11	11
			Attendance	05
			Total	30

External Evaluation

The University examination will be for 70 marks (Theory). The examination will avoid, as far as possible, direct questions on usage, grammar, errors, etc. and will focus on applications.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. **Learning Outcomes**

At the end of the course, learners will be able to:

- Understand the concept of society, governance and international studies.

- Understand the application of citizenship, governance, international principles and trends

- Understand the application of society, governance and international studies in personal, social, academic, global and profession life.

F. **Reference Books / Reading**

1) Theories of International Relations, Scott Burshilet. al. Palgrave Macmillan, 2005. (http://psi505.cankaya.edu.tr/uploads/files/Theories%20of%20IR.pdf)

2) http://cmsdata.iucn.org/downloads/eplp_70_governance_for_sustainability.pdf

3) www.uno.org

4) www.unesco.org

Credits and Schemes:

Credits	Teaching Scheme	Evaluation Scheme				
	Contact Hours/ Week	Theory		Practical		Total
		Internal	External	Internal	External	
02	02	30	70	–	–	100

A. Course Objectives

To develop in the students

- An understanding of the concepts of law and justice
- An appreciation of the significant role played by the judiciary in the protection of individual liberty and human rights
- An understanding of the substantive law concerning his / her professional field
- A broad understanding of human rights
- Acceptable attitudes and viewpoints with respect to professional ethics and social responsibility.

B. Course Outline

Module No.	Title/Topic	Classroom Contact Hours
1	**An Introduction to Law and Justice** • Concept and Meaning of Law and Justice • Fundamentals of Law and Justice • Introduction to Indian Constitution • Law and Justice in the Globalized World	05
2	**Literature and Social Justice** • Concept of Literature and Social Justice • Conceptual History of Social Justice • Race and Racism in 21st Century	05
3	**Understanding Human Rights** • Scope and Significance of Human Rights • Human Rights in the Indian Sphere - An Overview • Constitutional Analysis of Preamble, Citizenship • Directive Principles and Fundamental Duties	05

	• Fundamental Rights – Right to Life, Right to Education, Right to Equality, Right to Freedom, Right to Information, Right against Exploitation, Right to Property, Intellectual Property Rights, Right to Speech		
4	**International Law with reference to Social Justice** • Perspectives on International Law • Origin and Nature • Is International Law, "Law"? • Theories and Basis of International Law • International Personalities in Law and Justice	05	
5	**Social Justice and Sustainability** • Need for reforms in Global Context • Law related to the Weaker Section: Women and Law, Crime against Women, Reservation and its various forms • Development v/s Social Justice & Sustainability	05	

6	**Contemporary Issues in Law and Justice**
	• Contemporary Issues Concerning
	  1) Law and Justice in India: A Study of Supreme Court Judgements / Landmarks
	  2) Important Amendments in Law and Justice
	  3) Contemporary Issues in Law and Justice: Perspectives of all Stake Holders
	  4) Reservation Policies
	  5) Global Environment Protection
	  6) Public Interest Litigation
		05	

	Total	30	

C. Instruction Methods and Pedagogy

The course is based on theoretical perspectives based on real-life cases. Teaching (Classroom Deliberations) will be facilitated by reading material, discussions, case and task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

D. Evaluation

The students will be evaluated continuously in the form of internal as well as external examinations. The evaluation - Theory is schemed as 30 Marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be on a continuous basis through the following components:

Sl. No.	Component	Number	Marks per incidence	Total Marks
Theory				
1	Assignment	03	5	15
2	Participation / Project	01	10	10
3	Attendance			05
			Total	30

External Evaluation

The University examination – Theory will be for 70 marks. The examination will focus more on case studies, prevalent practices and contemporary issues.

Sl. No.	Component	Number	Marks per incidence	Total Marks
1	Theory Paper	01	70	70
			Total	70

E. Learning Outcomes

At the end of the course, learners will have developed:

- An understanding of the concepts of law and justice
- An appreciation of the significant role played by the judiciary in the protection of individual liberty and human rights
- An understanding of the substantive law concerning his / her professional field
- A broad understanding of human rights
- Acceptable attitudes and viewpoints with respect to professional ethics and social responsibility.

F. Reference Books / Reading

1) HLA Hart, Concept of Law

2) Law and Constitution by A V Dicey

3) Intellectual Property Law by Cornish P

Credits and Hours:

Credits	Teaching Scheme Contact Hours/Week	Evaluation Scheme				Total
		Theory		Practical		
		Internal	External	Internal	External	
02	02	_	_	30	70	100

A. Course Objectives

To facilitate learners to:

- Become familiar with basic concept of personality and personality development
- Understand personality development theories and strategies
- Evaluate one's personality and inculcate traits of an assertive personality
- Develop an assertive personality
- Develop life skills and required management traits
- Enhance contributory personality for academic and career success

B. Course Outline

Module No.	Title/Topic	Classroom Contact Hours
1	**Concept of Personality:** • Meaning of Personality • Types of Personality • Factors contributing to Personality • Personality Traits	06
2	**Soft Skills and Personality Development:** • Critical, Creative and Positive Thinking • Leadership, Assertiveness and Negotiation Skills • Self-Management • People's Skills • Building Relationship Skills • Being a Team Player	08

3	**Developing Contributor Personality – Part I** • Concept of Contributor • Characteristics of a Contributor • The Contributor's Vision of Success & Career • The Scope of Contribution • Embarking on the Journey to Contributor ship	06
4	**Developing Contributor Personality – Part II** • Focus on Values • Engage Deeply • Think in Enlightened Self-Interest • Practice Imaginative Sympathy • Demonstrate Trust Behavior • Developing a sense of duty and morality	06
5	**Contemporary Issues in CPD** • Contemporary Practices & Trends in Contributor Personality Development • Case Study & Presentations	04
	Total	**30**

C. Instruction Methods and Pedagogy

The course is based on practical learning. Teaching will be facilitated by reading material, discussion, task-based learning, projects, assignments and various interpersonal activities like case studies, critical reading, group work, independent and collaborative research, presentations etc.

D. Evaluation:

The students will be evaluated continuously in the form of internal as well as external examinations. The practical evaluation is schemed as 30 marks for internal evaluation and 70 marks for external evaluation in the form of University examination.

Internal Evaluation

The students' performance in the course will be evaluated on a continuous basis through the following components:

Sr. No.	Component	Number	Marks per incidence	Total Marks
1	Assignment / Project Work / Term Work / Quiz	2	25	25
2	Attendance and Class Participation			05
			Total	30

External Evaluation

The University Practical examination will be of 70 marks and will test the contributory personality aspects and their applications by carrying out practical assessment. The examination will avoid, as far as possible, grammatical errors and will focus on applications.

Sr. No.	Component	Number	Marks per incidence	Total Marks
1	Practical Exam / Viva	01	70	70
			Total	70

E. **Learning Outcomes:**

At the end of the course, learners will be able to:

- Identify one's individual personality strengths and challenges
- Develop more assertive and optimist attitude towards work and life
- Develop quintessential soft skills to groom one's personality

F. **Reference Books / Reading**

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

Credits and Hours:

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

A. **Objectives of the Course:**

The main objectives of the course are:

- To learn the fundamental concepts in the field of water supply and environmental engineering.
- To understand sources of water, water requirements and methods for estimation of water quantities.
- To perceive the basic understanding of various methods of conveyance and fundamentals of distribution systems.
- To learn the various characteristics of drinking water and methods for their examination.
- To develop an alertness towards methods of water treatment with their functioning.
- To learn the importance of house drainage and it's planning.

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Environmental Engineering	05
2	Water Demands and Sources of Water	07
3	Water Conveyance and Distribution Systems	12
4	Quality and Treatment of water	32
5	House Drainage	04

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	**Introduction to Environmental Engineering**	05 Hours	08%
1.1	Scope and Importance of Environmental Engineering		
1.2	Necessity of planned water supplies		
1.3	Present water supply systems scenario		
1.4	Environmental Ethics and Role of Environmental Engineer		
2	**Water Demands and Sources of Water**	07 Hours	12%
2.1	Various types of water demands & factors affecting per capita demand		
2.2	Variations in Demand & Design Periods		
2.3	Population Forecasting Methods		
2.4	Surface and Ground water Sources		
3	**Water Conveyance and Distribution Systems**	12 Hours	20%
3.1	Water Intakes-types and design considerations		
3.2	Types of Conduits, Flow in pipe systems and types of pressure pipes		
3.3	Selection of pumps, their types and economical diameter of mains		
3.4	Distribution System-Requirements, layouts and methods		
3.5	Distribution Reservoirs-functions, types and determination of storage capacity		
3.6	Analysis of Pipe Networks		
4	**Quality and Treatment of water**	32 Hours	53%
4.1	Necessity of characterization		
4.2	Quality of Water- Physical, Chemical and Biological Aspects		
4.3	Analysis of Water and Drinking water quality standards		
4.4	Water Treatment Processes		
4.5	Design of Water Treatment Plant Units		
5	**House Drainage**	04 Hours	07%
5.1	Principles of House Drainage		
5.2	Types of Traps		
5.3	House drainage plan for residential building		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. **Students Learning Outcomes:**

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

- The knowledge on hydraulic concepts and their relation in transport and distribution systems.
- The water quality criteria and standards with their relation to public health and environment.
- Water quality concepts and their relation with treatment process selection.
- The fundamental working of a house drainage system.

F. **Recommended Study Material:**

Text Books:

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, Tata Mcgraw 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.

Web Materials:

1) http://nptel.iitm.ac.in

2) http://www.epa.gov

3) http://www.nesc.wvu.edu

LIST OF EXPERIMENTS

Experiment No.	Name of Experiment
A	**Analysis of Water Quality Parameters**
1.	Determination of pH and Conductivity for a given water sample
2.	Determination of Acidity for given water sample
3.	Determination of Alkalinity in water sample
4.	Determination of Solids in water sample
5.	Determination of Hardness in water sample
6.	Determination of Chlorides in water sample
7.	Determination of Residual Chlorine in water sample
8.	Determination of Optimum Coagulant Dose by Jar Test for a given water sample
9.	Determination of Dissolved Oxygen in water sample
10.	Determination of Most Probable Number (MPN)
B.	**Design Problems on Treatment Units / Distribution Systems**

Credits and Hours:

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

A. Objective of the Course:

The main objectives of the course are:

- To make students aware about Geotechnical Engineering and its importance
- To explain how soil properties are estimated using three phase system
- To explain role of water in soil behavior and how soil stresses, permeability and quantity of seepage are estimated
- To determine shear parameters of soil
- To estimate the magnitude and time-rate settlement due to consolidation

B. 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

C. 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		

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignment/Surprise tests/Quizzes/Seminar will be conducted as a part of internal theory evaluation.

- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. **Students Learning Outcomes:**

On successfully completion of the course, students will be able to
- Evaluate soil properties by performing various experiments
- Carry out soil classification,
- Solve practical problems related to permeability, seepage and consolidation settlement,
- Relate soil properties to workout theoretical soil strength with confidence.

F. **Recommended Study Material:**

Text Books:
1) Arora, K.R., Soil Mechanics & Foundation Engineering, Standard Publicaiton, 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.	Name of Experiment
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

Credits and Hours:

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

A. **Objectives of the Course:**

The main objectives of the course are:

- To build on the student's background in hydrology and understanding of water resources systems
- To create a vision for the water resources development and management
- To understand the importance of estimation of runoff, analysis of rainfall data and hydrographs
- To build the necessary theoretical background of ground water hydrology, types of aquifers and their yields
- To introduce students to basic concepts of water, plants, their interactions as well as irrigation systems

B. **Outline of the Course:**

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction to Water Resources Engineering	04
2	Precipitation and Abstractions	12
3	Runoff and Hydrograph	12
4	Groundwater Hydrology	16
5	Irrigation & Irrigation Methods	04
6	Water Requirements of Crops	12

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	**Introduction to Water Resources Engineering**	04 Hours	07%
1.1	Need of water resources projects		
1.2	Hydrologic cycle - scope and application		
1.3	Hydro-metrology and its significance in water resources engineering		
1.4	Hydrologic Equation (Water Balance Equation)		
2	**Precipitation and Abstractions**	12 Hours	20%
2.1	Precipitation: Types, forms, measurement, estimation of missing data, mean rainfall computation		
2.2	Evaporation: Process, factors affecting, measurement – analytical methods & evaporimeters		
2.3	Evapotranspiration: Transpiration, evapotranspiration, factors affecting, measurement – field methods, Empirical equations & examples for determining evapotranspiration - Blanny-Criddle, Modified Penmen methods		
2.4	Infiltration: Process, infiltration rate, infiltration capacity, infiltration indices, measurement - infiltrometers		
3	**Runoff and Hydrograph**	12 Hours	20%
3.1	Runoff: Types, factors affecting, estimating volume of runoff (yield) – rainfall runoff correlation & empirical equations		
3.2	Hydrograph: Factors affecting, components, unit hydrograph, S-Hydrograph, computation of flood		
3.3	Flood& Flood Routing: Definition, types, causes, effects, flood estimation – rational, empirical, Gumble's method		

	& flood frequency studies, SPF, PMF, Flood routing – reservoir (storage) & channel, examples		
4	**Groundwater Hydrology**	16 Hours	26%
4.1	Occurrence and movement of groundwater, Darcy's law, governing ground water flow equations, Factors governing ground water flow, Types of aquifers, porosity, specific yield, specific retention, storage coefficient, permeability, hydraulic conductivity, hydraulic transmissibility, Conjunctive use and it's necessity		
4.2	Introduction to Ground Water Geophysical Investigation techniques		
4.3	Hydraulics of wells under steady & introduction to unsteady condition in confined and unconfined aquifers yield of wells, pumping and recuperation tests, types of tube wells.		
4.4	Needs of ground water recharge, ground water recharge methods, Rain water harvesting		
4.5	Occurrence and causes of saline water intrusion, Ghyben-Herzberg Relation, Upconing of saline water, Control of saline water intrusion		
5	**Irrigation & Irrigation Methods**	04 Hours	07%
5.1	Irrigation: Definition, merits, demerits, irrigation in India, water quality of irrigation water		
5.2	Irrigation methods: Detailed classification		
5.3	Surface methods: Over view of border, basin & furrow methods		
5.4	Pressurized methods: Over view of drip & sprinkler systems		
6	**Water Requirements of Crops**	12 Hours	20%
6.1	Crop seasons and crops in India		
6.2	Terms used in crop water requirement		

6.3　Soil-water-plant relationship: Classification of soil water, soil moisture constants, extraction pattern of moisture in root zone

6.4　Duty of water and delta, factors affecting on duty and delta, relation between duty-delta & examples based on it

6.5　Irrigation efficiencies and calculation of efficiencies

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

On the completion of the course one should be able to

- Understand the fundamental concepts of hydrological cycle, occurrence and distribution of surface and ground water.
- Understand the significance of various hydrological parameters, types and forms of precipitations
- Implement remedial measures to control the ground water pollution and apply different techniques of ground water recharge to augment the ground water table.
- Understand types of irrigation systems and different hydraulic structures.

- Estimate the quantity of water required by crops.

F. 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
6) McGraw Hill, New Delhi.
7) Patel, A.S. and Shah, D.L., Water Management – Conservation, Harvesting & Artificial
8) 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

LIST OF EXPERIMENTS

Experiment No.	Name of Experiment
1.	Measurement of Infiltration Using Double- Ring Infiltrometer
2.	Measurement of Evaporation Using Pan Evaporimeter

LIST OF TUTORIALS

Tutorial No	Title
1	Introduction to Hydrology
2	Precipitation
3	Evaporation & Evapotranspiration
4	Infiltration
5	Runoff
6	Hydrograph
7	Flood
8	Ground Water Hydrology
9	Well Hydraulics
10	Ground Water Recharge and Salt Water Intrusion
11	Irrigation Methods
12	Water Requirements of Crop

Credits and Hours:

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

A. Objectives of the Course:

- The eventual aim of this subject is to incorporate psychological perception of learning and reasoning of engineering aspects of highway field into Engineers in general.

- To provide fundamental knowledge in transportation so that students can understand and be able to solve transportation related problems and design for highway mode of transportation involving the application of scientific and technological principles with focus on highway user characteristics, geometric and pavement design, traffic engineering and transportation planning.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	07
2	Traffic Engineering	13
3	Highway Geometric Design	13
4	Highway Materials and Construction	04
5	Highway Pavement Design	13
6	Highway Drainage, Maintenance, Economics and Arboriculture	10

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

C. Detailed Syllabus:

1	Introduction	07 Hours	14%

1.1 Role/Impacts of transportation in nation's development, Modes of transportation and its characteristics, Scope of Transportation Engineering

1.2 Importance of Highway Engineering

1.3 Highway Planning and Development in India: Jayakar Committee, IRC, CRRI, CRF, HRB, NTPC, NHAI,NHDP, MORTH, Motor Vehicle Act, National Highway Act, Nagpur Road Plan, Bombay Road Plan, Lucknow Road Plan , Vision 2021, Rural Roads: Vision 2025.

1.4 Classification of Roads

1.5 Highway Alignment and Surveys: Introduction, Ideal Requirement of Alignment, Factors controlling Alignment, Engineering Surveys, Drawing and Reports, Highway Project

2	Traffic Engineering	13 Hours	20%

2.1 Introduction

2.2 Characteristics of Traffic Engineering

2.3 Traffic Surveys: Traffic Volume Studies, Speed Studies, Traffic Density & Capacity, Relations between traffic parameters, Level of service, Passenger car unit, Parking studies, Accident Studies

2.4 Traffic Operations: Traffic Regulations, Traffic Control Devices (Signs, Signals and Markings) with its design

2.5 Highway Intersection: At grade & Grade separated intersections, Rotary intersection, IRC Recommendations

2.6 Highway Lightning: Definitions, Factors affecting street lightening, IRC Recommendations

3	**Highway Geometric Design**	13 Hours	20%
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	10%
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	Highway Construction: Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavement and Cement Concrete Pavement		
5	**Highway Pavement Design**	13 Hours	20%
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

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar will be conducted.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning 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:

- To design highway pavement geometrics
- To understand the procedure to collect the traffic data for design and the need of traffic management
- Test the highway material as per IS recommendations

- Carryout preliminary design of flexible and rigid pavement as per IRC
- To understand the concept for providing highway drainage, maintenance and arboriculture.

F. **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

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

Credits and Hours:

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

A. **Objective of the Course:**

- To explain the importance of maintenance of buildings with study of the damages in the buildings
- To teach the importance of durability of structure and introducing causes of deterioration of structures
- To equip student with damage assessment and evaluation of structures
- To introduce the students in depth about knowledge of professional practice of repair techniques with right selection of repairing materials
- To study principles of Retrofitting and Rehabilitation
- To explain demolition techniques for structures and safety measures to be followed during demolition
- To enlighten on care to be taken in dismantling of buildings

B. **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

C. 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

2	Deterioration and Durability Aspects	10 Hours	22%

2.1 <u>Deterioration:</u> Types of deterioration – Signs, causes & symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability & micro-structure of concrete

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

2.3 Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack

2.4 Deterioration due to water leakage, fire – detection & mitigation of the same. Deterioration due to ageing, inadequate maintenance, Design & construction deficiencies, overloading etc.

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

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

2.7	Effect of Biological Agents like fungus, moss, plants, trees, algae, Termite Control and Prevention		
2.8	Chemical Attack on Building Materials and Components		
2.9	Aspects of Fire and Fire Prevention on Buildings		
2.10	Impact of Pollution on Buildings		
3	**Conditional/damage assessment & Evaluation of structures**	**08 Hours**	**18%**
3.1	Conditional evaluation– Importance, objective & stages, Conditional/damage assessment procedure, Preliminary & Detailed investigation–Scope, Objectives, Methodology & Rapid visual inspection of structures		
3.2	Damage Assessment allied Tests (Destructive, Semi-destructive, Nondestructive)		
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	Gunniting, 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

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Internal Exams/Assignments/Surprise tests/Quizzes/Seminar/Project, etc., will be conducted as a part of internal theory evaluation.

- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

- Experiments/Tutorials/Term work related to course content will be carried out in the laboratory.

E. **Students Learning Outcomes:**

On the successful completion of this course

- Students can understand the types of requirement of maintenance in building.

- Can able to assess the quality aspects of existing building.

- Identify and define all the terms and concepts associated with deterioration of concrete structures.

- Students will learn the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.

- Carryout analysis using NDT and evaluate structures.

- Develop a knowledge of the Concrete repair industry equipped with variety of repair materials and techniques.

- Understand and apply rehabilitation and retrofitting processes.

- Can able to strengthen earthquake deficiency in the structure.

- Can 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.

- Can understand care to be taken in dismantling of buildings so that maximum resale value of materials is generated.

F. **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.

Credits and Hours:

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

A. **Objectives of the Course:**

The main objectives of the course are:

- To make students aware with different advance surveying methodologies applied to carry out large scale survey works as modern instruments have largely changed the approach to survey works with the same principles

- Identify and correct errors in field measurements

- Understand the basic principles of astronomical survey

- Understand procedures of Triangulation

- To get introduced to modern advanced surveying techniques involved such as remote sensing, Total station, GPS, Photogrammetry, etc.

- To know the ground topography and be able to use different software applications in surveying

B. **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

C. 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		

D. **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP, etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams / Unit tests will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments/Surprise tests/Quizzes/Seminar will be conducted as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

After studying this subject students will be able to:

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

F. 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

Credits and Hours:

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

A. **Objectives of the Course:**

The main objectives of the course are:

- To understand the advanced methods of structural analysis that are essential for an economical dimensional proportioning of various civil engineering structures
- To learn and practice the analysis process to be involved in designing various structural components used in professional structural engineering
- To make students recognize the different structural systems and their range of applications
- To provide essential knowledge of Matrix method used in developing programme

B. **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

C. 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

D. Instructional Method and Pedagogy:

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory.
- Internal exams will be conducted as per pedagogy as a part of internal theory evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar will be conducted as per pedagogy as a part of internal theory evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments/Tutorials related to course content will be carried out in the laboratory.

E. Students Learning Outcomes:

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

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

F. 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

5) http://freevideolectures.com/Subject/Civil-Engineering

6) http://freevideolectures.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

Credits and Hours:

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

A. Objectives of the Course:

The main objectives of the course are:
- To expose the students to the history and development of town planning, its relevance & application to modern day principles of town planning.
- To develop an appreciation of the planning procedure, concepts and issues involved at the scale of a town or a city.
- To create awareness about the causes and consequences of housing problems and to impart knowledge about the possible solutions.
- To give an insight into the works of well-known town planners.

B. 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

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		

6.2   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

D. Instructional Method and Pedagogy:

At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures and laboratory.

- Internal exams will be conducted as per pedagogy as a part of internal theory evaluation.

- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.

- Surprise tests/Quizzes/Seminar will be conducted as per pedagogy as a part of internal theory evaluation.

- The course includes tutorial, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

- Theoretical concepts will supported by different models and charts in the laboratory.

E. Learning Outcomes:

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

- Have a proper understanding of history of town planning, ideas developed in the past and its relevance in today's world.

- Understand procedure involved in making development plans and various concepts, and issues of town planning.
- Understand the importance of housing and its cost effectiveness.
- Understand the causes of slum formation and measures needed to prevent it.
- Understand the ideology behind different planned cities.

F. **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