CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ACADEMIC REGULATIONS & SYLLABUS

(Choice Based Credit System)

Faculty of Technology & Engineering
Chandubhai S Patel Institute of Technology
M. S. Patel Department of Civil Engineering
Bachelor of Technology Programme

Second Year Civil Engineering - NEP

Effective from 2025-26

ऋते ज्ञानान्न मुक्ति : ।
cspit
Chandubhai S Patel
Institute of Technology

Vision

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

Mission

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

Programme Educational Objectives (PEO's):

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

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

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

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

Programme Outcomes (PO's)

Engineering Graduates will be able to:

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

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

Programme Specific Outcomes (PSO's):

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

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

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

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

CHARUSAT welcomes you for a Bright Future

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

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Bachelor of Technology - Civil Engineering (NEP) 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

Academic Year – 2025-26
CHARUSAT

FACULTY OF TECHNOLOGY AND ENGINEERING
ACADEMIC REGULATIONS
Bachelor of Technology Programmes

Academic regulations recommendations are provided to ensure uniform system of education, programmes duration, eligibility criteria for admission, course credits distribution, teaching and examination pedagogy, detailed syllabus with reference material.

1) System of Education

   The Charotar University of Science and Technology (CHARUSAT) shall follow Choice based Credit System (CBCS) with Semester pattern at Undergraduate and Master levels. Each semester will be at least of 90 working days. Apart from the programme core courses, provision for choosing University level electives and Programme electives are available under the CBCS.

2) Duration of Programme

   Undergrauate Programme – B.Tech

Minimum	8 semesters (4 academic years)
Maximum	14 semesters (7 academic years)

3) Eligibility for admissions

   As enacted by Government of Gujarat/AICTE/UGC from time to time.

4) Mode of admissions

   As enacted by Government of Gujarat from time to time.

5) Programme Structure and Credits

   As per annexure – 1 attached

6) Attendance

   6.1 Students are expected to maintain 100% attendance in all courses. However, students may involuntarily have to miss classes due to illness or some family emergency; students are permitted to maintain a minimum attendance of 75% with producing proof or reason for the absence. In case of medical exigencies, the student/parent should inform the principal immediately through call or by

email. Within a week, starting from the day of absence, the proof of medical exigency must be submitted to the Principal's office.

6.2 Unauthorized absence will be considered as part of the discretionary 25% for fulfilling the minimum 75% attendance requirement for appearing in the examination.

6.3 Students nominated/sponsored by the University to represent in various forums like seminars/conferences/workshops/competitions or taking part in co-curricular/extra-curricular events will be given attendance credit provided the student applies in writing for such a leave in advance and obtains sanction from the Principal of his/her Institute for academic related requests.

7) Course Evaluation

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

7.1.1 Internal evaluation by the course faculty member(s) based on continuous assessment. The respective department /institute will conduct the continuous assessment. The course faculty members shall share the pedagogy related to the continuous evaluation with the students.

7.1.2 Final end-semester examination shall be conducted by the University through written paper, practical test, oral test, presentation by the student or a combination of these.

7.1.3 The weightages of continuous assessment and end-semester university examination in overall assessment shall depend on individual course as approved by Academic Council through Faculty Board and Board of Studies.

7.1.4 The performance of candidate in continuous assessment and in end-semester examination together (if applicable) shall be considered for deciding the final grade in a course.

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

7.2 Performance in continuous assessment and end-semester University Examination

7.2.1 Minimum performance with respect to continuous assessment as well as end- semester university examination will be an important consideration for passing a course.

7.2.2 If a candidate fails to obtain minimum required overall percentage of marks (36%), student has to repeat the examination till the minimum required overall percentage obtained.

8) Grade Point System

1. The total of the internal evaluation marks and end semester examination marks in each course will be converted to a letter grade on a ten-point scale as per the following scheme:
2. Proposed Grading Scheme to awarding letter grade and grade point as per NEP 2020.

Letter Grade	**Grade Point**	**Grading Scheme for Mark (In %)**
O (Outstanding)	10	96.0-100
A+ (Excellent)	9	86.0-95.9
A (Very Good)	8	76.0-85.9
B+ (Good)	7	66.0-75.9
B (Above Average)	6	56.0- 65.9
C (Average)	5	46.0 – 55.9
P (Pass)	4	36.0 – 45.9
F (Fail)	0	Below 36.0
Ab (Absent)	0	Absent

The minimum passing marks for each pattern of evaluation are 36%.

3. 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 = $\Sigma C_iG_i / \Sigma C_i$ 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 = $\Sigma C_iG_i / \Sigma C_i$ 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

9) Award of Class

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

Award of Class	**CGPA Range**
First Class with Distinction	CGPA ≥ 7.0 & ≤ 10.0
First class	CGPA ≥ 6.0 & < 7.0
Second Class	CGPA ≥ 5.0 & < 6.0
Pass Class	CGPA < 5.0

10) Detention Criteria

A student will be promoted to next year only if he/she has cleared all the courses of the year he/she is studying in.

Link: https://charusat.ac.in/ => Student's Corner => Detention Rules

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING (FTE)

CHOICE BASED CREDIT SYSTEM

A. Choice Based Credit System:

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

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

Types of Courses: The Programme Structure consist Foundation courses, Core courses, Elective courses, Non-credit (audit) courses and SWAYAM MOOCs.

1.1. Foundation Course

These courses are offered by the institute in order to prepare students for studying courses to be offered at higher levels.

1.2. Core Courses

A Course which shall compulsorily be studied by a candidate to complete the requirements of a degree / diploma in a said programme of study is defined as a core course. Following core courses are incorporated in CBCS structure:

A. University Core Courses (UC)

University core courses are compulsory courses which are offered across university and must be completed in order to meet the requirements of programme. Environmental science will be a compulsory University core for all Undergraduate Programmes.

B. Programme Core Courses (PC)

Programme core courses are compulsory courses offered by respective programme owners, which must be completed in order to meet the requirements of programme.

1.3 Elective Course (EC)

Generally, a course which can be chosen from a pool of courses and which may be very specific or specialised or advanced or supportive to the discipline of study or which provides an extended scope or which enables an exposure to some other discipline / domain or nurtures the candidates proficiency / skill is called an elective course.

Following elective courses are incorporated in CBCS structure:

A. University Elective Courses(UE):
The pool of elective courses offered across all faculties / programmes. As a general guideline, Programme should incorporate 2 University Electives of 2 credits each (total 4 credits).

B. **Programme Elective Course (PE)**
The programme specific pool of elective courses offered by respective programme.

1.4 Non Credit Course (NC) - AUDIT Course

A 'Non Credit Course' is a course where students will receive Participation or Course Completion certificate. This will be reflected in Student's Grade Sheet but the grade of the course will not be considered to calculate SGPA and CGPA. Attendance and Course Assessment is compulsory for Non Credit Courses.

1.5 Credit Transfer through SWAYAM MOOCs

CHARUSAT provides credit transfer as per UGC guidelines to all the students from SWAYAM against elective courses. The credit transfer is offered in two modes: (a) Partial credit transfer (b) Full credit transfer.

1.6 Medium of Instruction

The Medium of Instruction will be English.

In consonance with the National Education Policy (NEP) 2020 and the guidelines of the University Grants Commission (UGC), Charotar University of Science and Technology (CHARUSAT) implements the Multiple Exit scheme in their Bachelor of Technology programme.

Facilitating multiple exit options with UG certificate/UG diploma/or UG degree depending upon the number of credits secured. Skill component with progressive enhancement in skills in respective disciplines is introduced in the curriculum right from the 1st year of the program to ensure the student employability after every exit.

Students may be permitted to take a break from the study during the period of study but the total duration for completing the programme shall not exceed 7 years. If student wishes, he/she shall be allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years. Table 1 shows the exit qualifications along with credit requirements.

Table 1 Exit Qualifications along with Credit Requirement

ACADEMIC LEVEL	EXIT QUALIFICATION AND CREDITS REQUIRED	NATIONAL CREDIT LEVEL (NCrF)
1st year of UG Degree	UG Certificate will be awarded Minimum 40 credits followed by an exit 4-credit skills enhancement course	4.5
2nd year of UG Degree	UG Diploma will be awarded Minimum of 80 credits followed by an exit 4-credit skills enhancement course	5
3rd year of UG Degree	B.Sc. will be awarded Minimum of 120 credits	5.5
4th year of UG Degree	B. Tech. will be awarded Minimum of 160 credits, with minimum of 40 credits each at level	6.0

Guidelines for multiple exit along with awarding UG Certificate, UG Diploma, and Degrees:

A. Exit after First Year

Award: UG Certificate in XXXX

Student must undertake a 4-Credits skill enhancement course before commencement of 2nd year. This shall require 120 hours engagement in the relevant industry/organization. Student shall have an option to continue the 2nd year onward study.

The student shall be awarded with "UG Certificate in XXXX", with redemption of credits from ABC. Total credits redemption shall be 1st year credits + 4 credits earned in summer.

B. Exit after Second Year

Award: UG Diploma in XXXX

Student must undertake a 4-Credits summer internship/ skill enhancement course before commencement of 3rd year. This shall require 120 hours engagement in the relevant industry/organization. Student shall have an option to continue the 3rd year onward study.

The student shall be awarded with "UG Diploma in XXXX", with redemption of credits from ABC. Total credits redemption shall be 1st and 2nd year credits + 4 credits earned in summer.

C. Exit after Third Year

Award: B.Sc. Degree in XXXX

The student shall be awarded with "B.Sc. Degree in XXXX", with redemption of 3 years' credits from ABC.

4-Credit (120 hrs.) Skills Enhancement Courses:

Level/ Branch	ME	CL	EE
1st year of UG Degree	MEUS102: Machine Drawing	CLUS101: Elementary Surveying	EEUS101: Electrical Drawing

Value Added Courses:

Inclusion of 2 credits courses on Community Service/ NSS/NCC/ Sports; and provision to earn extra credits based on undertaking Research/ Academic/Cultural/ and other Developmental activities is introduced.

- The component of 'Value-added Courses' could be enriched to include alternatives that could contribute to the holistic development of the students. In light of this, it is proposed to include a 02 credit Course on Community Service/ NSS/NCC/Sports as a compulsory course in the existing curricula offered across all UG programs at CHARUSAT. It is mandatory for all UG students (2024-25 admission batch) to undertake this course and the course shall not account for the overall CGPA.
- Provision to earn extra credits (Skill Augmentation course) based on co-curricular & extra-curricular activities is proposed. It was emphasized that the extra credits could help in fuller realization of the Graduate Attributes laid down by the university as well as could serve as an important ingredient facilitating the

progression and recognition of fast learners. It is mandatory for all UG students (2024-25 admission batch) to undertake this course during the study and the credits of the course shall not account for the overall CGPA.

Annexure – 1

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (CHARUSAT)

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

Level	Course Code	Course Title	Teaching Scheme								Examination Scheme				
			Contact Hours				Credit				Theory		Practical		Total
			Theory	Practical	Tutorial	Total	Theory	Practical	Project	Total	Internal	External	Internal	External	
Sem 3	HSUV201	Creativity, Problem Solving and Innovation	2		0	2	0	2		2	0	0	25	25	50
	MSUD204	Advanced Mathematical Methods for Civil Engineering	3	0	0	3	3	0		3	50	50	0	0	100
	CLUC201	Building Construction	3	2	0	5	3	1		4	50	50	25	25	150
	CLUC202	Surveying	4	2	0	6	4	1		5	50	50	25	25	150
	CLUC203	Mechanics of Solids	4	2	0	6	4	1		5	50	50	25	25	150
	CLUC204	Fluid Mechanics	4	2	0	6	4	1		5	50	50	25	25	150
	XXXXX	University Elective - I	0	2	0	2	0	2		2	0	0	25	25	50
			20	**10**	**0**	30	**18**	**8**		**26**					**800**
Sem 4	HSUV202 HSUV203 HSUV206 HSUV207	Human Values and Ethics Indian Knowledge System Life Lessons from Ramayan and Mahabharat Spirituality for Harmonious Living	2		0	2	0	2		2	0	0	25	25	50

	CLUC205	Concrete Technology	3	4	0	7	3	2		5	50	50	25	25	150
	CLUC206	Building Planning	3	2	0	5	3	1		4	50	50	25	25	150
	CLUC207	Structural Analysis - I	3	2	0	5	3	1		4	50	50	25	25	150
	CLUC208	Geotechnics and Engineering Geology	3	2	0	5	3	1		4	50	50	25	25	150
	XXXXX	University Elective - II	0	2	0	2	0	2		2	0	0	25	25	50
	CUUV103	National Cadet Corps	0	2	0	2		2		2					
			14	**12**	**0**	**26**	**12**	**9**		**21**					**700**
	Exit Option (UG Diploma)														
Second Year Exit option Course	CLUS201	Summer Internship	0	4	0	4		4		4			50	50	100

List of University Elective Courses (UG Semester 3)

Course Code	Course Name	MOOC Course Link
MEUE201	Engineering Graphics and Design	https://archive.nptel.ac.in/courses/112/102/112102304/
EEUE201	Fundamentals Of Electrical Engineering	https://archive.nptel.ac.in/courses/108/105/108105112/
CLUE201	Environment and Development	https://nptel.ac.in/courses/109103186
ECUE201	Scientific Computing using MATLAB	https://archive.nptel.ac.in/courses/111/102/111102137/
CEUE201	The Joy of Computing using Python	https://nptel.ac.in/courses/106106182
ITUE201	Privacy and Security in Online Social Media	https://nptel.ac.in/courses/106106146
CSUE201	Python For Data Science	https://nptel.ac.in/courses/106106212
AIUE201	An Introduction to Artificial Intelligence	https://nptel.ac.in/courses/106102220
BMUD201	Money and Banking	https://nptel.ac.in/courses/109104076
CAUD203	Database Management System	https://archive.nptel.ac.in/courses/106/105/106105175/
PTUD191	Basics of Health Promotion and Education Intervention	https://onlinecourses.nptel.ac.in/noc22_ge18/preview
NRMD251	First Aid Masterclass - A complete guide to first aid	https://www.udemy.com/course/first-aid-masterclass/?couponCode=NEWYEARCAREER

List of University Elective Courses (UG Semester 4)

Course Code	Course Name	MOOC Course Link
MEUE202	Nature and Properties of Materials	https://nptel.ac.in/courses/112104203
EEUE202	Solar Energy Engineering and Technology	https://onlinecourses.nptel.ac.in/noc24_ge51/preview
CLUE202	Ecology and Environment	https://archive.nptel.ac.in/courses/127/106/127106004/
ECUE202	Introduction to Internet of Things	https://archive.nptel.ac.in/courses/106/105/106105166/
CEUE202	Software Conceptual Design	https://nptel.ac.in/courses/106101235
ITUE202	Ethical Hacking	https://nptel.ac.in/courses/106105217
CSUE202	Google Cloud Computing Foundations	https://nptel.ac.in/courses/106105223
AIUE202	Social Network Analysis	https://nptel.ac.in/courses/106106239
BMUD251	Economics of Health and Health Care	https://nptel.ac.in/courses/110104095
CAUD204	Modern Application Development	https://archive.nptel.ac.in/courses/106/106/106106222/
PTUD192	Ergonomics Workplace Analysis	https://onlinecourses.nptel.ac.in/noc20_de12/preview
NRMD261	Mindfulness and Well-being: Living with Balance and Ease	https://www.coursera.org/learn/foundations-of-mindfulness-ii-living-with-balance-and-ease#modules

CONTENTS

B. Tech. (Civil Engineering) Programme

SYLLABI (SEMESTER – 3)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

HSUV201: CREATIVITY, PROBLEM SOLVING AND INNOVATION

B. TECH 3rd SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	2	2	2
Marks	-	50	50	

A. Pre-requisite courses:

Creative Problem Solving

https://www.coursera.org/learn/creative-problem-solving

B. Objectives of the Course:

To facilitate learners to:

- gain familiarity with the mechanics of creativity and problem solving.
- develop an attitude for innovation.
- develop creative thinking skills using cone of learning components leading to understanding of strategies of creativity, problem solving and innovation.
- explore applications of the concepts of creativity and problem-solving skills in personal, social, academic, and profession life.

C. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to Creativity, Problem Solving and Innovation	06
2.	Questioning, Learning and Visualization	06
3.	Creative Thinking and Problem Solving	06
4.	Logic, Language and Reasoning	06
5.	Contemporary Issues and Practices in Creativity and Problem Solving	
	Total hours (Theory):	-
	Total hours (Practical):	30
	Total hours (Lab) :	-
	Total hours :	**30**

D. Detailed Syllabus:

1.	Introduction to Creativity, Problem Solving and Innovation	06 Hours	20%
	Definitions of Creativity and Innovation, Need for Problem Solving and Innovation, Scope of Creativity in various Domains, Types and Styles of Thinking, Strategies to develop Creativity, Problem Solving and Innovation skills		
2.	Questioning, Learning and Visualization	06 Hours	20%
	Strategy and Methods of Questioning, Asking the Right Questions, Strategy of Learning and its Importance, Sources and Methods of Learning, Purpose and Value of Creativity Education in real life, Visualization strategies - Making thoughts Visible, Mind Mapping and Visualizing Thinking		
3.	Creative Thinking and Problem Solving	06 Hours	20%
	Creative Thinking and its need, Strategy of Thinking Fluency, Generating all Possibilities, SCAMPER Technique, Divergent Vs Convergent Thinking, Lateral Vs Vertical Thinking, Fusion of Ideas for Problem Solving, Applying strategies for Problem Solving		
4.	Logic, Language and Reasoning	06 Hours	20%
	Basic Concepts of Logic, Statement Vs Sentence, Premises Vs Conclusion, Concept of an Argument, Functions of Language: Informative, Expressive and Directive, Inductive Vs Deductive Reasoning, Critical Thinking & Creativity, Moral Reasoning		
5.	Contemporary Issues and Practices in Creativity and Problem Solving	06 Hours	20%
	Cognitive Research Trust Thinking for Creatively Solving Problems, Case Study on Contemporary Issues and Practices in Creativity and Problem Solving		

E. Course Outcome (COs):

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

CO1	Demonstrate creativity in their day to day activities and academic output.
CO2	Solve personal, social and professional problems with a positive and an objective mind-set.
CO3	Think creatively and work towards problem solving in a strategic way.
CO4	Initiate new and innovative practices in their chosen field of profession.
CO5	Give logical ideas, opinions, and solutions to problems.
CO6	Think critically over the situation and drawing conclusion.

F. Evaluation Scheme

The evaluation scheme for the course will comprise the following components:

- Formative: Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks
- Summative: External / Semester End Evaluation (SEE) – 25 Marks

Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks	
Exam Pattern	**Marks**
Lab Work Assessment (Best 3 out of 4)	45
Viva voce/ Lab Quiz (Best 3 out of 4) (Note: Quiz Number 1 and 3 will be administered as lab quizzes, while Quiz Number 2 and/or 4 shall serve as part of the mid-term evaluation.)	45
Attendance	10
Total	**100*** **(scaled to 25 marks)**

*Note: The total Internal / CCE score out of 100 marks will be converted to 25 marks.

External / Semester End Evaluation (SEE) – 25 Marks	
Exam Pattern	**Marks**
Quiz	40
Viva-voce	30
Presentation/Task/GD/Case Analysis etc. (The Course Convenor / Faculty will brief the students about the examination components and weightage)	30
Total	**100*** **(scaled to 25 marks)**

*Note: The total External / SEE score out of 100 marks will be converted to 25 marks.

G. Recommended Study Material:

- **Text book:**
  1. R Keith Sawyer, ZigZag, The Surprising Path to Greater Creativity, Jossy-Bass Publication 2013
  2. Michael Michalko, Crackling Creativity, The Secrets of Creative Genus, Ten Speed Press 2001

- **Reference book:**
  1. Michael Michalko, Thinker Toys, Second Edition, Random House Publication 2006
  2. Edward De Beno, De Beno's Thinking Course, Revised Edition, Pearson Publication 1994

3. Edward De Beno, Six Thinking Hats, Revised and Update Edition, Penguin Publication 1999
4. Tony Buzan, How to Mind Map, Thorsons Publication 2002
5. Scott Berkum, The Myths of Innovation, Expended and revised edition, Berkun Publication 2010
6. Tom Kelly and David Kelly, Creative confidence: Unleashing the creative Potential within Us all, William Collins Publication 2013
7. Ira Flatow, The all Laughed, Harper Publication 1992
8. Paul Sloane, Des MacHale& M.A. DiSpezio, The Ultimate Lateral & Critical Thinking Puzzle book, Sterling Publication 2002

- **Additional Readings**

1. Keith Sawer, Group Genius, The Creative Power of Collaboration, Basic Books Publication 2007
2. Edward De Beno, Lateral Thinking, Creativity Step by Step, Penguin Publication 1973
3. Nancy Margulies with Nusa Mall, Mapping Inner Space, Crown House Publication 2002
4. Tom Kelly with Jonathan Littman, The Art of Innovation, Profile Publication 2001
5. Roger Von Oech, A Whack on the Side of the Head. Revised edition, Hachette Publication 1998
6. Roger Von Oech, A Kick in the Seat of the Head, William Morrow 1986
7. Jonah Lehrer, Imagine How Creativity Works, Canongate Books Publication 2012
8. James M Higgins, 101 Creative Problem Solving Techniques, New Management Publication1994
9. Soctt G Isaksen, K Brain Doval, Donald J Treffinger, Creative Approach to Problem Solving, Sage Publication 2000
10. Donald J Treffinger, Scott G Isaksen, K Brain stead Dorval, Creative Problem Solving An Introduction, Prufrock Press 2006
11. H Scott Fogler & Steven E. LeBlance, Strategies for Creative Problem Solving, Prentice Hall Publication 2008
12. Dave Gray, Sunni Brown and James Macanufo, Game Storming, O'reilly Publication 2010.
13. Howard Gardner, Creating minds, Basic Books Publication 1993
14. MihalyCsikzentmihalyi, Creativity–Flow and Psychology of Discovery and Invention, Harper Publication 1996
15. Martin Gerdner,W. H.,Ahal Insight, Freeman Publication 1978
16. Paul Sloane, Test Your Lateral Thinking IQ, Sterling Publication1994
17. Paul Sloane & Des Machale Intriguing, Lateral Thinking Puzzles, Sterling Publication 1996

- **Web material:**

1. Internet Search based May TED talks and other sources for videos, slide shares, problems, etc

MSUD204: ADVANCED MATHEMATICAL METHODS FOR CIVIL ENGINEERING

B TECH 3rd SEMESTER (CIVIL ENGINEERING)

Credit and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	3		-		3	3
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	-	-	100	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Fourier Series and Its Applications	12
2	Laplace Transform and Its Applications	12
3	Vector Differential Calculus	10
4	Vector Integral Calculus	11
	Total Hours (Theory):	**45**

B. Detailed Syllabus:

1	**Fourier Series and Its Applications**	**12 Hours**	**26%**
	Periodic functions, Dirichlet's conditions, Trigonometric series.		
	Euler formula, Fourier series of periodic function of period.		
	Fourier series: Discontinuous functions, Even and odd functions.		
	Half range Fourier series.		
	Solutions of heat, wave, Laplace equations by method of separation of variables and Fourier series.		
2	**Laplace Transform and Its Applications**	**12 Hours**	**26%**
	Laplace transforms as an improper integral and its existence.		
	Laplace transform of elementary functions and its properties.		
	Inverse Laplace transform and its properties.		

	First and second shifting theorems. Laplace transform of derivatives and integrals.		
	Convolution theorem and its application to obtain inverse Laplace transform.		
	Laplace transform of periodic functions, Unit step function, Unit impulse function (Dirac delta function).		
	Solving differential equations using Laplace transform.		
	Applications of ODE :Mechanical vibration system, deflection of beams.		
3	**Vector Differential Calculus**	**10 Hours**	**24%**
	Revision of concepts of Vector algebra, Scalar and Vector fields.		
	Gradient of a scalar functions, Directional derivatives.		
	Divergence and Curl of a vector field and their properties.		
	Physical interpretations of gradient, divergence and curl, Irrigational and Solenoidal vector fields.		
	Scalar potential function		
4	**Vector Integral Calculus**	**11 Hours**	**24%**
	Introduction to line integrals and examples.		
	Statement and examples of Green's theorem.		
	Introduction to Surface and Volume integrals.		
	Statements and examples of Stokes' and Gauss' divergence theorem.		

C. Course Outcomes (COs):

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

CO1	Compute the problems related to the Fourier Series.
CO2	Solve the complex problems through the concepts of Laplace transforms.
CO3	Explain the concepts of vectors, directional derivative, gradient, vector fields, divergence and curl.
CO4	Analyse parameterized curves and evaluate line integrals and surface integrals.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

1. B. S. Grewal, Higher engineering mathematics, Khanna Publisher, New Delhi, 1996.
2. Debnath, Lokenath, and Dambaru Bhatta, Integral transforms and their applications, CRC press, 2014.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Ed., Jhon Wiley & Sons, India, 1999.

Reference Books:

1. H. K. Dass, Advanced engineering mathematics, S. Chand, 2008.
2. M. D. Greenberg, Advanced Engineering Mathematics, 2nd ed., Pearson. 1998.

Web Materials:

1. http://mathworld.wolfram.com
2. http://en.wikipedia.org/wiki/Math

CLUC201 BUILDING CONSTRUCTION

B TECH 3rd SEMESTER (CIVIL ENGINEERING)

Credits and hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	3		2		5	4
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	25	25	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Masonry Works	08
2	Foundations	07
3	Doors, Windows & Ventilators	04
4	Stairs and Staircases	05
5	Floors and Floorings	04
6	Roofs and Roof Coverings	04
7	Wall Finishes	04
8	Temporary Works	05
9	Special Treatments	04
	Total Hours (Theory):	45
	Total Hours (Lab):	30
	Total Hours:	75

B. Detailed Syllabus:

1	**Masonry Works**	**08 Hours**	**18%**
1.1	Stone masonry: Technical terms; materials used; classification – random rubble, square rubble, Ashlar fine tooled, Ashlar chamfered; joints		
1.2	Brick masonry: Technical terms; bonds in brick work – stretcher, header, English, Flemish, Raking; pointing – method and types		
1.3	Composite masonry: Brick-stone composite masonry - properties and uses; Concrete masonry – hollow concrete blocks, Autoclaved aerated concrete (AAC), Advantages and Disadvantages over other cement construction materials; Reinforced brick masonry		

2	**Foundations**	**07 Hours**	**15%**
2.1	Classification, Necessity, essential requirements		
2.2	methods of site exploration		
2.3	Settlement, causes of failures of foundation and remedial measures		
2.4	Bearing capacity of soils		
2.5	Shallow foundations: Depth of footing, types and construction, design of strip footing		
3	**Doors, Windows & Ventilators**	**04 Hours**	**09%**
3.1	Doors: Location, technical terms, door frames, types of doors – construction, suitability - panelled, glazed, flushed doors, collapsible steel doors		
3.2	Windows: Types of windows–construction, suitability - Casement, Sash, and Skylight windows		
3.2	Ventilators: Ventilators combined with window; fan light fixtures and fastenings		
4	**Stairs, Staircases and escalators**	**05 Hours**	**11%**
4.1	Technical terms, requirements of good stair		
4.2	Dimensions of a step, types of steps, classification of stairs		
4.3	Design of stair, example – stair planning, elevators, escalators		
5	**Floors and Floorings**	**04 Hours**	**09%**
5.1	Components of a floor		
5.2	Flooring material and factors affecting selection of flooring material		
5.2	Types of ground floors –cement concrete, tiles, marble, timber etc., Recent Developments in Flooring Technology		
5.3	Types of upper floors –Conventional floors (timber, steel joist), reinforced cement concrete & pre-cast concrete floors		
6	**Roofs and Roof Coverings**	**04 Hours**	**09%**
6.1	Requirements of a good roof, technical terms		
6.2	Types of roofs – single, trussed, steel roof trusses		
6.3	Types of roof covering –G.I. Sheets, light weight roofing, Flat terraced roof – advantages, disadvantages, types, Water proofing techniques in flat roofs.		
7	**Wall Finishes**	**04 Hours**	**09%**

7.1	Plastering: Objectives, requirements, terms, tools, cement plaster, special materials used in plastering, defects		
7.2	Painting: Painting on different surfaces, defects, Recent Developments in painting technology		
8	**Temporary Works**	**05 Hours**	**11%**
8.1	Timbering in trenches		
8.2	Component and types of scaffolding		
8.3	Formwork		
9	**Special Treatments**	**04 Hours**	**09%**
9.1	Water resistance, Thermal insulation,		
9.2	Acoustical construction and anti-termite treatment.		

C. Course Outcomes:

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

CO1	Demonstrate knowledge of the types, dimensions, and construction methods of various building components, including checks required for their construction.
CO2	Identify, select, and recommend suitable building elements based on specific construction needs and site conditions.
CO3	Develop a comprehensive understanding of construction materials, their properties, and applications, and apply this knowledge effectively in building construction projects.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text books:

1. Punamia, B.C., Building Construction, Laxmi Publication, New Delhi
2. Sushil Kumar, Building Construction, Standard Publishers Distributors, New Delhi
3. Rangwala, S.C., Building Construction, Charotar Publishing House Pvt. Ltd., Anand

Reference books:

1. Varghese, P.C., Building Construction, Prentice-Hall of India (PHI) Learning Pvt. Ltd.,

New Delhi
2. Roy Chudley & Roger Greeno, Construction Technology, Prentice Hall
3. Roy Chudley & Roger Greeno, Building Construction Handbook, Routledge Publications
4. Francis D. K. Ching, Building Construction Illustrated, Wiley Publications
5. Edward Allen & Joseph Iano, Fundamentals of Building Construction: Materials and Methods, Wiley Publications
6. National Building Code of India, Indian Standard Institution (ISI), 2005, New Delhi

Web Materials:

1. http://nptel.ac.in/courses/105102088/
2. https://www.youtube.com/watch?v=fDUD36VPD_U
3. https://www.youtube.com/watch?v=wmRYKrfQjuk
4. https://theconstructor.org/category/building/

E. List of Tutorials:

Sr. No.	Topic
1.	Masonry work A) Stone masonry work
2.	Masonry work B) Brick masonry work
3.	Foundations -Shallow Foundation
4.	Doors, Windows & Ventilators
5.	Stairs and Staircases
6.	Floors and Flooring
7.	Roofs and Roof Coverings
8.	Temporary Works

CLUC202: SURVEYING

B. TECH 3rd SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	4		2		6	**5**
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	25	25	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Min. No. of Hours
1	Measurement of Elevation, Contouring	05
2	Compass and Theodolite Surveying	12
3	Plane Table Surveying	8
4	Engineering Curves	10
5	Computation of Areas and Volumes	10
6	Hydrography	05
7	Setting Out Works	05
8	Modern Survey Instruments	05
	Total Hours (Theory):	**60**
	Total Hours (Lab):	**30**
	Total Hours:	**90**

B. Detailed Syllabus:

1	Measurement of Elevation, Contouring	05 Hours	08%
	Profile levelling and cross sectioning & contouring, Errors in levelling, Permanent adjustment of level		
2	Compass and Theodolite Surveying	12 Hours	20%
2.1	Compass Surveying		
	Introduction to Compass Surveying, Types of Compass, Bearings and Meridian, Local Attraction and Corrections		
2.2	Theodolite Surveying		
	Introduction to vernier transit theodolite, Temporary and permanent adjustment of theodolite, Measuring horizontal and vertical angles, Computation of latitudes and departure & gale"s table, Methods of traversing, closing error, Check in closed and open traverse, balancing of traverse, Area of traverse,		

	omitted measurement, co-ordinate method		
3	Plane Table Surveying	08 Hours	13%
	Introduction, Principle, Advantages & limitation, Accessories of plane tabling, setting up the plane table, Methods of plane table surveying, Sources of errors		
4	Engineering Curves	10 Hours	16%
	Introduction to engineering curves, Classification & elements of simple circular curve, Methods of setting out a simple circular curve, Elements of compound curve & reverse curve, Transition curve & vertical curve		
5	Computation of Areas and Volumes	10 Hours	16%
	Different methods to compute area of traverse, Determining areas from plans, trapezoidal rule- Simpson"s rule, Planimeter, digital planimeter, Computation of volumes, volume from cross sections, Trapezoidal and prismoidal formulae, Prismoidal correction, curvature correction, Determination of capacity of reservoir and volume of borrow pits		
6	Hydrography	05 Hours	08%
	Introduction, Purposes, control points, Soundings, Instruments and methods of locating soundings		
7	Setting Out Works	05 Hours	08%
	Introduction, Setting out the buildings, Setting out the sewer grades, Setting out the bridge & culvert,		
8	Modern Survey Instruments	05 Hours	08%
	Introduction, Electromagnetic distance measurement, Electronic theodolite, Total station		

C. Course Outcomes:

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

CO1	Demonstrate proficiency in leveling, contouring, compass theodolite and plane table surveying for accurate land measurement and mapping.
CO2	Utilize mathematical techniques for area and volume estimation, and apply principles of curve setting in construction projects.
CO3	Operate modern surveying tools such as total stations, electronic theodolites, and hydrographic instruments for precise field measurements.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

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

Reference Books:

1. Punamia, B.C., Surveying Vol. I, II & III, Laxmi Publications
2. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling Vol. I & II, Pune
3. Arora, K.R., Surveying Vol. I, II & III, Standard Book House. New Delhi
4. Basak, N.N., Surveying and Levelling, Tata Mcgraw Hill, New Delhi
5. Agor, R., Surveying and Levelling, Khanna Publishers, New Delhi

Web Materials:

1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-ROORKEE/SURVEYING
2. http://nptel.iitm.ac.in/courses/Webcoursecontents/IITROORKEE/SURVEYING/home.htm
3. http://nptel.iitm.ac.in/courses.php?branch=Civil

E. List of Experiments/Tutorials/Termwork:

Sr. No.	Experiments Name
1	Signs and Symbols
2	Profile Levelling
3	Theodolite Survey
4	Plane Table Survey
5	Setting Out Simple Circular Curve
6	Setting Out Building
7	Use of Electronic Theodolite & Total Station
8	Indirect Method of Contouring
9	**FIELD PROJECTS** Theodolite Traversing (Gale's Traverse Survey)
10	Measure Area of Closed Traverse

CLUC203: MECHANICS OF SOLIDS

B. TECH 3rd SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	4		2		6	**5**
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	25	25	150	

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction	3
2	Simple Stresses and Strains	15
3	Principal Stresses and Strains	11
4	Shear Force and Bending Moment	10
5	Moment of Inertia	6
6	Bending and Shear Stresses in Homogeneous and Composite Beam Sections	10
7	Strain Energy	5
	Total hours (Theory) :	**60**
	Total hours (Practical) :	**30**
	Total hours :	**90**

B. Detailed Syllabus:

1	**Introduction**	**03 Hours**	**04%**
1.1	Introduction to mechanics of deformable bodies		
1.2	Principle of superposition		
1.3	Classification of loaded bar		
1.4	Gradual, sudden, impact and shock loading		
1.5	Mechanical properties of materials		
2	**Simple Stresses and Strains**	**15 Hours**	**25%**
2.1	Stress and types of stress, Strain and types of strain		
2.2	Stress strain Characteristics for ductile and brittle materials		
2.3	Shear stresses and strains, Elasticity, Hook's law		
2.4	Axial and shear deformations, Axial force diagram		
2.5	Bars of varying section, Bars of uniformly varying cross section		

2.6	Analysis of stress for statically determinate structures and indeterminate structures		
2.7	Poisson's ratio, Volumetric strain, Biaxial and tri-axial deformations		
2.8	Elastic constant and relation between three elastic constants		
2.9	Stresses due to thermal effect		
3	**Principal Stresses and Strains**	**11 Hours**	**18%**
3.1	Introduction, Sign convention		
3.2	Transformation of stresses for a state of stresses under axial loading		
3.3	Transformation of stresses for plate under biaxial loading		
3.4	Principal plane and principal stresses		
3.5	Maximum shear stress, Element subjected to principal stresses		
3.6	Mohr's circle for stresses on an oblique section of a body subjected to direct stress in one plane and two plane with or without shear stress,		
3.7	Pure shear		
4	**Shear Force and Bending Moment**	**10 Hours**	**17%**
4.1	Concept of shear force and bending moment		
4.2	Sign conventions		
4.3	Relation between bending moment, shear force and rate of loading		
4.4	Bending moment and shear force diagrams for statically determinate beams subjected to all different types of loading		
4.5	Important points for shear force and bending moment diagram.		
5	**Moment of Inertia**	**6 Hours**	**10%**
5.1	Introduction, Radius of gyration		
5.2	Parallel axis theorem and perpendicular axis theorem		
5.3	Polar moment of inertia		
5.4	Moment of inertia by integration		
5.5	Moment of inertia of composite areas		
6	**Bending and Shear Stresses in Homogeneous and composite beam sections**	**10 Hours**	**17%**
6.1	Pure bending, Theory of pure bending		
6.2	Assumptions and derivation of theory of simple bending		
6.3	Neutral axis, moment resistance, section modulus		
6.4	Strength of section		
6.5	Bending stress in symmetrical, unsymmetrical and composite sections		
6.6	Shear stresses, Shear flow		

6.7	Shear stress distribution for various cross section		
7	**Strain Energy**	**05 Hours**	**09%**
7.1	Elastic strain energy due to gradual loading, sudden loading, impact loading, shear and bending, Resilience		

C. Learning Outcomes:

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

CO1	Demonstrate an understanding of the basics of deformation and the relationship between stress and strain in solids.
CO2	Analyze bending moments, shear forces, and stress distributions in statically determinate beams.
CO3	Calculate moments of inertia for different geometrical shapes and their applications in engineering problems.
CO4	Evaluate principal stresses, principal planes, and strain energy under various loading conditions.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text book:

1. Junarkar, S.B. & Shah, H.J., Mechanics of Structures Vol-I, Charotar Publishing House
2. Shah, H. J., Mechanics of Solids, Charotar Publishing House
3. Khurmi R. S., Strength of Materials, S. Chand Publications
4. S. S. Bhavikatti, Strength of Materials, Vikas Publishing House Pvt. Ltd
5. Hibbeler, R.C., "Mechanics of Materials", 6th SI edition

Reference book:

1. Beer and Johnston, Mechanics of Materials
2. Gere & Timoshenko, Mechanics of Materials, CBS Publishers & Distributors, Delhi
3. S. Timoshenko, Strength of Materials (Part -1), D. Van Nostrand Company, Inc.
4. R. Subramanian, Strength of Materials, Oxford University Press
5. S. S. Rattan, Strength of Materials, Tata McGraw Hill Education Pvt. Ltd.
6. R. K. Bansal, Strength of Materials, Lakshmi Publications House Pvt. Ltd.

E Books:

1. Barry Dupen, Applied Strength of Materials for Engineering Technology
2. S. Timoshenko, Strength of Materials (Part -1), D. Van Nostrand Company, Inc

Web material:

1. https://onlinecourses.nptel.ac.in/noc19_ce18/preview#:~:text=Strength%20of%20Materials%20is%20a,basic%20behavior%20of%20such%20materials
2. https://www.youtube.com/watch?v=GkFgysZC4Vc
3. http://nptel.ac.in/syllabus/112106141/
4. http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm

E. List of Experiments:

Sr. No.	List of Experiments
1	Izod Impact Test
2	Rockwell Hardness Test
3	Transverse Test on Timber
4	Compression Test on Bricks & Blocks
5	Tension Test on Various Materials
6	Tutorial: 1 Simple Stresses and Strains
7	Tutorial: 2 Shear Force and Bending Moment
8	Tutorial: 3 Moment of Inertia
9	Tutorial: 4 Principal Stresses and Strains
10	Tutorial: 5 Bending and Shear Stresses in Homogeneous and Composite Beam Sections
11	Tutorial: 6 Strain Energy

Credits and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	4		2		6	**5**
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	25	25	150	

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1	Properties of Fluid	4
2	Fluid Statics	10
3	Fluid Kinematics	9
4	Fluid Dynamics	8
5	Measurement of Flow	8
6	Flow Through Pipes	9
7	Open Channel Flow	10
8	Introduction to the Hydraulic machinery	2
	Total hours (Theory) :	**60**
	Total hours (Practical) :	**30**
	Total hours :	**90**

B. Detailed Syllabus:

1	**Properties of Fluid**	**04 Hours**	**7%**
1.1	Types of Fluid		
1.2	Fluid properties		
1.3	Fluids as a continuum		
1.4	Control volume concept		
1.5	Viscometers		
2	**Fluid Statics**	**10 Hours**	**17%**
2.1	Pressure and it's measurement		
2.2	Pascal's law, hydrostatic pressure, atmospheric, absolute, gauge and vacuum pressure		
2.3	Pressure measurement through piezometer and manometer		
2.4	Total pressure, intensity of pressure, centre of pressure,		

	Pressure on horizontal, vertical, inclined and curved surface		
2.5	Floating Bodies, Buoyancy and centre of buoyancy, meta centre and meta centre height		
2.6	Condition of equilibrium of floating and submerged body, determination of meta-centric height by experimental and analytical method, stable and unstable equilibrium, pressure in case of accelerated rigid body motion		
3	**Fluid Kinematics**	**09 Hours**	**15%**
3.1	Types of fluid motion, methods of describing fluid flow - Langrangian and Eulerian method		
3.2	Inviscid flows, velocity and acceleration, flow rate		
3.3	Continuity equation		
3.4	Potential flows, flow lines, velocity potential and stream function		
3.5	Flownet its characteristic and utility, circulation and vorticity		
4	**Fluid Dynamics**	**08 Hours**	**13%**
4.1	Energy processed by a fluid body, Types of forces, Forces influencing fluid motion, head-energy correction factor		
4.2	Euler and Bernoulli's equations, application of Bernoulli's equation		
4.3	Flow measurement, momentum of fluid in motion, momentum equation and momentum correction factor		
4.4	Application of momentum equation, forces on a pipe bend, free jets		
5	**Measurement of Flow**	**08 Hours**	**13%**
5.1	Orifice & Mouth piece Classification, hydraulic coefficients, experimental determination of hydraulic coefficient, discharge through all types of office & mouthpiece, time of emptying the tank through orifice and mouthpiece		
5.2	Notches and Weirs Classification, discharge through various types of Notches and weirs, time of emptying a reservoir or a tank with notches & weirs		
5.3	Venturimeter		
5.4	Nozzles and Bendmeter		
6	**Flow Through Pipes**	**09 Hours**	**15%**
6.1	Introduction		
6.2	Major and minor losses of energy in pipes, hydraulic gradient, total energy line		
6.3	Pipes in series and parallel, flow through branched pipes		
6.4	Hydraulic transmission of power		

6.5	Water hammer and its effects		
7	**Open Channel flow**	**10 Hours**	**17%**
7.1	Comparison between pipe flow and open channel flow		
7.2	Classification of open channel flow		
7.3	Uniform flow – Chezy's formula		
7.4	Manning's formula- numerical		
7.5	Hydraulically efficient channel cross section		
7.6	Rectangular section		
7.7	Trapezoidal section and circular section		
8	**Introduction to the Hydraulic machinery**	**02 Hours**	**3%**
8.1	Introduction to various types of Turbines and hydraulic pumps, Hydraulic press - hydraulic accumulator - Hydraulic ram		
8.2	Working principle, discharge calculations and use of and machines Centrifugal pumps		

C. Course Outcomes:

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

CO1	Explain fluid properties, pressure measurement, and fundamental fluid flow principles, including continuity and energy equations.
CO2	Analyze flow behavior in closed and open channels, considering frictional losses and optimal section design for efficient conveyance.
CO3	Evaluate and select appropriate hydraulic machines, such as pumps and turbines, based on system requirements, including head and discharge conditions.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

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

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., 1993, New Delhi
3. Shaughnessy, E.J., Katz, I.M. and Schaffer, J.P., Introduction to Fluid Mechanics, SI edition, 2005, Oxford University Press, New Delhi
4. White, F.M. Fluid Mechanics, McGraw Hill, New York
5. Kumar, D.S., Fluid Mechanics, S.K.Kataria & Sons
6. Rajput, R.K., Fluid Mechanics, S. Chand & Co. publications
7. Modi, P.N. and Sheth, Fluid Mechanics & Hydraulic Machines, Standard Book House
8. Ramamurtham, S., Hydraulic Fluid Mechanics & Fluid Machines, Dhanpatrai Publishing Co.
9. Garde, R.J. and Mirajgaoker, A.C., Engineering Fluid Mechanics, New Chand & Sons

Web Materials:

1. http://www.msubbu.in/ln/fm/
2. http://nptel.ac.in/courses/105103095/

E. List of Experiments/Tutorials/Term work:

Sr. No	List of Experiments/Tutorials/Termwork
1	Study of various types of fluid flows
2	Finding viscosity of fluid using falling ball type viscometer
3	Experimental Determination of Metacentric Height of Floating Body
4	Friction losses in pipes
5	Verification of Bernoulli's Theorem
6	Flow measurement with the help of Notch in open channel
7	Flow measurement with the help of Orificemeter
8	Flow measurement with the help of Venturimeter
9	Calibration of Rotameter
10	Determination of Reynold's number for different flow regime
11	Determine the coefficient of discharge of the standing wave venturiflume
12	Determine discharge of the open channel with a slope

B. Tech. (Civil Engineering) Programme

SYLLABI (SEMESTER – 4)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

HSUV202: HUMAN VALUES AND ETHICS

B. TECH 4th SEMESTER (CIVIL ENGINEERING) – HS ELECTIVE

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	2	2	2
Marks	-	50	50	

Pre-requisite:

- Basic awareness of Values and Ethics

A. Objectives of the Course:

To facilitate learners to:

- Develop a familiarity with the Fundamental Human Values and Ethics
- Understanding Values and Ethics as per Ancient Indian Tradition
- Apply Values and Ethics in their professional, social and personal spectrum
- Understand and apply Constitutional Values and Fundamental Duties
- Explore global issues and propose solutions with reference to values and Ethics

B. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to Values and Ethics	05
2.	Ethics and Values in Ancient Indian Tradition	08
3.	Types of Values and Applied Ethics	08
4.	Constitutional Values and Fundamental Duties	05
5.	Global Issues of Values and Ethics in Contemporary Society	04
	Total hours (Theory):	-
	Total hours (Practical):	30
	Total hours (Lab) :	-
	Total hours :	**30**

C. Detailed Syllabus:

1.	Introduction to Values and Ethics	05 Hours	17%
	Need, Relevance and Significance of Values, Concept and Meaning of Values and Ethics		
2.	Ethics and Values in Ancient Indian Tradition	08 Hours	26%

	Lessons from Jatakkatha Lessons from Panchtantra Tales Ethics to be followed from Ancient Hinduism, Jainism and Buddhism Selected Anecdotes from ancient mythology and Moral Learnings		
3.	Types of Values and Applied Ethics	08 Hours	26%
	Personal Values, Social, Civic & Democratic Value, Universal Code of Ethics, Professional Ethics, OrganizationalEthics, Ethical Leadership, Domain Specific Ethics		
4.	Constitutional Values and Fundamental Duties	05 Hours	17%
	Basics of Indian Constitution Constitutional Values: Justice, Liberty, Equality and Fraternity Fundamental Rights Fundamental Duties		
5.	Global Issues of Values and Ethics in Contemporary Society	04 Hours	14%
	Case Studies, Presentations, Projects		

D. Course Outcomes (COs):

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

CO1	Understand the significance of values and ethics
CO2	Understand concept of values and ethics as per Ancient Indian Tradition
CO3	Understand and apply various types of Values and Applied Ethics
CO4	Develop awareness and initiate implementation of Constitutional Values and Fundamental Duties
CO5	Get aware of the global issues and scope and application of values and ethics in problem solving

E. Evaluation Scheme

The evaluation scheme for the course will comprise the following components:

- Formative: Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks
- Summative: External / Semester End Evaluation (SEE) – 25 Marks

Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks	
Exam Pattern	**Marks**
Lab Work Assessment (Best 3 out of 4)	45
Viva voce/ Lab Quiz (Best 3 out of 4) (Note: Quiz Number 1 and 3 will be administered as lab quizzes, while Quiz Number 2 and/or 4 shall serve as part	45

of the mid-term evaluation.)	
Attendance	10
Total	**100* (scaled to 25 marks)**

*Note: The total Internal / CCE score out of 100 marks will be converted to 25 marks.

External / Semester End Evaluation (SEE) – 25 Marks	
Exam Pattern	**Marks**
Quiz	40
Viva-voce	30
Presentation/Task/GD/Case Analysis etc. (The Course Convenor / Faculty will brief the students about the examination components and weightage)	30
Total	**100* (scaled to 25 marks)**

*Note: The total External / SEE score out of 100 marks will be converted to 25 marks.

F. Recommended Study Material:

References:

1. Human Values and Ethics in Workplace, United Nations Settlement Program, 2006. (http://www.unwac.org/new_unwac/pdf/HVWSHE/Human%20Values%20&%20Ethics%20-%20Individual%20Guide.pdf).
2. Ethics for Everyone, Arthur Dorbin, 2009. (http://arthurdobrin.files.wordpress.com/2008/08/ethics-for-everyone.pdf).
3. Values and Ethics for 21st Century, BBVA. (https://www.bbvaopenmind.com/wp-content/uploads/2013/10/Values- and-Ethics-for-the-21st-Century_BBVA.pdf).

Web Materials:

1. www.ethics.org

HSUV203: INDIAN KNOWLEDGE SYSTEM

B. TECH 4th SEMESTER (CIVIL ENGINEERING) – HS ELECTIVE

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	2	2	2
Marks	-	50	50	

A. Objectives of the Course:

- To develop a foundational understanding of the Indian Knowledge System, its origins, and its significance in shaping Indian culture and society.
- To analyze the Vedic texts, their content, and their cultural and philosophical implications.
- To investigate major philosophical schools in India, including their core tenets and historical context.
- To understand the continuity and evolution of knowledge and wisdom in India across different time periods.
- To gain insight into the role of linguistics and languages in preserving and transmitting knowledge within the Indian context.

B. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1.	An overview of Indian Knowledge System (IKS)	04
2.	The Vedic Corpus	06
3.	Indian Philosophical Systems	04
4.	Wisdom through the Ages	04
5.	Linguistics	06
6.	The knowledge triangle	06
	Total hours (Theory):	-
	Total hours (Practical):	30
	Total hours (Lab) :	-
	Total hours :	**30**

C. **Detailed Syllabus:**

1	**An overview of Indian Knowledge System (IKS):**	04
	• Importance of Ancient Knowledge • Definition of IKS • Classification framework of IKS • Unique aspects of IKS	
2	**The Vedic Corpus:**	06
	• Vedas and Vedangas • Distinctive features of Vedic Life	
3	**Indian Philosophical Systems:**	04
	• Introduction to Indian Philosophies • Different schools of philosophy	
4	**Wisdom through the Ages:**	04
	• Puranas • Ithihasas • Niti shastras • Subhasitas	
5	**Linguistics:**	06
	• Components of a language • Paṇini's work on Sanskrit grammar • Phonetics in Sanskrit • The role of Sanskrit in natural language processing	
6	**The knowledge triangle:**	06
	• Prameya • Pramaṇa • Saṃsaya • Framework for establishing Valid Knowledge • Potential fallacies in the reasoning process	

D. **Course Outcomes:**

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

CO1	Describe the fundamental concepts and components of the Indian Knowledge System, including its historical development.
CO2	Analyze select Vedic texts, extracting their philosophical and cultural

	significance.
CO3	Differentiate between major Indian philosophical systems, such as Vedanta, Nyaya, and Sankhya, and comprehend their key principles.
CO4	Trace the evolution of wisdom and knowledge in India from ancient times to the present day, recognizing its continuity.
CO5	Examine the role of language and linguistics in preserving and transmitting knowledge and cultural heritage.
CO6	Discuss the interconnectedness of philosophy, science, and spirituality in IKS, highlighting their contributions to holistic understanding.

E. Evaluation Scheme

The evaluation scheme for the course will comprise the following components:

- Formative: Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks
- Summative: External / Semester End Evaluation (SEE) – 25 Marks

Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks	
Exam Pattern	**Marks**
Lab Work Assessment (Best 3 out of 4)	45
Viva voce/ Lab Quiz (Best 3 out of 4) (Note: Quiz Number 1 and 3 will be administered as lab quizzes, while Quiz Number 2 and/or 4 shall serve as part of the mid-term evaluation.)	45
Attendance	10
Total	**100*** **(scaled to 25 marks)**

*Note: The total Internal / CCE score out of 100 marks will be converted to 25 marks.

External / Semester End Evaluation (SEE) – 25 Marks	
Exam Pattern	**Marks**
Quiz	40
Viva-voce	30
Presentation/Task/GD/Case Analysis etc. (The Course Convenor / Faculty will brief the students about the examination components and weightage)	30
Total	**100*** **(scaled to 25 marks)**

*Note: The total External / SEE score out of 100 marks will be converted to 25 marks.

F. Recommended Study Material:

Reference Books:

1. "Indian Knowledge Systems" by Kapil Kapoor
2. "Indian Knowledge Tradition" by K. Ramasubramanian
3. "The Advaita Worldview: God, World, and Humanity" by Anantanand Rambachan
4. "The Vedas: An Introduction to the Sacred Texts of India" by Roshen Dalal
5. "The Rigveda: 3-Volume Set" translated by Stephanie W. Jamison and Joel P. Brereton
6. "The Yajur Veda: A Rendering of the Jewel of the Vedic Hymns" translated by Devi Chand
7. "A History of Indian Philosophy" by Surendranath Dasgupta (Multi-volume work)
8. "Indian Philosophy and Modern Culture" by Satyendra Nath Dasgupta
9. "The Wisdom of the Upanishads" by A. Parthasarathy
10. "The Dhammapada: The Sayings of the Buddha" translated by Eknath Easwaran
11. "Prameya Mala" by Swami Tattvavidananda Saraswati
12. "Pramana: Vaisheshika Sutra of Kanada" translated by Satish Chandra Vidyabhusana
13. "Saṃsāya in Indian Philosophy: Text and Commentaries" by Bibhuti Baruah
14. "The Art of Reasoning" by David Kelley

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	2	2	2
Marks	-	50	50	

A. Pre-requisite:

- A general interest in mythology, literature, and ethical teachings

B. Objectives of the Course:

The learners will be able to

- Analyze the timeless wisdom and ethical principles embedded within the Ramayana and Mahabharata.
- Explore the complex characters and their motivations, drawing parallels to real-life situations.
- Apply the moral lessons learned from these epics to navigate personal and societal challenges.
- Appreciate the cultural and historical significance of these ancient Indian literary works.

C. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1.	Introduction to the Epics	06
2.	Dharma and its Significance	06
3.	Duty, Sacrifice, and Leadership	06
4.	Love, Family, and Social Order	06
5.	Legacy and Contemporary Relevance	06
	Total hours (Theory):	-
	Total hours (Practical):	30
	Total hours (Lab) :	-
	Total hours :	**30**

D. Detailed Syllabus:

1	Introduction to the Epics	06
	• Historical and cultural context of Ramayana and Mahabharata. • Introduction to the key characters and their relationships. • Overview of the central plotlines of each epic.	
2	Dharma and its Significance	06
	• The concept of Dharma - its meaning, interpretations, and applications. • Contrasting approaches to Dharma displayed by various characters. • The consequences of upholding and neglecting Dharma. • Application of ethical lessons in contemporary contexts	
3	Duty, Sacrifice, and Leadership	06
	• The portrayal of duty and its precedence over personal desires. • Examples of characters who make significant sacrifices for the greater good. • Leadership qualities exemplified by prominent figures in the epics. • Lessons on governance, decision-making, and conflict resolution • Relevance of leadership principles in modern society	
4	Love, Family, and Social Order	06
	• Depictions of love, loyalty, and devotion within families and relationships. • The importance of social order and upholding societal norms. • Challenges faced by individuals caught between personal desires and social obligations. • Analysis of conflicts and resolutions within families • Examination of the roles of women and societal norms portrayed in the epics • Lessons on fostering healthy relationships and resolving conflicts	
5	Legacy and Contemporary Relevance	06
	• The enduring influence of Ramayana and Mahabharata on Indian culture and society. • Examining the applicability of the epics' lessons in a contemporary context. • Contemporary interpretations and adaptations of the narratives. • Application of lessons learned from the epics to real-life situations	

E. Course Outcomes (COs):

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

CO1	Demonstrate an understanding of the historical and cultural context surrounding the Ramayana and Mahabharata.
CO2	Critically analyze the concept of Dharma and its application within the narratives, explaining its significance in guiding characters' actions and choices.
CO3	Evaluate the portrayal of duty, sacrifice, and leadership qualities exhibited by prominent figures in the epics, drawing parallels to real-life situations.
CO4	Analyze the diverse forms of love, family dynamics, and the importance of social order as depicted in the narratives, identifying the conflicts arising from individual choices and societal expectations.
CO5	Critically assess the enduring influence of Ramayana and Mahabharata on Indian culture and society, explaining the contemporary relevance of the epics' lessons in addressing present-day challenges.
CO6	Effectively communicate their understanding of the course material through written assignments, class discussions, and presentations, demonstrating their ability to apply the learned ethical principles to real-world scenarios.

F. Evaluation Scheme

The evaluation scheme for the course will comprise the following components:

- Formative: Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks
- Summative: External / Semester End Evaluation (SEE) – 25 Marks

Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks	
Exam Pattern	**Marks**
Lab Work Assessment (Best 3 out of 4)	45
Viva voce/ Lab Quiz (Best 3 out of 4) (Note: Quiz Number 1 and 3 will be administered as lab quizzes, while Quiz Number 2 and/or 4 shall serve as part of the mid-term evaluation.)	45
Attendance	10
Total	**100*** **(scaled to 25 marks)**

*Note: The total Internal / CCE score out of 100 marks will be converted to 25 marks.

External / Semester End Evaluation (SEE) – 25 Marks	
Exam Pattern	**Marks**
Quiz	40
Viva-voce	30
Presentation/Task/GD/Case Analysis etc.	30

(The Course Convenor / Faculty will brief the students about the examination components and weightage)	
Total	**100* (scaled to 25 marks)**

*Note: The total External / SEE score out of 100 marks will be converted to 25 marks.

G. Recommended Study Material:

Text Books:

- Abridged versions of Ramayana and Mahabharata

Reference Books:

- India: A History by John Keay
- The Hindus: An Alternative History by Wendy Doniger
- Dharma and the Hindu Order by Julius Lipner
- The Gunas: Nature of Passion and Harmony in Indian Culture by Satguru Sivaya

Web material

- https://epicmahabharat.com/
- https://www.valmikiramayan.net/
- https://www.hinduismtoday.com/

HSUV207: SPIRITUALITY FOR HARMONIOUS LIVING

B. TECH 4th SEMESTER (CIVIL ENGINEERING) – HS ELECTIVE

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	-	2	2	2
Marks	-	50	50	

A. Course Objectives:

To facilitate learners to:

- analyze the historical, cultural, and personal significance of spirituality in the contemporary world.
- compare and contrast core beliefs and practices related to harmony within major spiritual traditions and contemporary movements.
- apply spiritual principles to cultivate healthy, compassionate, and forgiving relationships.
- identify a personal sense of purpose through introspection and aligning values with actions.
- explore the role of spirituality in promoting social justice, interfaith understanding, and global citizenship

B. Outline of the course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1.	Introduction to Spirituality	05
2.	Exploring Spiritual Traditions	05
3.	Spiritual Practices for Inner Harmony	05
4.	Spirituality and Relationships	05
5.	Living a Meaningful Life	05
6.	Spirituality and Action	05
	Total hours (Theory):	-
	Total hours (Practical):	**30**
	Total hours (Lab) :	-
	Total hours :	**30**

C. Detailed Syllabus:

1.	Introduction to Spirituality	05 Hours	20%
	• Defining spirituality: exploring various perspectives (religious, philosophical, psychological) • History and evolution of spirituality across cultures • The significance of spirituality in today's world • Contemporary spiritual movements: Mindfulness, New Age, etc.		
2.	Exploring Spiritual Traditions	05 Hours	15%
	• Exploring major spiritual traditions: Buddhism, Hinduism, Christianity, Islam, etc. (Focus on core beliefs and practices related to harmony)		
3.	Spiritual Practices for Inner Harmony	05 Hours	20%
	• Meditation techniques for inner peace and focus • Mindfulness practices for cultivating awareness in daily life • Gratitude and appreciation exercises for positive emotions • Stress management techniques • Embracing slow living and simplicity • Connecting with nature		
4.	Spirituality and Relationships	05 Hours	15%
	• The importance of healthy relationships • Cultivating compassion and empathy towards others • Forgiveness: Exploring the concept of forgiveness and its significance in relationship • Building healthy relationships: Applying spiritual principles in communication and conflict resolution		
5.	Living a Meaningful Life	05 Hours	15%
	• Defining personal purpose: Exploring different frameworks for identifying a life's purpose • Aligning values and actions – examining daily activities and making them more meaningful		
6.	Spirituality and Action	05 Hours	15%
	• The role of spirituality in promoting social justice and ethical living • Interfaith dialogue: Exploring commonalities and fostering understanding between different faiths. • Developing a sense of global citizenship		

D. Course Outcome (COs):

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

CO1	Define spirituality (religious, philosophical, psychological perspectives) and analyze its contemporary significance.
CO2	Compare and contrast core beliefs and practices related to achieving harmony within two chosen spiritual traditions
CO3	Apply various spiritual practices (meditation, mindfulness, gratitude, etc.) to achieve personal well being
CO4	Apply spiritual practices to build healthy relationships
CO5	Formulate a personal statement outlining values, aspirations, and life purpose.
CO6	Design a project promoting social justice or ethical living, inspired by a chosen spiritual tradition.

Note:

Candidates are expected to attend at least 80% of the classes. Failure to meet the minimum attendance will result in a failing grade / not-eligibility for university examination.

E. Evaluation Scheme:

The evaluation scheme for the course will comprise the following components:

- Formative: Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks
- Summative: External / Semester End Evaluation (SEE) – 25 Marks

Internal / Continuous and Comprehensive Evaluation (CCE) – 25 Marks	
Exam Pattern	**Marks**
Lab Work Assessment (Best 3 out of 4)	45
Viva voce/ Lab Quiz (Best 3 out of 4) (Note: Quiz Number 1 and 3 will be administered as lab quizzes, while Quiz Number 2 and/or 4 shall serve as part of the mid-term evaluation.)	45
Attendance	10
Total	**100*** **(scaled to 25 marks)**

*Note: The total Internal / CCE score out of 100 marks will be converted to 25 marks.

External / Semester End Evaluation (SEE) – 25 Marks	
Exam Pattern	**Marks**
Quiz	40
Viva-voce	30
Presentation/Task/GD/Case Analysis etc. (The Course Convenor / Faculty will brief the students about the examination components and weightage)	30
Total	**100*** **(scaled to 25 marks)**

*Note: The total External / SEE score out of 100 marks will be converted to 25 marks.

F. Recommended Study Material:

Reference Books:

1. "World Religions: A Journey with Hope" by Huston Smith, HarperOne
2. "Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life" by Jon Kabat-Zinn, Hyperione
3. "Waking Up: A Guide to Spiritual Awakening" by Sam Harris, Simon & Schuster
4. "The Power of Now: A Guide to Spiritual Enlightenment" by Eckhart Tolle, New World Library
5. "The Bhagavad Gita" (Translated by Eknath Easwaran), Nilgiri Press
6. "Radical Compassion: Learning to Care Deeply in a Difficult World" by Tara Brach, Rider
7. "Sacred Activism: A Handbook for Healing Ourselves and Our World" by Andrew Harvey, Hay House

Web Materials:

1. Online Course Title: Mindfulness and Well-being: Foundations (16 Hours) Platform: Coursera (Offered by: Rice University)
   Course Link: https://www.coursera.org/learn/foundations-of-mindfulness
2. Online Course Title: The Science of Well-Being Platform: Coursera (Offered by: Yale University)
   Course Link: https://www.coursera.org/

CLUC205: CONCRETE TECHNOLOGY

B TECH 4th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	3		4		7	
Examination Scheme	Internal	External	Internal	External		5
Marks	50	50	25	25	150	

A. 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	03
5	Fresh Concrete	05
6	Harden Concrete	05
7	Selection of Concrete Mix Proportion (Mix Design)	08
8	Special Concrete	06
	Total Hours (Theory):	**45**
	Total Hours (Lab):	**60**
	Total Hours:	**105**

B. Detailed Syllabus:

1	**Introduction**	**02 Hours**	**05%**
1.1	Ingredients of concrete		
1.2	Strength development		
1.3	New developments and future trends		
2	**Cement**	**08 Hours**	**18%**
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 and laboratory tests of cement		
2.8	Types of cement		
3	**Aggregate**	**06 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**	**03 Hours**	**6%**
4.1	Advantages of admixtures, Types of admixtures		
4.2	Chemical Admixtures: Accelerators, retarders, water reducing admixture, and air entraining admixtures		
4.3	Cementitious materials: Fly ash, silica fume, rice husk ash, ground granulated blast furnace slag, metakaolin		
5	**Fresh Concrete**	**05 Hours**	**11%**
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**	**07 Hours**	**16%**
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		
6.8	Testing of concrete core, Non-destructive test, Rebound Hammer test, Ultrasonic Pulse Velocity test		
7	**Selection of Concrete Mix Proportions (Mix Design)**	**08 Hours**	**18%**
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**	**13%**
8.1	High performance concrete		
8.2	Lightweight concrete		
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		

C. Course Outcomes:

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

CO1	The students will be able to test and understand concrete and its ingredients as per IS code.

CO2	The students will understand concrete mix design using ACI and IS code methods.
CO3	The students are able to determine the properties of fresh and hardened concrete.
CO4	The students have knowledge of special concretes and their specific applications

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

1. Naville, 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/

G. List of Experiments

Sr. No.	Name of the Experiment
1	Standard consistency of cement
2	Initial and final setting time of cement
3	Soundness of cement
4	Sieve analysis of coarse and fine aggregates**.**
5	Compressive strength of cement
6	Workability of concrete using slump cone.
7	Workability of concrete by using compaction factor apparatus.
8	Ultra sonic pulse velocity test
9	Concrete Mix Design
10	Compressive strength of concrete cube
11	Split tensile strength of concrete

CLUC206: BUILDING PLANNING

B.TECH 6th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	3		2		5	4
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	25	25	150	

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1	Building Drawing	03
2	Building Byelaws	06
3	Planning of Residential Buildings	10
4	Planning of Public Buildings	04
5	Principle of Planning for Differently Abled Public	04
6	Building Services	07
7	Perspective Drawing	07
8	Introduction to Town Planning	04
	Total hours (Theory) :	**45**
	Total hours (Practical) :	**30**
	Total hours :	**75**

B. Detailed Syllabus:

1	**Building Drawing**	**03 Hours**	**07%**
1.1	Classification of buildings		
1.2	Basic principles of planning		
1.3	Principles of Architecture		
1.4	Standard conventional signs, symbols and abbreviations		
1.5	ISI nomenclature: Size of scale, standard method of Dimensioning		
2	**Building Byelaws**	**06 Hours**	**14%**
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**	**10 Hours**	**24%**
3.1	Different types of Residential Buildings		
3.2	Selection of site for residential buildings		
3.3	Orientation of Buildings		
3.4	Guidelines for making wall thickness plan from line diagram		
3.5	Detailed drawing–plan, elevation, sections		
3.6	Design of Individual rooms with particulars attention to anthropometric data, functional and furniture requirements.		
3.7	Design of buildings with particular attention to orientations, FSI and allowable built up area.		
3.8	Furniture layout, Kitchen layout with emphasis on kitchen work triangle		
4	**Planning of Public Buildings**	**04 Hours**	**08%**
4.1	School – Principles of planning a school building, Components, Design of a classroom, Sanitary Requirements		
4.2	Hospital – Site selection, Principles of planning a hospital building, Wards, Different departments, Operation theatre, Sanitary Requirements		
5	**Principle of Planning for Differently Abled Public**	**04 Hours**	**09%**
5.1	Standardization and Contextualization of accessibility in built environment, Overview of accessibility codes		
5.2	Design for Inclusion : A holistic Approach (User centric approach to design, WINIT Model)		
5.3	Accessibility Elements of Built Environment in urban and rural Contexts (Kerb Ramps, Bollards, Level and gratings, Ramps, Gradients and other relevant elements)		
5.4	Principle of site planning and approaches for accessibility		
5.5	Accessibility in public Sanitation System (Washroom typologies and Accessibility perspectives emergency evacuation systems and codes)		
6	**Building Services**	**07 Hours**	**15%**

6.1	Water supply and Drainage – water distribution systems, materials used for plumbing, drainage systems		
6.2	Electrification – distribution of electrical energy, accessories of electrical installation, purpose of earthing		
6.3	Working drawing of a building – Electrical layout, Water supply and drainage layout		
7	**Perspective Drawing**	**07 Hours**	**15%**
7.1	Introduction & technical terms		
7.2	Classifications, elements of perspective		
7.3	One point perspective		
7.4	Two point perspective		
8	**Introduction to Town Planning**	**04 Hours**	**8%**
8.1	History, ancient planning in India		
8.2	Objects & importance of town planning		
8.3	Principles of town planning		
8.4	Horizontal growth, vertical growth		
8.5	Satellite town, ribbon development, concentric growth		

C. Course Outcome (COs):

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

CO1	Utilize the basic principles of planning and architecture, building bye-laws, provisions of NBC and universal design guidelines in design of residential buildings and public buildings.
CO2	Design and draw various constructional drawings of the building including planning of building services like electrification and plumbing.
CO3	Exhibit the knowledge of town planning and its history.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text book:

1. M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India.
2. Singh Gurcharan, Building Planning, Designing and Scheduling, Standard Publishers and Distributors.
3. Dr. N. Kumara Swamy & Rao A. Kameswara, Building Planning and Drawing, Charotar Publishing House.
4. Wagh Sajjan V., Building and Town Planning, Tech-Max Publications.
5. Khasiya R. B, Motiani A. T and Khasiya K. R, Building & Town Planning, Mahajan Publishing House.

Reference book:

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. General Development Control Regulations published by AUDA and GICEA.
5. N.B.C.-2016, Volume 1 & 2, BIS.
6. SP-35 (1987): Handbook of Water supply & drainage-BIS.
7. Bureau of Indian Standards, "HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989 (SP - 41)

Web material:

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=PL060E3166E87E1FD5
5. https://www.designingbuildings.co.uk/wiki/Types_of_drawings_for_building_design
6. http://freevideolectures.com/Course/86/Building-Materials-and-Construction/31
7. https://youtu.be/G-tHuD7R8cs?si=TcCFsAEcMNXhHFHe
8. https://youtube.com/playlist?list=PLwDAYS7BPcgJBsYV6NtdMTBlezCdy7Uly&si=Ye8U-lu5E4cLyGXU
9. https://youtu.be/A88E4DH2asQ?si=zRASSBTkIEQIPUFp

E. List of Tutorials:

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

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

CLUC207: STRUCTURAL ANALYSIS-I

B. TECH 4th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	3		2		5	4
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	25	25	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	04
2	Slope and Deflection of Statically Determinate Beams	09
3	Combined Direct and Bending Stresses	06
4	Columns and Struts	06
5	Influence Line for Statically Determinate Beams	10
6	Torsion in Circular Shafts	04
7	Arches	06
	Total Hours (Theory):	**45**
	Total Hours (Lab):	**30**
	Total Hours:	**75**

B. Detailed Syllabus:

1	**Introduction (SI & KI of Structure)**	**04 Hours**	**10%**
	Concepts of Structural Analysis, Idealization of structures, Static indeterminacy and kinematic indeterminacy (Beam, Frame , Truss)		
2	**Slope and Deflection of Statically Determinate Beams**	**09 Hours**	**20%**
	Differential Equation of the Elastic Curve, Relationship of slope deflection with radius of curvature, bending moment, shear force and load intensity, Relation between Moment, Slope and Deflection using fundamental, Computation of Slope and Deflection of determinate structures using Macualay's Method, Double Integration Method, Moment Area Method, Conjugate		

	Beam Method		
3	**Combined Direct and Bending Stresses**	**06 Hours**	**13%**
	Eccentric Loads, Column Subjected to eccentric loads, Kernal (Core) of Section, Analysis of Structures Subjected to Lateral loads such as chimney etc.		
4	**Columns and Struts**	**06 Hours**	**13%**
	Concept of buckling, different end conditions, Euler's buckling theory of struts with different boundary conditions, Equivalent Length, Applicability and limitations of Euler's Formula, Rankine's buckling theory for columns		
5	**Influence Line for Statically Determinate Beams**	**10 Hours**	**22%**
	Basic of Influence lines, Types of rolling Loading, Qualitative Influence lines for statically determinate beams under moving loads, Quantitative Influence lines Diagram for support reactions, shear force & bending moment etc., Application of ILD for determinate Beam		
6	**Torsion in Circular Shafts**	**04 Hours**	**09%**
	Assumption for shear stress in a circular shaft subjected to torsion, Torsion Stress and Strain, Torsion Formula, Power Transmitted by Shaft, Power Transmitted by Shaft, Design of Shaft: Shafts of Uniform Section, Shaft of Varying Section, Coupling and Keys		
7	**Arches**	**06 Hours**	**13%**
	Arches as structural forms, Types of arches, Horizontal thrust, Normal thrust, bending moment, and radial shear for parabolic and segmental three hinged arches.		

C. Course Outcomes (COs):

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

CO1	Understand and analyze the stability and determinacy of planar structures.
CO2	Apply various methods to calculate slope and deflections in statically determinate beams and evaluate the results.
CO3	Analyze the combined effects of direct and bending, and torsional stresses in structural members, and evaluate the stability and strength of columns and struts under various loading conditions.
CO4	Design and construct influence lines for statically determinate beams and use them to predict and optimize the maximum load effects.
CO5	Analyze the behavior of determinate arches

Course Articulation Matrix:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	1	1	-	-	-	1	1	-	1	2	1	1
CO2	3	2	2	1	2	-	-	-	1	1	-	1	2	1	1
CO3	3	2	2	1	1	-	-	-	1	1	-	1	2	1	1
CO4	3	2	2	1	2	-	2	-	1	1	-	1	2	1	1
CO5	3	2	2	1	1	-	-	-	1	1	-	1	2	1	1

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

D. Recommended Study Material:

Text Books:

1. S.B Junnarkar, Structural Mechanics Volume I, and II Charotar Publishers, 2016. (ISBN:978-9385039270).
2. C.S. Reddy, Basic Structural Analysis, Publisher: Tata McGraw Hill, 2010. (ISBN-
3. 1283187140/978-1283187145). R. Agor, Structural Analysis, Khanna Book Publishing Co., (ISBN: 978-81-95123-100)
4. D. Menon, Structural Analysis Volume – I and II Narosa Publication, 2010. (ISBN-978-1842653371/1842653377).

Reference Books:

1. Negi, L.S. and Jangid, R.S., Structural Analysis, Tata McGraw Hill
2. Dupen Barry, Applied Strength of Materials for Engineering Technology
3. Gere and Timoshenko, Mechanics of Materials, CBS Publishers
4. Hibbler, R.C., Mechanics of Materials, Pearson Education
5. Wang, C.K., Intermediate Structural Analysis, Tata McGraw Hill

Web Materials:

1. https://archive.nptel.ac.in/courses/105/101/105101086/
2. https://nptel.ac.in/courses/105106050

E. List of Experiments/Tutorials:

Sr. No.	Topic
1.	Introduction: SI and KI
2.	Deflection of Beams
3.	Direct and Bending Stresses
4.	Buckling of Struts
5.	Torsion in circular Shafts

6.	Influence Line for Determinate Beams
7.	Arch

CLUC208: GEOTECHNICS AND ENGINEERING GEOLOGY

B. TECH 4th SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

Teaching Scheme	Theory		Practical		Total	Credit
Hours/week	3		2		5	4
Examination Scheme	Internal	External	Internal	External		
Marks	50	50	25	25	150	

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Origin & Evolution of Soil	04
2	Index Properties of soil	06
3	Consolidation	08
4	Shear Strength	09
5	Compaction	07
6	Permeability & Seepage	05
7	Introduction to Engineering Geology	06
	Total Hours (Theory):	**45**
	Total Hours (Lab):	**30**
	Total Hours:	**75**

B. Detailed Syllabus:

1	**Origin & Evolution of Soil**	**04 Hours**	**08%**
	Types of Rock & Soil, Geological Cycle, Physical and Chemical Agencies for Soil Formation, Soil Structure & Clay Minerals		
2	**Index Properties of soil**	**06 Hours**	**13%**
	Three Phase Diagrams of Soil, Volumetric Relationship and Weight – Volume Relationships, Determination of Different Index Properties, Grain Size Distribution, Atterberg Limits and Indices, Activity, Sensitivity & Thixotropy of Soil, IS Classification of Soil		

3	**Consolidation**	**08 Hours**	**18%**
	Compressibility of Soil, Mechanism of Consolidation, One Dimensional Consolidation Test and Analysis, Consolidation Settlement, Time – Settlement Rate Studies		
4	**Shear Strength**	**09 Hours**	**20%**
	Definition, Mohr-Coulomb's Strength Theory, Shear Test Based on Drainage Condition, Factors Affecting Shear Strength, Direct Shear Test, Triaxial Compression Test, Unconfined Compression Test, Vane Shear Test		
5	**Compaction**	**07 Hours**	**16%**
	Definition and Importance, Factors Affecting Compaction, Influence of Compaction on Soil Properties, Laboratory Compaction Test, Field Compaction and its Control		
6	**Permeability & Seepage**	**05 Hours**	**12%**
	Permeability of Soil, Darcy's Law, Factors Affecting Permeability, Tests for Determination of Coefficient of Permeability in laboratory, Permeability of Stratified Soil, Quick- Sand Condition, Seepage, Seepage Velocity		
7	**Introduction to Engineering Geology**	**06 Hours**	**13%**
	Various Methods of Geological Investigation, Geology for Site Selection: Dam, Tunnel, Reservoir and Highways		

C. Course Outcomes (COs):

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

CO1	Apply fundamental knowledge of soil mechanics and geological principles to analyze and classify soils.
CO2	Evaluate and interpret soil behavior under various loading and stress conditions using appropriate testing methods.
CO3	Design and assess soil compaction, permeability, and seepage to ensure sustainable and effective engineering solutions.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

1. Arora, K.R., Soil Mechanics & Foundation Engineering, Standard 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.
5. Parbin Singh, Engineering and General Geology, S. K. Kataria & Sons 2010.

Reference Books:

1. Singh Alam, Soil Engineering, Agion Publishers, Jodhpur.
2. Purshottam Raj, Geotechnical Engineering, Tata McGraw Hill Publication.
3. Singh, Alam, Soil Mechanics & Foundation Engineering, CBS Publishers & Distributors, New Delhi.
4. Taylor, D.W., Fundamentals of Soil Mechanics, Asia Publishing House, Mumbai.
5. Ranjan Gopal and Rao, A.S.R., Basic and Applied Soil Mechanics, New Age International Pvt. Ltd.
6. Braja Das, M., Principles of Geotechnical Engineering, Thomson Asia Pvt. Ltd.
7. F. G. Bell, Engineering Geology Second Edition, Elsevier Ltd, 2007.

Web Materials:

1. https://archive.nptel.ac.in/courses/105/105/105105168/
2. https://onlinecourses.nptel.ac.in/noc23_ce107/preview

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	Identification of Rocks