



CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

ACADEMIC REGULATIONS & SYLLABUS

Faculty of Technology & Engineering

Bachelor of Technology Programme

(Second Year Civil Engineering)

Effective from 2023-24

Vision

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

Mission

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

Programme Educational Objectives (PEO's):

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

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

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

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

Programme Outcomes (PO's)

Engineering Graduates will be able to:

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

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

Programme Specific Outcomes (PSO's):

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

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

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

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

CHARUSAT welcomes you for a Bright Future



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

Faculty of Technology and Engineering

ACADEMIC REGULATIONS

Bachelor of Technology (Civil Engineering) Programme

Charotar University of Science and Technology (CHARUSAT)
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Phone: 02697-247500, Fax: 02697-247100, Email: info@charusat.ac.in
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Academic Year – 2023-24

CHARUSAT

FACULTY OF TECHNOLOGY AND ENGINEERING

ACADEMIC REGULATIONS

Bachelor of Technology Programmes

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

1. System of Education

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

2. Duration of Programme

Undergraduate programme	(B. Tech.)
Minimum	8 semesters (4 academic years)
Maximum	12 semesters (6 academic years)

3. Eligibility for Admissions

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

4. Mode of Admissions

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

5. Programme Structure and Credits

As per Annexure – 1 attached

6. Attendance

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

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

7. Course Evaluation

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

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

7.2 Internal Evaluation

As per Annexure – 1 attached

7.3 University Examination

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

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

7.5 Performance at Internal & University Examination

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

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

- 7.5.2 A student failing to score 40% in the final examination will get an FF grade.

7.5.3 If a candidate obtains minimum required marks in each course but fails to obtain minimum required overall marks, he/she has to repeat the university examination till the minimum required overall marks are obtained.

8. Grading

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

Table: Grading Scheme (UG)

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

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

(i) $SGPA = \frac{\sum C_i G_i}{\sum C_i}$ where,
 C_i = Number of credits of course i
 G_i = Grade Point for the course i
 $i = 1$ to n
 n = number of courses in the semester

(ii) $CGPA = \frac{\sum C_i G_i}{\sum C_i}$ where,
 C_i = Number of credits of course i
 G_i = Grade Point for the course i
 $i = 1$ to n
 n = number of courses of all semesters up to which CGPA is computed

(iii) No student will be allowed to move further in next semester if CGPA is less than 3 at the end of an academic year.

(iv) A student will not be allowed to move to third year if he/she has not cleared all the courses of first year.

(v) A student will not be allowed to move to fourth year if he/she has not cleared all the courses of first and second year.

9. Award of Degree

- 9.1 Every student of the programme who fulfills the following criteria will be eligible for the award of the degree:
- 9.1.1 He/ She should have earned minimum required credits as prescribed in course structure; and
 - 9.1.2 He/ She should have cleared all internal and external evaluation components in every course; and
 - 9.1.3 He/ She should have secured a minimum CGPA of 4.5 at the end of the programme;
 - 9.1.4 **In addition to above, the student has to complete the required formalities as per the regulatory bodies, if any.**
- 9.2 The student who fails to satisfy minimum requirement of CGPA will be allowed to improve the grades so as to secure a minimum CGPA for award of degree. Only latest grade will be considered.

10. Award of Class

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

Distinction	:	$CGPA \geq 7.5 \ \& \ \leq 10.0$
First class	:	$CGPA \geq 6.0 \ \& \ < 7.5$
Second Class	:	$CGPA \geq 5.0 \ \& \ < 6.0$
Pass	:	$CGPA < 5.0$

11. Transcript

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

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(CHARUSAT)

FACULTY OF TECHNOLOGY & ENGINEERING (FTE)

CHOICE BASED CREDIT SYSTEM

A. Choice Based Credit System:

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

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

1.1. Core Courses

1.1.1 University Core (UC)

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

1.1.2 Programme Core (PC)

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

1.2 Elective Course (EC)

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

1.2.1 Institute Elective Course (IE)

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

1.2.2 Programme Elective Course (PE)

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

1.2.3 Cluster Elective Course (CE)

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

1.3 Non Credit Course (NC) - AUDIT Course

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

Annexure – 1

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY (CHARUSAT)											
TEACHING & EXAMINATION SCHEME FOR B TECH PROGRAMME IN CIVIL ENGINEERING											
Level	Course Code	Course Title	Teaching Scheme				Examination Scheme				
			Contact Hours			Credit	Theory		Practical		Total
			Theory	Practical	Total		Internal	External	Internal	External	
Level 2	MA251	Engineering Mathematics III	4		4	4	30	70			100
	CL241	Geology for Civil Engineers	4	2	6	5	30	70	25	25	150
	CL242	Surveying	4	2	6	5	30	70	25	25	150
	CL243	Mechanics of Solids	4	2	6	5	30	70	25	25	150
	HS121.02 A	Creativity, Problem Solving and Innovation	2		2	2	30	70			100
	XXXXX	University Elective - I	0	2	2	2			30	70	100
		Remedial Classes			10						
					36	23					750
	CL244	Fluid Mechanics-I	4	2	6	5	30	70	25	25	150
	CL245.01	Building Construction Technology	3	2	5	4	30	70	25	25	150
	CL246.01	Structural Analysis I	3	2	5	4	30	70	25	25	150
	ME241	Material Science & Technology	3	2	5	4	30	70	25	25	150
	HS III.02 A	Human Values and Professional Ethics	0	2	2	2			30	70	100
	MA249	Numerical Methods	3	2	5	4	30	70	25	25	150
	XXXXX	University Elective - II	0	2	2	2			30	70	100
	Remedial Classes			06							
				36	25					950	

LIST OF UNIVERSITY ELECTIVE COURSES

3RD SEMESTER UNDERGRADUATE PROGRAMME (ACADEMIC YEAR 2022-23)

Sr. No.	Course Code & Course Name	Department / Faculty offering the Course
1	EC281.01: Introduction to MATLAB Programming	EC / FTE
2	CE281.01: Art of Programming	CE / FTE
3	CL281.01: Environmental Sustainability and Climate Change	CL / FTE
4	CL283: SDG Handprint Laboratory	CL / FTE
5	EE284: Python Programming	EE/FTE
6	IT283: Web Designing & UI/UX	IT/FTE
7	ME281.01: Engineering Drawing	ME/FTE
8	PH233.01: Fundamentals of Packaging	RPCP/FPH
9	PD260.01: Basic Laboratory Techniques	PDPIAS/FAS
10	NR251.01: First Aid & Life Support	NURSING / FMD
11	PT191.01: Health Promotion and Fitness	ARIP / FMD
12	CA224: Introduction to Web Designing	CMPICA / FCA
13	BM231: Banking and Insurance	I2IM / FMS

LIST OF UNIVERSITY ELECTIVE COURSES

4TH SEMESTER UNDERGRADUATE PROGRAMME (ACADEMIC YEAR 2022-23)

Sr. No.	Course Code & Course Name	Department / Faculty offering the Course
1	EC282.01: Prototyping Electronics with Arduino	EC / FTE
2	CE282.01: Web Designing	CE / FTE
3	CL282.01: Basics of Environmental Impact Assessment	CL / FTE
4	EE287: MATLAB Programming	EE/FTE
5	EE288: Maintenance Of Household Apparatus	EE/FTE
6	IT284: Data Visualization	IT/FTE
7	ME282.01: Material Science	ME/FTE
8	PH238.01: Cosmetics in daily life	RPCP/FPH
9	NR261.01: Life Style Diseases & Management	NURSING / FMD
10	PT192.01: Occupational Health & Ergonomics	ARIP / FMD
11	CA225: Programming the Internet	CMPICA / FCA
12	BM241: Health Care Management	I2IM / FMS

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B. Tech. (Civil Engineering) Programme

SYLLABI (Semester – 3)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

MA251: ENGINEERING MATHEMATICS-III
B TECH 3rd SEMESTER (CL/EE/ME)

Credits and Hours:

Teaching Scheme	Theory	Practical	Total	Credit
Hours/week	4	-	4	4
Marks	100	-	100	

A. Outline of the course:

Sr. No.	Title of the Unit	Minimum number of hours
1.	Fourier Series and Its Applications	15
2.	Laplace Transform and Its Applications	15
3.	Vector Differential Calculus	10
4.	Vector Integral Calculus	12
5.	Curve Fitting	08
	Total hours:	60

B. Detailed Syllabus:

1. **Fourier Series and Its Applications:** 15 Hours 25%
 - 1.1 Periodic functions, Dirichlets conditions, Trigonometric series.
 - 1.2 Euler formulae, Fourier series of periodic function of period p .
 - 1.3 Fourier series: Discontinuous functions, Even and odd functions.
 - 1.4 Half range Fourier series.
 - 1.5 Solutions of heat, wave, Laplace equations by method of separation of variables and Fourier series.
2. **Laplace Transform and Its Applications:** 15 Hours 25%
 - 2.1 Laplace transform as an improper integral and its existence.
 - 2.2 Laplace transform of elementary functions and its properties.
 - 2.3 Inverse Laplace transform and its properties.
 - 2.4 First and second shifting theorems. Laplace transform of derivatives and integrals.
 - 2.5 Convolution theorem and its application to obtain inverse

- Laplace transform.
- 2.6 Laplace transform of periodic functions, Unit step function, Unit impulse function (Dirac delta function).
- 2.7 Solving differential equations using Laplace transform.
- 2.8 Applications of ODE : Mechanical vibration system, deflection of beams.
- 3 Vector Differential Calculus:** 10 Hours 17%
- 3.1 Revision of concepts of Vector algebra, Scalar and Vector fields.
- 3.2 Gradient of a scalar functions, Directional derivatives.
- 3.3 Divergence and Curl of a vector field and their properties.
- 3.4 Physical interpretations of gradient, divergence and curl. Irrotational and Solenoidal vector fields.
- 3.5 Scalar potential function.
- 4 Vector Integral Calculus:** 12 Hours 20%
- 4.1 Introduction to line integrals and examples.
- 4.2 Statement and examples of Green's theorem.
- 4.3 Introduction to Surface and Volume integrals.
- 4.4 Statements and examples of Stokes' and Gauss' divergence theorem.
- 5 Curve Fitting:** 08 Hours 13%
- 5.1 Normal equations.
- 5.2 Fitting a straight line: $y = a + bx$ (linear regression).
- 5.3 Fitting a parabola: $y = a + bx + cx^2$.
- 5.4 Fitting a curve by transformation: $y = ab^x$, $xy^a = b$, $y = ax^b$.

C. Course Outcome :

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

- CO1 Represent continuous time periodic signals using concepts of Fourier series and determine the solution of complex engineering problems heat, wave and Laplace's equations using it.
- CO2 Classify and apply the necessary Laplace transform and inverse Laplace transform techniques to solve ordinary differential equations of real world problems.

- CO3 Differentiate the dot product, cross product, length of vectors, partial derivatives, derivatives of vector-valued functions, gradient functions and these tools are employed successfully in different branches of engineering and physics.
- CO4 Analyze parameterize curves and calculate line integrals using them and Use vector operators and implement into surface integrals, Classify and examine the Green, Stokes and Divergence theorem
- CO5 Appraise the Least squares fitting method of data approximation and Discuss the concept of curve fitting of different types of curves using specific data

Course Articulation Matrix (ME/CL):

	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	-	1	2	2	-
CO4	3	2	2	1	1	-	1	-	-	1	-	1	2	2	-
CO5	3	3	2	2	2	-	1	-	-	1	-	1	2	2	-

- Enter correlation levels 1, 2 or 3 as defined below:
- 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
- If there is no correlation, put “-”

D. Recommended Study Material:

Text Books:

1. Erwin Kreyszig; Advanced Engineering Mathematics, 9th Ed., Jhon Wiley & Sons, India, 1999.
2. Shankar S. Sastry; Introductory methods of numerical analysis. PHI Learning Pvt. Ltd., 2015.

Reference Books:

1. Ahsaan, Zafar; Differential equations and their applications. PHI Learning Pvt. Ltd., 2004.
2. Stewart James; Calculus Early Transcendental, 5th Ed., Thomson India, 2007.
3. Wylie & Barrett; Advanced Engineering Mathematics, Mc graw Hill pub., 1982.

4. M. D. Greenberg; Advanced Engineering Mathematics, 2nd ed., Pearson. 1998.
5. B. S. Grewal; Higher engineering mathematics. Khanna Publisher, New Delhi, 1996.
6. H. K. Dass; Advanced engineering mathematics. S. Chand, 2008.
7. Debnath, Lokenath, and Dambaru Bhatta. Integral transforms and their applications. CRC press, 2014.
8. Kenneth A. Stroud and Dexter J. Booth. Advanced engineering mathematics. Palgrave Macmillan, 2011.

Web Materials:

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

CL241: GEOLOGY FOR CIVIL ENGINEERS
B TECH 3RD SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Physical Geology	17
2	Natural Materials	13
3	Structural Geology	12
4	Engineering Geology	18

Total Hours (Theory): 60

Total Hours (Lab): 30

Total Hours: 90

B. Detailed Syllabus:

1	Physical Geology	17 Hours	28%
1.1	Earth: Origin, internal structure.	3	
1.2	Work of natural agencies: Lakes, Oceans, Atmosphere, wind, streams, sea, glacier, mass movements	7	
1.3	Plate tectonics: Concepts and plate boundaries	2	
1.4	Earthquakes: Basics of earthquake, intensity and magnitude, causes, Earthquake zones of India	5	
2	Natural Materials	13 Hours	22%
2.1	Minerals: Formation, Identification and Use:	5	

Physical properties of minerals; basics of optical mineralogy, SEM, XRD

2.2	Rocks:	8	
	Types of rock and origin:		
	Igneous (extrusive and intrusive), sedimentary and metamorphic		
	Igneous Rock:		
	Agents, structure, texture, IUGG classification of intrusive and extrusive rocks		
	Metamorphic Rock :		
	Causes of metamorphism (stress, temperature, tectonism, pore fluid), structure and texture		
	Sedimentary Rock:		
	Sedimentation environments, structure, textural classification of siliciclastic and carbonate rock		
3	Structural Geology	12 Hours	20%
3.1	Introduction:	2	
	Outcrop, stratification, dip and strike relation		
3.2	Study of Structural Features:	10	
	Fold, Fault, Joints and Unconformities; Classification, formation and Identification		
4	Engineering Geology	18 Hours	30%
4.1	Geologic Mapping:	3	
	Various methods of geological investigations, mapping, preparation of geologic sections Interpretation of reports.		
4.2	Indian geology:	2	
	Geological framework of India, Geology of Gujarat		
4.3	Ground water:	2	
	Basics and engineering difficulties		
4.4	Geology for Site selection:	6	
	Dam, Tunnel, Reservoir and Highways		
4.5	Case studies:	5	
	Important international and Indian examples of failures of civil structures due to geological constrains.		

C. Course Outcomes:

On the successful completion of this course:

- CO1 The student will have basic understanding of Geology, natural materials such as minerals and rocks, use of rocks and minerals and availability of rocks and mineral.
- CO2 The student will have basic understanding of Geological framework of India and Gujarat.
- CO3 The student will be able to analyse geological maps and process of resolving geological issues in civil engineering projects.
- CO4 The student will be able to apply the knowledge of natural dynamic process, and other geological factors while taking decision on civil engineering constructions.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

1. Prabin Singh, Engineering & General Geology, and S.K. Kataria & Sons, Katson Books,1999, New Delhi
2. Kesavulu, C., Textbook of Engineering Geology, Macmillan India Ltd, 1993, New Delhi

Reference Books:

1. Bangar, K.M., Principles of Engineering Geology, Standard Publishers Distributors, 1995, New Delhi
2. Billings, M.P., Structural Geology, Prentice-Hall India, 1974, New Delhi
3. Blyth, F.G.H. and DE'Freits, M.H. Geology for Engineers. ELBS, 1974, London

4. Gokhale, K.V.G.K. and Rao, D.M., Experiments in Engineering Geology, Tata McGraw Hill, 1981, New Delhi
5. Reddy, V., Engineering Geology for Civil Engineers, Oxford & IBH, 1997, New Delhi
6. Parthasarathy, A., Panchapakesan, V. and Nagarajan, R. "Engineering Geology", Wiley India Pvt Ltd., 2013. ISBN-13: 9788126541829
7. Reddy, D. V. "Engineering Geology", Vikas Publishing House, 2010. ISBN13: 9788125919032
8. Krynine, D.P. and Judd, W.R. "Principles of Engineering Geology and Geotechnics", CBS Publishers & Distributors, New Delhi, 1957. ISBN-10: 812390603X.

Web Materials:

1. <http://nptel.ac.in/courses/105105106/>
2. <http://freevidelectures.com/Course/87/Engineering-Geology>
3. <http://www.cosmolearning.com/courses/engineering-geology/video-lectures/>
4. <http://geology.about.com/>

LIST OF EXPERIMENTS

Sr. No.	Name of Experiment
1	Fundamentals of Geology
2	Study of Minerals
	Study of Physical Properties of Minerals
	Identification Rock Forming Minerals by Studying Physical Properties
	Identification Ore Minerals by Studying Physical Properties
3	Study of Rocks
	Study of Igneous Rocks
	Study of Sedimentary Rocks
	Study of Metamorphic Rocks
4	Geological Mapping
	Map of layered horizontal beds
	Map of layered inclined beds
	Map of layered inclined beds
	Map of Unconformity with Inclined and Horizontal Bed Series
	Map of Faulted Sequence
	Map of Folded Sequence
	Various Combination Maps for General Practice

CL242: SURVEYING
B TECH 3RD SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Out Line of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Measurement of Elevation, Contouring	5
2	Theodolite Traversing	10
3	Plane Table Surveying	10
4	Engineering Curves	10
5	Computation of Areas and Volumes	10
6	Hydrography	5
7	Setting Out Works	5
8	Modern Surveying Instruments	5

Total hours (Theory): 60 Hours

Total hours (Lab): 30 Hours

Total hours: 90 Hours

B. Detailed Syllabus:

1	Measurement of Elevation, Contouring	05 Hours	08%
1.1	Profile levelling and cross sectioning & contouring		
1.2	Errors in levelling		
1.3	Permanent adjustment of level.		
2	Theodolite Surveying	10 Hours	17%
2.1	Introduction to vernier transit theodolite		
2.2	Temporary and permanent adjustment of theodolite		
2.3	Measuring horizontal and vertical angles		
2.4	Computation of latitudes and departure & gale's table		

2.5	Methods of traversing, closing error		
2.6	Check in closed and open traverse, balancing of traverse		
2.7	Area of traverse, omitted measurement, co-ordinate method		
3	Plane Table Surveying	10 Hours	17%
3.1	Introduction		
3.2	Principle		
3.3	Advantages & limitation		
3.4	Accessories of plane tabling		
3.5	Setting up the plane table		
3.6	Methods of plane table surveying		
3.7	Sources of errors		
4	Engineering Curves	10 Hours	17%
4.1	Introduction to engineering curves		
4.2	Classification & elements of simple circular curve		
4.3	Methods of setting out a simple circular curve		
4.4	Elements of compound curve & reverse curve		
4.5	Transition curve & vertical curve		
5	Computation of Areas and Volumes	10 Hours	17%
5.1	Different methods to compute area of traverse		
5.2	Determining areas from plans, trapezoidal rule- Simpson's rule		
5.3	Planimeter, digital planimeter		
5.4	Computation of volumes, volume from cross sections		
5.5	Trapezoidal and prismoidal formulae		
5.6	Prismoidal correction, curvature correction		
5.7	Determination of capacity of reservoir and volume of borrow pits		
6	Hydrography	05 Hours	08%
6.1	Introduction		
6.2	Purposes, control points		
6.3	Soundings		
6.4	Instruments and methods of locating soundings		
7	Setting Out Works	05 Hours	08%
7.1	Introduction		

- 7.2 Setting out the buildings
- 7.3 Setting out the sewer grades
- 7.4 Setting out the bridge & culvert

8 Modern Survey Instruments

05 Hours 08%

- 8.1 Introduction
- 8.2 Electromagnetic distance measurement
- 8.3 Electronic theodolite
- 8.4 Total station

C. Course Outcomes :

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

- CO1 Carry out elevation measurement and prepare contour maps.
- CO2 Plan theodolite survey applications.
- CO3 Measure and Plot maps with plane table.
- CO4 Set out curves, buildings, culverts and tunnels
- CO5 Compute ground areas and earthwork volumes
- CO6 Carry out basic hydrographic survey and invoke application of modern surveying instruments over conventional instruments.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	2	-	-	-	2	1	-	1	3	1	2
CO2	1	2	1	-	3	-	-	1	-	1	-	2	1	2	2
CO3	1	-	-	-	-	-	-	-	1	1	-	-	-	-	1
CO4	3	2	2	-	-	1	-	-	1	-	-	2	1	-	2
CO5	3	2	2	1	-	-	1	-	-	1	-	1	2	1	2
CO6	1	-	2	-	3	-	-	-	1	3	2	2	2	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 Vidhyarthi Gruh
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/Webcourse-contents/IITROORKEE/SURVEYING/home.htm>
3. <http://nptel.iitm.ac.in/courses.php?branch=Civil>

CL243: MECHANICS OF SOLIDS
B TECH 3RD SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Out Line 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	10
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	6

Total hours (Theory): 60 Hours

Total hours (Lab): 30 Hours

Total hours: 90 Hours

B. Detailed Syllabus:

1	Introduction	03 Hours	05%
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	22%

- 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** **10 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 22%**
- 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
Important points for shear force and bending moment diagram.

5	Moment of Inertia	6 Hours	12%
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	14%
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	06 Hours	07%
7.1	Elastic strain energy due to gradual loading, sudden loading, impact loading, shear and bending, Resilience		

C. Course Outcomes

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

- CO1 Classify and determine the strength parameters of materials and compute stresses & strains for structural elements due to normal, shear loads and temperature changes.
- CO2 Calculate bending moment and shear force for statically determinate beams and draw the distributions.
- CO3 Calculate the cross sectional moment of inertia using the parallel axis theorem.
- CO4 Analyse stresses in a beam under combined loadings and also Calculate bending stress, shear stress and their distribution at any desired location along the beam elements.
- CO5 Evaluate the different mechanical properties of materials and also Calculate strain energy due to different loadings.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

1. Junarkar, S.B. & Shah, H.J., Mechanics of Structures Vol-I, 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 Books:

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 Materials:

1. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm>
2. <http://nptel.ac.in/video.php?subjectId=112107147>
3. <https://www.youtube.com/watch?v=GkFgysZC4Vc>
4. <http://nptel.ac.in/syllabus/112106141/>
5. <http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Mechanics%20Of%20Solids/index.htm>

HSI21.02 A: CREATIVITY, PROBLEM SOLVING AND INNOVATION
B TECH 3RD SEMESTER (UNIVERSITY ELECTIVE)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	--	30/15	--	30/15	2
Marks	--	100	--	100	

Pre-requisite courses:

Creative Problem Solving

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

A. 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

B. Detailed Syllabus:

- 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
- Questioning, Learning and Visualization 6 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 | 6 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 | 6 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 | 6 Hours | 20% |
| Cognitive Research Trust Thinking for Creatively Solving Problems, Case Study on Contemporary Issues and Practices in Creativity and Problem Solving | | |

C. Course Outcome :

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 mindset.
- 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.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

❖ Text book:

1. R Keith Sawyer, ZigZag, The Surprising Path to Greater Creativity, Jossey-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 Berkun, The Myths of Innovation, Expanded 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 Sawyer, 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 Publication 1994
9. Scott 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 Doval 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 Macanuso, Game Storming, O'Reilly Publication 2010.
13. Howard Gardner, Creating minds, Basic Books Publication 1993
14. Mihaly Csikszentmihalyi, Creativity—Flow and Psychology of Discovery and Invention, Harper Publication 1996
15. Martin Gardner, W. H., Aha! Insight, Freeman Publication 1978
16. Paul Slovic, Test Your Lateral Thinking IQ, Sterling Publication 1994
17. Paul Slovic & Des Macchale 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

B. Tech. (Civil Engineering) Programme

SYLLABI (Semester – 4)

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

CL244: FLUID MECHANICS- I
B TECH 4TH SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	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 (Lab): 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 its 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 - Lagrangian 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 possessed 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 orifice & 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	2 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 (COs):

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

- CO1 Determine the properties of fluid and pressure and their measurement.
- CO2 Apply continuity equation and energy equation in solving problems on flow through conduits.
- CO3 Compute the frictional loss in laminar and turbulent flows.

CO4 Design open channels for most economical sections like rectangular, trapezoidal and circular sections.

CO5 Select the type of pumps and turbine required with reference to available head of water and discharge.

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	1	-	-
CO2	3	3	2	-	-	-	-	-	-	1	-	2	1	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	1	1	-	-
CO4	3	3	2	1	-	-	-	-	-	1	-	2	2	-	2
CO5	3	1	-	-	-	1	-	-	-	-	-	2	1	-	1

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

D. Recommended Study Material:

Text Books:

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

CL245.01: BUILDING CONSTRUCTION TECHNOLOGY
B TECH 4TH SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Outline of the Course:

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Masonry Works	09
2	Foundations	07
3	Doors, Windows & Ventilators	05
4	Stairs and Staircases	05
5	Floors and Floorings	05
6	Roofs and Roof Coverings	05
7	Wall Finishes	04
8	Temporary Works	05

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

- | | | | |
|----------|--|-----------------|------------|
| 1 | Masonry Works | 09 Hours | 20% |
| 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	16%
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	05 Hours	11%
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	05 Hours	11%
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	05Hours	11%
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		

C. Course Outcomes:

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

- CO1 Understand the types, dimensions and method of construction of various building components along with various checks required for their construction.
- CO2 Identify, select and recommend appropriate type of building elements suitable for a particular situation.
- CO3 Select and recommend appropriate temporary structures suitable for various building construction needs.
- CO4 Select and recommend appropriate mode of vertical movements and design of staircase
- CO5 Design strip footing type of shallow foundation.

Course Articulation Matrix:

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

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, NewDelhi
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, NewDelhi

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>

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

CL246.01: STRUCTURAL ANALYSIS -I
B TECH 4TH SEMESTER (CIVIL ENGINEERING)

Credits and Hours:

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

A. Outline of the Course

Sr. No.	Title of the Unit	Minimum Number of Hours
1	Introduction	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 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	04 Hours	10%
1.1 Concepts of Structural Analysis		
1.2 Idealization of structures		
1.3 Static indeterminacy and kinematic indeterminacy		
2. Slope and Deflection of Statically Determinate Beams	09 Hours	20%
2.1 Differential Equation of the Elastic Curve, Relationship of slope deflection with radius of curvature, bending moment, shear force and load intensity		

2.2	Relation between Moment, Slope and Deflection using fundamental, Macaulay's Method (Method of Singularity Function), Moment Area Method, Conjugate Beam Method		
3	Combined Direct and Bending Stresses	06 Hours	13%
3.1	Eccentric Loading along One Principle Axis		
3.2	Middle Third Rule, Kernal (Core) of Section		
3.3	Column Subjected to Biaxial Bending		
3.4	Structures Subjected to Lateral Pressure		
4	Columns and Struts	06 Hours	13%
4.1	Buckling of Columns, different end conditions		
4.2	Euler's Theory, Equivalent Length		
4.3	Applicability and limitations of Euler's Formula		
4.4	Rankine's Formula		
5	Influence Line for Determinate Beams	10 Hours	22%
5.1	Uses of influence lines, Various Types of Loading		
5.2	Influence lines for statically determinate beams under moving loads		
5.3	Influence lines for support reactions, shear force & bending moment for uniformly distributed load and several point loads		
5.4	Criteria for maximum effects		
6	Torsion in Circular Shafts	04 Hours	9%
6.1	Assumption for shear stress in a circular shaft subjected to torsion		
6.2	Torsion Stress and Strain, Torsion Formula		
6.3	Power Transmitted by Shaft		
6.4	Design of Shaft: Shafts of Uniform Section, Shaft of Varying Section, Coupling and Keys		
7	Arches	06 Hours	13%
7.1	Arches as structural forms – Examples of arch structures, Types of arches		
7.2	Analysis of three hinged - parabolic and circular arches		

C. Course Outcomes :

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

- CO1 Identify the stability and determinacy of planar structures.
- CO2 Calculate deflections for statically determinate beams using different methods of analysis.
- CO3 Analyses the columns with different end conditions and understand the effect of same.
- CO4 Construct influence lines for statically determinate beams and to use influence lines to find maximum load effects in beams.
- CO5 Calculate the combined stresses and torsion in the circular shaft.
- CO6 To analyze the determinate arches.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

Text Books:

- 1) Junarkar, S.B. and Shah, H.J., Mechanics of Structures Vol. I, Charotar Publishing House
- 2) Negi, L.S. and Jangid, R.S., Structural Analysis, Tata McGraw Hill
- 3) Reddy, C.S., Basic Structural Analysis, Tata McGraw Hill

Reference Books:

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

ME241: MATERIAL SCIENCE AND TECHNOLOGY
B TECH 4TH SEMESTER (CIVIL / MECHANICAL ENGINEERING)

Credit and Hours

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

A. Outline of the Course

Sr. No.	Title of the Unit	Minimum number of hours
1	Introduction to Material Science	04
2	Crystal Structure and Properties	10
3	Mechanism of crystallization & Phase Transformation	06
4	Engineering Steels and Alloys	07
5	Corrosion and degradation of metals	04
6	Fiber Reinforced Composites	08
7	Engineered Wood & Wood Products	06

Total Hours (Theory): 45

Total Hours (Lab): 20

Total Hours: 65

B. Detailed Syllabus

- | | | | |
|------------|---|-----------------|------------|
| 1.0 | Introduction to Material Science | 04Hours | 9% |
| 1.1 | Classification of Engineering Materials | | |
| 1.2 | Engineering requirements of materials | | |
| 1.3 | Properties of engineering materials | | |
| 1.4 | Criteria for selection of materials for engineering applications | | |
| 1.5 | Structure property relationship | | |
| 2.0 | Crystal Structure and Properties | 10 Hours | 22% |
| 2.1 | Atomic structure & bonding in solids | | |
| 2.2 | Bravais lattices & Crystal Structure, Crystal planes & directions, Atomic packing | | |

- 2.3 Bragg Law & Diffraction
- 2.4 Imperfection in solids, Linear defects, Slip, Dislocation & Plastic deformation, Planar defects, Volume defects
- 2.5 Mechanical properties of metals, Strain hardening, Thermal, Magnetic, Electrical & Optical properties of materials
- 3.0 Mechanism of crystallization & Phase Transformation 06 Hours 13%**
- 3.1 Nucleation-Homogeneous and Heterogeneous
Nucleation- Growth -Single crystal -Polycrystalline Materials
- Basic principles of solidification of metals and alloys
- 3.2 Phase diagram & phase transformation
- 4.0 Engineering Steels and Alloys 07 Hours 16%**
- 4.1 Iron carbon diagram and phase diagrams
- 4.2 Grades of CI, Alloyed Cast Iron, Malleable Iron and S. G. Iron
- 4.3 Classification, Properties and Use of Structural Steels, High Carbon and Mild Steels, TMT Steel
- 4.4 Effects of different alloying metals
- 5.0 Corrosion and degradation of metals 04 Hours 9%**
- 5.1 Causes and nature of corrosion
- 5.2 Inter-granular corrosion (IGC), Hydrogen embrittlement
- 5.3 Measures of counteracting corrosion,
- 5.4 Metal coatings, Organic coatings, Lining and cladding, Use of Corrosion inhibitors, Cathodic protection against corrosion
- 6.0 Fiber Reinforced Composites 08 Hours 18%**
- 6.1 Types and application of composites
- 6.2 Particle reinforced composites, Influence of fiber orientation and concentration
- 6.3 Fiber phase and the matrix phase, Polymer matrix composite
- 6.4 Metal matrix composite, Ceramic matrix composite and carbon-carbon composites
- 7.0 Engineered Wood and Wood Products 06 Hours 13%**
- 7.1 Laminated veneer lumber (LVL): Laminated

strand lumber (LSL), Parallel strand lumber (PSL),
Wood I-joists, Glue-laminated beams

7.2 Reconstituted products: Particle boards,
Medium Density Fibre Board (MDF), Hardboard
and Block Board

C. Course Outcomes :

On the successful completion of this course:

- CO1 Familiar with various atomic bonding and crystal structure, and also their characteristics and influence on engineering properties
- CO2 Understand basic engineering properties of materials and the underlying structural features which are governing such properties
- CO3 Know the mechanism of crystallization and phase transformation in major engineering materials
- CO4 Be able to understand fundamentals of various engineering steels and alloys and should have ability to select suitable materials based on their structure-property relations
- CO5 Be able to understand the corrosion and other degradation in metals and suggest suitable remedial measures.
- CO6 Know the structure, properties and application of various fiber reinforced composites used in engineering, Know process, structure, properties and application of various processed wood products used in engineering

Course Articulation Matrix:

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

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

D. Recommended Study Material

Text Books:

1. Materials Science and Engineering: A First Course, Raghvan V, Prentice Hall of India
2. Callister W. D. Jr, "Materials science and engineering : An Introduction", Edition:-2006, Wiley India, New Delhi, India
3. Dharmendra K umar and Jain S. K., "Material science and manufacturing process", Vikas Pub House, New Delhi, India
4. Van Vlack, Elements of Materials Science and Engineering, 1989

Reference books

1. Narula& Gupta, Material Science, Tata McGraw-Hill Education
2. Avner Sidney H., "Physical Metallurgy", Tata Mcgraw Hill Education
3. Khanna O. P., "Material Science - A Text Book of Material Science & Metallurgy", Dhanpat Rai Pub
4. Narang G. B. S. and Manchanedy K., "Materials and Metallurgy", Khanna Pub New Delhi, India
5. Thomas G. Williamson, APA Engineered Wood Handbook, McGraw Hill Professional, 2002

Reading Materials, web materials with full citations

1. <http://ocw.mit.edu/OcwWeb/web/courses/courses/index.htm#MaterialsScienceandEngineering>
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIScBANG/Material%20Science/New_index1.html

HSIII.02 A: HUMAN VALUES & PROFESSIONAL ETHICS
B TECH 4TH SEMESTER (UNIVERSITY ELECTIVE)

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	-	02/01	-	30/15	2
Marks	-	100	-	100	

Pre-requisite courses:

- Ethical Leadership through Giving Voice to Values
<https://www.coursera.org/learn/uva-darden-giving-voice-to-values?skipBrowseRedirect=true>

A. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to Values and Ethics	05
2.	Elements and Principles of Values	08
3.	Applied Ethics	08
4.	Value, Ethics & Global Issues	05
5.	Contemporary Issues in Values and Ethics	04

Total hours (Theory): --

Total hours (Practical): 30

Total hours (Lab) : --

Total hours : 30

B. Detailed Syllabus:

- | | | |
|--|---------|-----|
| 1. Introduction to Values and Ethics | 5 Hours | 17% |
| Need, Relevance and Significance of Values General, Concept and Meaning of Values and Ethics | | |
| 2. Elements and Principles of Values | 8 Hours | 26% |
| Universal & Personal Values, Social, Civic & Democratic Value | | |

- | | | | |
|----|--|---------|-----|
| 3. | Applied Ethics
Universal Code of Ethics, Professional Ethics, Organizational Ethics, Ethical Leadership, Domain Specific Ethics | 8 Hours | 26% |
| 4. | Value, Ethics & Global Issues
Cross-Cultural Issues, Role of Ethics & Values in Sustainability | 5 Hours | 17% |
| 5. | Contemporary Issues in Values and Ethics
Case Studies, Presentations, Projects | 4 Hours | 14% |

C. Course Outcome :

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

- CO1 Understand the concepts and mechanics of values and ethics.
- CO2 Understand the significance of value and ethical inputs in and get motivated to apply them in their life and profession.
- CO3 Understand the significance of value and ethical inputs in and get motivated to apply them in social, global and civic issues.
- CO4 Develop their responsibility towards society.
- CO5 Comprehend their own core values and adhere to those values at their workplace.
- CO6 Practice Ethical Leadership.

Course Articulation Matrix:

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

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

D. Recommended Study Material:

❖ Reference book:

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 material:

- www.ethics.org

MA249: NUMERICAL METHODS
B TECH 4TH SEMESTER (CL/ME)

Credit and Hours:

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

A. Outline of the Course:

Sr. No	Title of Unit	Minimum number of Hours
1	Errors	05
2	Approximate solutions of nonlinear equations and system of linear equations	08
3	Interpolation	12
4	Numerical Integration and Differentiation	08
5	Numerical Solution of Ordinary and Partial Differential equations	12

Total Hours (Theory): 45

Total Hours (Lab): 30

Total Hours: 75

B. Detailed Syllabus:

1	Errors	05 Hours	(12%)
1.1	Exact and Approximate Numbers and Significant figures		
1.2	Rules of Rounding of numbers, Correct digit		
1.3	Types of errors: Absolute, Relative and Percentage		
1.4	Rounding error, Inherent error and Truncation error		
1.5	Propagation of errors		
2	Approximate solutions of nonlinear equations and System of linear equations	08 Hours	(18%)
2.1	Bisection method, Method of False position, Method of Iteration.		

2.2	Newton-Raphson method for single variable and their convergenc		
2.3	Gauss Jordan method		
2.4	Gauss Seidel method and Gauss Jacobi method		
3	Interpolation	12 Hours	(26%)
3.1	Finite differences and associated operators		
3.2	Newton's Interpolation formulas		
3.3	Lagrange interpolation, Hermite interpolation		
3.4	Error estimates of these formulae		
3.5	Piecewise Interpolation : Linear Spline, Cubic Spline		
4	Numerical Integration and Differentiation	08 Hours	(18%)
4.1	Newton-Cotes Quadrature formula		
4.2	Trapezoidal rule with error		
4.3	Simpson's 1/3 rule and Simpson's 3/8 rule with respective errors		
4.4	Romberg Integration and Gaussian Quadrature		
4.5	Numerical Differentiation		
5	Numerical Solution of Ordinary and Partial Differential Equations	12 Hours	(26%)
5.1	Overview of ordinary differential equations and partial differential equations		
5.2	Euler method and Modified Euler method		
5.3	Runge -Kutta 2 nd and 4 th order methods		
5.4	Finite difference approximations to derivatives		
5.5	Solution of Laplace Equation by Gauss Jacobi and Gauss Seidel Method		
5.6	Solution of Heat Equation in One dimension		
5.7	Solution of Wave Equation in One dimension		

C. Course Outcome:

After learning the course, students will able to

- CO1 Employ the knowledge of various types of numerical methods to Engineering and real world problems.
- CO2 Determine approximate solution of non-linear equations and system of linear equations and examine the error using numerical methods.
- CO3 Use numerical techniques for differentiation and definite integration.
- CO4 Interpolate or extrapolate approximate value of dependent variable for any value of independent variable, employing only finitely many tabulated values.
- CO5 Interpret the solution of ordinary and partial differential equation numerically.
- CO6 Construct the algorithm and perform the various commands in programming language.

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	1	2	-	-	-	-	-	-	-	1	1	1	1
CO2	3	3	1	2	-	-	-	-	-	-	-	-	1	1	1
CO3	3	3	1	2	-	-	-	-	-	-	-	-	1	1	1
CO4	3	3	1	2	-	-	-	-	-	-	-	-	1	1	1
CO5	3	3	1	2	-	-	-	-	-	-	-	-	1	1	1
CO6	2	3	-	2	1	-	-	-	-	-	-	1	1	2	1

- Correlation levels 1, 2 or 3 as defined below:
- 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

D. Recommended Study Material:

Text Books:

1. S. S. Sastry;, Introductory methods of numerical analysis. PHI Learning Pvt. Ltd.,2012.
2. Steven C. Chapra and Raymond P. Canale; Numerical methods for engineers. Vol. 2. New York: McGraw-Hill, 2012.

Reference Books:

1. S. Grewal and J. S. Grewal; Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB. Khanna, 2014.
2. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., "Numerical Methods for Scientific and
3. Engineering Computation", New Age Pvt. Pub, New Delhi, 2000
4. K. E. Atkinson, Introduction to Numerical Analysis, 2nd Edn, John Wiley, 1989

Web Materials:

1. <http://numericalmethods.eng.usf.edu>
2. <http://mathworld.wolfram.com/>
3. <http://nptel.ac.in>

B. Tech. (Civil Engineering) Programme

ANNEXURE II - UNIVERSITY ELECTIVE SYLLABI

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY