HERITAGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution affiliated to MAKAUT, West Bengal)

DEPARTMENT
OF
CIVIL ENGINEERING

B.TECH. PROGRAMME

Curriculum and Detailed Syllabus

Release Version 1: JULY 2023

Release Version 2: June 2024

(Applicable from 2023 admitted batch)

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Preamble

The curriculum for the B. Tech. in Civil Engineering program has been modified as per the guidelines of AICTE and MAKAUT, and considering the new education policy (NEP) under Academic Regulation 2022 from the academic session 2023 - 2024. In addition, this outcome-based curriculum (OBC) is created with a choice-based credit system (CBCS), which enables students to develop professional competency through a multidisciplinary approach that satisfies the requirements of industry, academics and the different Accreditation bodies like NBA and NAAC. Courses such as Repair and Rehabilitation of Structures, Sustainable Construction Method, Design Thinking and Idea Lab etc. are included in the syllabus keeping in mind the industry demand, as well as the suggestions given by the NBA experts in the very recent visit. Basic mathematical and other computer application courses are included to strengthen the aptitude of students that enables them to learn latest developments in Civil Engineering and be more innovative in application of the same. Moreover students are being motivated to select and study MOOC subjects of their choice towards attaining the degree with honors. Apart from this, the course code is now changed from 4 letters to 3 letters from the session 2023 – 2024 as per the suggestions came from the office of the controller of examinations. This will help to distinguish the new courses from the old ones. In accordance with this, the curriculum and syllabi are revised in a structured manner by implementing Feedback Mechanism on Curriculum from various stakeholders, including potential employers, alumni, and parents.

Institutional Vision & Mission

VISION:

To prepare dynamic and caring citizens to meet the challenges of global society while retaining their traditional values.

MISSION:

- To prepare students with strong foundation in their disciplines and other areas of learning.
- To provide an environment for critical and innovative thinking, and to encourage life-long learning.
- To develop entrepreneurial and professional skills.
- To promote research and developmental activities and interaction with industry.
- To inculcate leadership qualities for serving the society.

Departmental Vision & Mission

VISION:

Developing motivated, skilled and highly competent Civil Engineers to excel in education, research, entrepreneurship and technological services, so that the department as well as the institute will be recognized high in a global scenario.

MISSION:

M1: To empower the students with broad and in-depth knowledge in Civil Engineering fundamentals and their applications in practical as well as professional fields to meet socio-economic challenges.

M2: To educate the students in the latest technologies in Civil Engineering, imbibe in them human values, self-confidence, team work and independent thinking in solving diverse problems in the related field so that they can serve the society.

M3: To achieve international recognition by developing professional Civil Engineers, offering continuing education and interacting with industries by emphasizing research and development.

Program Educational Objectives (PEOs) of B.Tech. in Civil Engineering Programme

The graduate students with the B.Tech. degree in Civil Engineering from Heritage Institute of Technology, Kolkata are expected to achieve the following qualities after a few years of getting this degree.

PEO1. Academic Competence: Graduates will be able to apply the knowledge of mathematics, science and engineering for problem investigation, analysis and design/development of solutions.

PEO2. Application Ability and Multi-disciplinary Proficiency: Graduates will be able to use appropriate techniques, resources, and modern engineering tools to accomplish Civil engineering applications as per the societal requirements considering ethics and environmental sustainability.

PEO3. Professional Communication and Leadership Skills: Graduates will be able perform to their best both individually and in team, by applying their leadership and communication skills involving themselves in lifelong learning.

Program Outcomes (POs)

Engineering Graduates will be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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.

PO3: 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.

PO4: 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.

PO5: 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.

PO6: 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.

PO7: 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.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: 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.

Program Specific Outcomes (PSOs) of
B.Tech. in Civil Engineering Programme

PSO1. Civil Engineering knowledge and resource utilization: Students should be able to apply the knowledge of Civil engineering and modern tools to analyze and solve engineering problems and projects with optimal utilization of resources.

PSO2. Industrial interaction: Students should be able to acquire the knowledge of project management as a member and leader in a team with the development of their communication and presentation skills.

PSO3. Societal awareness: Students should be able to understand the impact of engineering solutions considering ethical principles in societal and environmental context with the recognition for the need of lifelong learning.

Credit Summary for B. Tech. programme in Civil Engineering

with effect from 2023-2024

Sl. No.	Course Type	Credit CE
1.	Humanities and Social Sciences including Management Courses	12
2.	Basic Science Courses	20
3.	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	25
4.	Professional Core Courses	63
5.	Professional Elective Courses relevant to chosen Specialization / Branch	15
6.	Open Subjects – Electives from other Technical and/or Emerging Subjects	12
7.	Project Work, Seminar and Internship in industry or elsewhere (Comprehensive Viva-voce)	18
8.	Mandatory Courses (Non-credit) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	0
	Total	**165**
9	Honours Courses (MOOCs or otherwise)	20
	Grand Total	**185**

Definition of Credit (as per National Credit Framework 2022):
- Total notional learning hours = 1200 Hours/ Year
- Minimum credits to be earned = 40/ Year
- 1 Credit = 30 notional learning hours

Range of Credits (as per AICTE):
- ➢ A student will be eligible to get B. Tech. degree with Honours if he/she completes an additional 20 credit points.
- ➢ These could be acquired through MOOCs. For details kindly refer to APPENDIX – A.
- ➢ A student will be eligible to get B. Tech. degree certificate, if he/ she acquires 100 MAR points in 4 years of their study.
- ➢ Lateral entry students must acquire 75 MAR points in their 3 years of study.
- ➢ For details kindly refer to APPENDIX – B.

Curriculum

1st Year 1st Semester

A. Theory

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CHM1001	Chemistry I	3	0	0	3	3
2	MTH1101	Mathematics I	3	1	0	4	4
3	CSE1001	Programming for Problem Solving	4	0	0	4	4
4	ELE1001	Basic Electrical Engineering	3	1	0	4	4
5	HUM1001	English for Technical Writing	2	0	0	2	2
		Total Theory	**15**	**2**	**0**	**17**	**17**

B. Practical

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CHM1051	Chemistry I Laboratory	0	0	2	2	1
2	CSE1051	Programming for Problem Solving Laboratory	0	0	3	3	1.5
3	ELE1051	Basic Electrical Engineering Laboratory	0	0	2	2	1
4	HUM1051	English for Technical Writing Laboratory	0	0	2	2	1
		Total Practical	**0**	**0**	**9**	**9**	**4.5**
		Total of Semester	**15**	**2**	**9**	**26**	**21.5**

1st Year 2nd Semester

			Contacts Periods/ Week				Credit Points
A. Theory							
Sl.	**Code**	**Subject**	**L**	**T**	**P**	**Total**	
1	PHY1001	Physics I	3	0	0	3	3
2	MTH1201	Mathematics II	3	1	0	4	4
3	ECE1001	Introduction to Electronics Devices and Circuits	3	0	0	3	3
4	HUM1002	Universal Human Values and Professional Ethics	3	0	0	3	3
Total Theory			**12**	**1**	**0**	**13**	**13**
B. Practical							
1	PHY1051	Physics I Laboratory	0	0	2	2	1
2	ECE1051	Introduction to Electronics Devices and Circuits Laboratory	0	0	2	2	1
3	MEC1051	Workshop/ Manufacturing Practices	1	0	3	4	2.5
4	MEC1052	Engineering Graphics & Design	1	0	3	4	2.5
Total Practical			**2**	**0**	**10**	**12**	**7**
Total of Semester			**14**	**1**	**10**	**25**	**20**

2nd Year 1st Semester

			Contacts Periods/ Week				Credit Points
A. Theory							
Sl.	**Code**	**Subject**	**L**	**T**	**P**	**Total**	
1	CIV2101	Fundamentals of Strength of Materials	3	0	0	3	3
2	CIV2102	Fluid Mechanics	3	0	0	3	3
3	CIV2103	Construction Materials and Technology	3	0	0	3	3
4	CIV2104	Surveying	3	0	0	3	3
5	CIV2105	Design Thinking	1	0	0	1	1
6	EVS2016	Environmental Sciences	2	0	0	2	0
		Total Theory	**15**	**0**	**0**	**15**	**13**
B. Practical							
1	CIV2151	Strength of Materials Laboratory	0	0	3	3	1.5
2	CIV2152	Fluid Mechanics Laboratory	0	0	2	2	1
3	CIV2156	Engineering Drawing	0	0	3	3	1.5
4	CIV2157	CAD Laboratory	0	0	2	2	1
5	CIV2158	Idea Laboratory	0	0	2	2	0
		Total Practical	**0**	**0**	**12**	**12**	**5**
		Total of Semester	**15**	**0**	**12**	**27**	**18**

2nd Year 2nd Semester

A. Theory

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	MTH2001	Mathematical Methods	4	0	0	4	4
2	CIV2201	Structural Analysis – I	3	0	0	3	3
3	CIV2202	Soil Mechanics	3	0	0	3	3
4	CIV2203	Highway and Traffic Engineering	3	0	0	3	3
5	CIV2204	Concrete Technology	3	0	0	3	3
6	CIV2205	Environmental Engineering	3	0	0	3	3
		Total Theory	18	1	0	**19**	**19**

B. Practical

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CIV2252	Soil Mechanics Laboratory – I	0	0	3	3	1.5
2	CIV2254	Concrete Technology Laboratory	0	0	3	3	1.5
3	CIV2256	Surveying Laboratory	0	0	3	3	1.5
4	CIV2257	Quantity Survey & Estimation Laboratory	0	0	2	2	1
		Total Practical	0	0	11	**11**	**5.5**
		Total of Semester	**18**	**1**	**11**	**30**	**24.5**

3rd Year 1st Semester

			Contacts Periods/ Week				Credit Points
Sl.	**Code**	**Subject**	**L**	**T**	**P**	**Total**	

A. Theory

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CIV3101	Structural Analysis – II	3	0	0	3	3
2	CIV3102	Design of RCC Structures	3	0	0	3	3
3	CIV3103	Foundation Engineering	3	0	0	3	3
4	CSE3106	Data Structure & RDBMS	4	0	0	4	4
5	CIV3131 - CIV3134	Professional Elective-I	3	0	0	3	3
	CIV3131 CIV3132 CIV3133 CIV3134	Air and Noise Pollution Structural Dynamics and Earthquake Engineering Rock Mechanics Offshore Structures					
6	CIV3121 - CIV3122	Open Elective-I	3	0	0	3	3
	CIV3121 CIV3122	Repair & Rehabilitation of Structures Sustainable Construction Methods					
7	INC3016	Indian Constitution and Civil Society	2	0	0	2	0
		Total Theory	21	0	0	21	**19**

B. Practical

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CIV3152	RCC Design and Detailing Laboratory	0	0	3	3	1.5
2	CIV3153	Soil Mechanics Laboratory – II	0	0	3	3	1.5
3	CIV3154	Environmental Engineering Laboratory	0	0	3	3	1.5
4	CSE3156	RDBMS Laboratory	0	0	3	3	1.5
		Total Practical	**0**	**0**	**12**	**12**	**6**
		Total of Semester	**21**	**0**	**12**	**33**	**25**

Open Elective –I (Emerging Field) - to be offered exclusively for the students of Civil Engineering

3rd Year 2nd Semester

A. Theory

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CIV3201	Design of Steel Structures	3	0	0	3	3
2	CIV3203	Water Resources Engineering	3	0	0	3	3
3	HUM3201	Economics for Engineers	3	0	0	3	3
4	CIV3231 – CIV3234	Professional Elective-II	3	0	0	3	3
	CIV3231 CIV3232 CIV3233 CIV3234	Prestressed Concrete Structures Solid and Hazardous Waste Management Advanced Structural Analysis Advanced Foundation Engineering					
5	CIV3241-CIV3244	Professional Elective-III	3	0	0	3	3
	CIV3241 CIV3242 CIV3243 CIV3244	Irrigation Engineering Design of Tall Structures Advanced Highway and Traffic Engineering Environmental Impact Assessment					
6	CIV3221 - CIV3222	Open Elective-II	3	0	0	3	3
	CIV3221 CIV3222	Project Planning and Management Principles of Sustainable Engineering					
		Total Theory	**18**	**0**	**0**	**18**	**18**

B. Practical

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CIV3251	Industrial Structure Design and Detailing Laboratory	0	0	2	2	1
2	CIV3254	Computer-aided Structural Analysis and Design Laboratory	0	0	3	3	1.5
3	CIV3255	Highway Engineering Laboratory	0	0	3	3	1.5
		Total Practical	**0**	**0**	**8**	**8**	**4**

C. Sessional

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CIV3293	Term Paper and Seminar	0	0	4	4	2
		Total Sessional	**0**	**0**	**4**	**4**	**2**
		Total of Semester	**18**	**0**	**12**	**30**	**24**

Note: Open Elective-II to be offered for the students of other Departments.

4th Year 1st Semester

A. Theory

Sl.	Code	Subject	L	T	P	Total	Credit Points
			Contacts Periods/ Week				
1	HUM4101	Principles of Management	3	0	0	3	3
2	CIV4101	Project Planning and Management	2	0	0	2	2
3	CIV4131-CIV4135	Professional Elective-IV	3	0	0	3	3
	CIV4131 CIV4132 CIV4133 CIV4134 CIV4135	Airport and Railway Engineering Bridge Engineering Ground Improvement Techniques Soil Dynamics and Machine Foundations Port, Dock and Harbour Engineering					
4	CIV4141-CIV4144	Professional Elective-V	3	0	0	3	3
	CIV4141 CIV4142 CIV4143 CIV4144	Hydraulic Structures Pavement Design Finite Element Analysis Advanced Concrete Technology					
5	CIV4121-CIV4122	Open Elective-III	3	0	0	3	3
	CIV4121 CIV4122	An Introduction to Concrete Technology Construction Materials					
6	*** 4126 - *** 4130	Open Elective-IV	3	0	0	3	3
		Total Theory	**17**	**0**	**0**	**17**	**17**

B. Sessional

Sl.	Code	Subject	L	T	P	Total	Credit Points
1	CIV4191	Industrial Training / Internship	-	-	-	-	2
2	CIV4195	Project-I	0	0	10	10	5
		Total Sessional	**0**	**0**	**10**	**10**	**7**
		Total of Semester	**17**	**0**	**10**	**27**	**24**

Open Elective-III to be offered for the students of other Departments.

4th Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	CIV4295	Project-II	0	0	12	12	6
2	CIV4297	Comprehensive Viva-voce	-	-	-	-	2
Total Sessional			**0**	**0**	**12**	**12**	**8**
Total of Semester			**0**	**0**	**12**	**12**	**8**

DETAILED CURRICULUM

1st Year 1st Semester

Course Title : Chemistry I					
Course Code : CHM1001					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Course outcomes:

The subject code CHM-1001 corresponds to Chemistry Theory classes (Chemistry-1) for the first year B. Tech students, offered as Chemistry for Engineering and is common to all Branches of Engineering Disciplines. The course provides basic knowledge of theory and applications in the subjects like Thermodynamics, Quantum mechanics, Electrochemistry, & Energy conversion, Structure and reactivity of molecules. Spectroscopic techniques and their applications, Synthesis & use of Drug molecules. The Course Outcome for the subject code CHM1001, is furnished below:

CHM1001.1. Knowledge acquisition of bulk properties of materials and understanding of reaction processes using thermodynamic considerations.

CHM1001.2. Conception of energy conversion and its importance in clean energy scenario, the operating   principles for batteries, fuel cells and the materials and reactions involved there in, their applications as sustainable energy devices, particularly in automobiles sectors to reduce environmental pollution.

CHM1001.3. Analytic view of microscopic chemistry in terms of atomic structure, molecular orbital and   intermolecular forces to reinforce strong background on materials science and engineering.

CHM1001.4. Rationalize periodic trends of elements to explain various physico - chemical properties.

CHM1001.5. Understanding of the spectrum of electromagnetic radiation used for exciting different molecular energy levels in various spectroscopic techniques.

CHM1001.6. Knowledge of stereochemistry and conception of the mechanism of major chemical reactions involved in synthesis of drug molecules.

MODULE 1

Thermodynamics

The 1st and 2nd laws of thermodynamics and thermodynamic functions like free energy, work function and entropy; Carnot cycle, Joule-Thomson effect, Gibbs-Helmholtz equation; Chemical Potential, Gibbs- Duhem Equation and Clausius-Clapeyron Equation.

5L

Electrochemical Cell

Generation of electromotive force in electrochemical cells and application of Nernst equation; Electrode potentials and the redox reactions; Cell configuration and half cell reactions; Standard Hydrogen Electrode, Reference electrode, evaluation of   thermodynamic   functions; Electrochemical corrosion.

Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells.

4L

MODULE 2

Molecular Structure

Molecular geometry, Hybridization, Ionic, dipolar and van Der Waals interactions; Molecular Orbital Theory and its application in diatomic molecule; Pi-molecular orbital of unsaturated

system; Band structure of solids, intrinsic and extrinsic semiconductors and the role of doping on band structures.
5L

Periodic Properties

Effective nuclear charge, penetration of orbitals; variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes; ionization energies, electron affinity and electro-negativity, polarizability, oxidation states, coordination numbers and geometries; hard-soft acid base theory.
4L

MODULE 3

Atomic structure and Wave Mechanics

Brief outline of the atomic structure, wave particle duality, Heisenberg uncertainty principle; Introduction to quantum mechanics, Schrodinger wave equation for particle in one dimensional box.
5L

Spectroscopic Techniques & Applications

Electromagnetic spectrum: Interaction of EMR with matter; Principle and applications of Fluorescence & Phosphorescence, UV-Visible, Infrared and NMR spectroscopy.
4L

MODULE 4

Stereochemistry

Representations of 3- dimensional structures, structural isomers and stereo-isomers; configurations, symmetry and chirality; enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.
5L

Organic reactions and synthesis of drug molecules

Introduction to reaction mechanism: substitution, addition, elimination and oxidation, reduction reactions. Synthesis of commonly used drug molecules.
4L

TEXT BOOKS

1. Atkins' Physical Chemistry, P.W. Atkins (10th Edition)
2. Organic Chemistry, I. L. Finar, Vol-1 (6th Edition)
3. Engineering Chemistry, Jain & Jain, (16th Edition)
4. Fundamental Concepts of Inorganic Chemistry, A. K. Das, (2nd Edition)
5. Engineering Chemistry -I, Gourkrishna Dasmohapatra, (3rd Edition)

REFERENCE BOOKS

1. General & Inorganic Chemistry, R. P. Sarkar
2. Physical Chemistry, P. C. Rakshit, (7th Edition)
3. Organic Chemistry, Morrison & Boyd, (7th Edition)
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4th Edition)
5. Physical Chemistry, G. W. Castellan, (3rd Edition)
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1st Edition)

Course Title : Mathematics I					
Course Code : MTH1101					
Contact hrs. per week :	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**4**

Course outcomes:

After successfully completing this course the students will be able to:

MTH1101.1 Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations.

MTH1101.2 Develop the concept of eigen values and eigen vectors.

MTH1101.3 Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals.

MTH1101.4 Analyze the nature of sequence and infinite series

MTH1101.5 Choose proper method for finding solution of a specific differential equation.

MTH1101.6 Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus

Detailed Syllabus:

Module I: [10L]
Matrix: Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module II: [10L]
Vector Calculus: Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics.

Infinite Series: Convergence of sequence and series; Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test(statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

Module III: [10L]
First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

Module IV: [10L]
Calculus of functions of several variables: Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables.

Multiple Integration: Concept of line integrals, Double and triple integrals. Green's Theorem,

Stoke's Theorem and Gauss Divergence Theorem.

Text Books
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

Reference Books

1. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.

2. Vector Analysis (Schaum's outline series): M. R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)

3. Engineering Mathematics: S. S. Sastry (PHI)

4. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.
5. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)
6. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006
7. S. L. Ross, Differential Equations", Wiley India, 1984.

Course Title : Programming for Problem Solving					
Course Code: CSE1001					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	4	**0**	**0**	**4**	**4**

Course Outcomes:

After completion of the course, students will be able to

CSE1001.1 Remember and understand the functionalities of the different hardware and software components present in a computer system, the standard representations of various types of data in a computer system.

CSE1001.2 Illustrate how a computer system with one way of representation can be converted to one another equivalent representation.

CSE1001.3 Construct flow charts for any arithmetic or logical problems in hand.

CSE1001.4 Remember and understand the C programming development environment, writing, compiling, debugging, linking and executing a C program using that development environment, basic syntax and semantics of C programming language and interpret the outcome of any given C program.

CSE1001.5 Use loop constructs, conditional branching, iteration, recursion to solve simple engineering problems.

CSE1001.6 Apply pointers, arrays, structures, files to formulate simple engineering problems.

Learning Objectives: Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Module I: [12L] Fundamentals of Computer

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler.

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).

Basic concepts of operating systems like MS WINDOWS, LINUX How to write algorithms & draw flow charts.

Module II: [12L] Basic Concepts of C

C Fundamentals:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions:

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control:

Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Module III: [12L] Program Structures in C

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes -

auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables. C preprocessor (macro, header files), command line arguments.

Arrays and Pointers:

One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality.

String and character arrays; C library string functions and their use.

Module IV: [12L] Data Handling in C

User defined data types and files:

Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs(), fseek(), ftell();

Text Books
1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E. Balagurusamy

Reference Books
1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D. M. Ritchie, B.W. Kernighan

Course Title: Basic Electrical Engineering					
Course Code : ELE1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

After attending the course, the students will be able to

ELE1001.1 Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.

ELE1001.2 Analyse DC Machines; Starters and speed control of DC motors.

ELE1001.3 Analyse magnetic circuits.

ELE1001.4 Analyse single and three phase AC circuits.

ELE1001.5 Analyse the operation of single phase transformers.

ELE1001.6 Analyse the operation of three phase induction motors.

Module-I: [11 L]

DC Network Theorem: Kirchhoff's laws, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star-Delta conversion. [6L]

Electromagnetism: Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet. [5L]

Module-II [10L]

AC single phase system: Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit.

Module-III [11L]

Three phase system: Generation of three-phase AC power, Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method. [4L]

DC Machines: Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of DC motor.[7L]

Module-IV [10L]

Transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, Open and Short circuit tests, Efficiency, Introduction to three phase transformer.[6L]

Three-phase induction motor: Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.[4L]

Text Books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition

2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition

3. Basic Electrical Engineering, Hughes

4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication

5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall

2. Advance Electrical Technology, H.Cotton, Reem Publication

3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers

4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai

5. Basic Electrical Engineering, Nath & Chakraborti

6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

Course Title : English for Technical Writing					
Course Code : HUM1001					
Contact Hours per week	L	T	P	Total	Credit Points
	2	0	0	2	2

Course Outcome:

Students will be able to

HUM1001.1 Communicate effectively in an official and formal environment
HUM1001.2 Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment
HUM1001.3 Use various techniques of communication for multiple requirements of globalized workplaces
HUM1001.4 Learn to articulate opinions and views with clarity.

HUM1001.5 Write business letters and reports.

HUM1001.6 Apply various communication strategies to achieve specific communication goals.

Module - I (6hrs.)

Introduction to Phonology and Morphology

- Phonetics- Vowel and Consonant Sounds (Identification & Articulation)
- Word- stress, stress in connected speech
- Intonation (Falling and Rising Tone)
- Vocabulary Building-The concept of Word Formation

Module - II (6hrs.)

Communication Skills

- The Basics of Business Communication- Process, types, levels
- Barriers to Communication Common obstacles to effective communication
- Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections
- Identify common audiences and design techniques for communicating with each audience

Module - III (6hrs.)

Organizational Communication

- Business Letters
- Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular
- Organizing e-mail messages, E-mail etiquette
- Techniques for writing precisely: Creating coherence, organizing principles –accuracy, clarity, brevity. Different styles of writing: descriptive, narrative, expository.

Module - IV (6hrs.)

Principles, techniques and skills for professional writing

- Logic in writing, thinking and problem-solving; applying deductive and inductive reasoning; Use of infographics in writing.

- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies. Interpreting data and writing reports
- Writing proposals and Statement of purpose

Text Books:
1 Kumar,S. &Lata, P. Communication Skills, OUP, New Delhi2011
2 Rizvi,Ashraf,M. Effective Technical Communication, Mc Graw Hill Education(India) Pvt. Ltd..Chennai,2018
3 Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

Reference Books:

1. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
2. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational   Series.

Subject Name: Chemistry I Laboratory					
Subject Code: CHM1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course outcome:

The subject code CHM1051 corresponds to chemistry laboratory classes for the first year B. Tech students. This course enhances the students' experience regarding handling of various chemicals along with various laboratory equipments. Hands on experiments increase the depth of knowledge that is taught in the theory classes as well as it increases research aptitude in students because they can see the direct application of theoretical knowledge in practical field. The course outcomes of the subject are

CHM1051.1 Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.

CHM1051.2 Estimation of ions like Fe^{2+}, Cu^{2+} and Cl^- present in water sample to know the composition of industrial water.

CHM1051.3 Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.

CHM1051.4 Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.

CHM1051.5 Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.

CHM1051.6 Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

Experiments

1. Estimation of iron using $KMnO_4$ self-indicator.
2. Iodometric estimation of Cu^{2+}.
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentiometric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethyl acetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).
10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.
11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.

12. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

Reference Books

1. Vogel's Textbook of Quantitative Chemical Analysis-G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney.
2. Advanced Practical Chemistry- S. C. Das
3. Practicals in Physical Chemistry- P. S. Sindhu

Course Title : Programming for Problem Solving Laboratory					
Course Code : CSE1051					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

After completion of this course the students should be able to:

CSE1051.1 Write simple programs relating to arithmetic and logical problems.

CSE1051.2 Interpret, understand and debug syntax errors reported by the compiler.

CSE1051.3 Implement conditional branching, iteration (loops) and recursion.

CSE1051.4 Decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.

CSE1051.5 Use arrays, pointers and structures effectively in writing programs.

CSE1051.6 Create, read from and write into simple text files.

Software to be used: GNU C Compiler (GCC) with LINUX NB: Cygwin (Windows based) may be used in place of LINUX

Topic 1: LINUX commands and LINUX based editors

Topic 2: Basic Problem Solving

Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)

Topic 4: Loops - Part I (for, while, do-while)

Topic 5: Loops - Part II

Topic 6: One Dimensional Array

Topic 7: Array of Arrays

Topic 8: Character Arrays/ Strings Topic

Topic 9: Basics of C Functions

Topic 10: Recursive Functions

Topic 11: Pointers

Topic 12: Structures

Topic 13: File Handling

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Course Title : Basic Electrical Engineering Laboratory					
Course Code : ELE1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes: The students are expected to

ELE1051.1 Get an exposure to common electrical apparatus and their ratings.

ELE1051.2 Make electrical connections by wires of appropriate ratings.

ELE1051.3 Understand the application of common electrical measuring instruments.

ELE1051.4 Understand the basic characteristics of different electrical machines.

List of Experiments:

1. Characteristics of Fluorescent lamps

2. Characteristics of Tungsten and Carbon filament lamps

3. Verification of Thevenin's & Norton's theorem.

4. Verification of Superposition theorem

5. Verification of Maximum Power Transfer theorem

6. Calibration of ammeter and voltmeter.

7. Open circuit and Short circuit test of a single phase Transformer.

8. Study of R-L-C Series / Parallel circuit

9. Starting and reversing of speed of a D.C. shunt Motor

10. Speed control of DC shunt motor.

11. No load characteristics of D.C shunt Generators

12. Measurement of power in a three phase circuit by two wattmeter method.

Course Title : English for Technical Writing Laboratory					
Course Code : HUM1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Course Outcome: Students will be able to

HUM1051.1 Communicate in an official and formal environment.

HUM1051.2 Effectively communicate in a group and engage in relevant discussion.

HUM1051.3 Engage in research and prepare presentations on selected topics.

HUM1051.4 Understand the dynamics of multicultural circumstances at workplace and act accordingly.

HUM1051.5 Organize content in an attempt to prepare official documents.

HUM1051.6 Appreciate the use of language to create beautiful expressions

Detailed Syllabus

Module- I (6hrs.)

The Art of Speaking

- Techniques for Effective Speaking
- Voice Modulation: Developing correct tone
- Using correct stress patterns: word stress, primary stress, secondary stress. Rhythm in connected speech
- Encoding Meaning Using Nonverbal Symbols,
- How to Improve Body Language
- Eye Communication, Facial Expression, Dress and Appearance
- Posture and Movement, Gesture, Paralanguage
- Encoding meaning using Verbal symbols: How words work and how to use words
- Volume, Pace, Pitch and Pause
- Structuring content for delivery in accordance with time, platform, and audience.

Module- II (6hrs)

Group Discussion

- Nature and purpose and characteristics of a successful Group Discussion
- Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion along, promoting optimal participation, Handling conflict, Effecting closure

Module- III (6hrs)

- Interviewing
  Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.
- Cover Letter & CV
- Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

Module- IV (6hrs.)

Professional Presentation Skills

- Nature and Importance of Presentation skills
- Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title.
- Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides
- Organizing the Presentation: Introduction-Getting audience attention, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion-summaries, re-emphasize, focus on the purpose, and provide closure.
- Improving Delivery: Choosing Delivery methods, handling stage fright
- Post-Presentation discussion: Handling Questions-opportunities and challenges.

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
4. R. Anand, Job Readiness For IT & ITES- A Placement and Career Companion, , McGraw Hill Education.2015
5. Malhotra, A., Campus Placements, McGraw Hill Education.2015

DETAILED CURRICULUM

1st Year 2nd Semester

Course Name: Physics I					
Course Code: PHY1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

After successfully completing this course the students will be able to:

PHY1001.1. Understanding physical systems in terms of their modelling of time evolution.
PHY1001.2. Comprehending wave interpretation of natural phenomena and implications of allied observations.
PHY1001.3. Understanding theoretical backgrounds associated to some experiments based on wave phenomena.
PHY1001.4. Grasping an analytic view of micro and macroscopic world.
Accessing the knowledge of the behaviour of a particle under the influence of different potential.
PHY1001.5. Understanding conservative systems based on their particle and wave nature.

Module I : 10L

Mechanics

Plane - polar coordinate system -velocity and acceleration of a particle- trajectory under central force- conservation principle - Kepler's laws - Rotating frame of reference - Five point acceleration formula- Coriolis effect - deflection of a moving particle.

Module II: 10L

Oscillatory Motion:

Constitutive equation of damping- nature of solutions for large, critical and weak damping-relaxation time, logarithmic decrement, energy decay (qualitative discussion) - Forced oscillation-transient and steady state -amplitude and velocity resonance---power transfer theorem- quality factor- series LCR circuit with AC source.

Module III: 10L
Optics:

Plane Progressive Wave - phase/wave-length/frequency - qualitative description of light as an electromagnetic wave - Huygens principle - polarization (state of polarization, general equation of ellipse, transformation of polarized lights) - interference (basic theory from superposition principle)-Division of wave front (Young's double slit experiment) - Division of amplitude (thin film, wedge, Newton's ring) - Diffraction (single slit, double slit, grating, Resolving Power).

Module – IV: 10L
Quantum Mechanics   :

An informal discussion from Planck to de Broglie as the historical context of quantum mechanics - Quantum Mechanics of a particle - operator- eigenvalue problem- Unitary-Hermitian frame work-position and momentum operator-Canonical Commutation Relations (CCR)- Schrodinger equation - time dependent/time independent Schrodinger equation- wave function- stationary states-probability density - probability current density- normalization- expectation value- uncertainty-Bound state problem-particle in a one dimensional box- scattering state problem-potential step-reflection and transmission coefficients- tunnelling.

BOOKS

1. Theoretical Mechanics : M R Spiegel (Schaum Series) McGrow-Hill Book Company
2. Classical Mechanics : N C Rana and P S Joag Tata- McGrow-Hill Publishing Company Limited.
3. Vibrations and Waves : A P French, W W Norton and Company,
4. The Physics of Waves and Oscillations : N K Bajaj, Tata- McGrow-Hill Publishing Company Limited.
5. Optics : A Ghatak, Tata McGraw-Hill Publishing Company Limited.
6. Optics : E. Hecht, Addison Wesley
7. Fundamentals of Optics : F A Jenkins and H E White, McGrow-Hill Higher Education.
8. Atomic Physics (Modern Physics): S N Ghosal, S. Chand and Company.
9. Practical Quantum Mechanics : S Flugge, Springer (Reprint of the 1994 Edition)
10. Concepts of Modern Physics : A Baiser, Tata McGraw-Hill Publishing Company Limited.
11. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – C.L.Arora.

Paper Name: MATHEMATICS II					
Paper Code: MTH1201					
Contact hours per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Course Outcomes:

After successfully completing this course the students will be able to:

MTH1201. 1 Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.

MTH1201. 2 Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.

MTH1201. 3 Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.

MTH1201. 4 Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms.

MTH1201. 5 Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.

MTH1201. 6 Interpret differential equations and reduce them to mere algebraic equations using Laplace Transform to solve easily.

Detailed Syllabus:

Module I: [10L]

Basic Probability: Random experiment, Sample space and events, Classical and Axiomatic definition of probability, Addition and Multiplication law of probability, Conditional probability, Bayes' Theorem, Random variables, General discussion on discrete and continuous distributions, Expectation and Variance, Examples of special distribution: Binomial and Normal Distribution.

Module II: [10L]

Basic Numerical Methods: Solution of non-linear algebraic and transcendental equations: Bisection Method, Newton-Raphson Method, Regula-Falsi Method. Solution of linear system of equations: Gauss Elimination Method, Gauss-Seidel Method, LU Factorization Method, Matrix Inversion Method. Solution of Ordinary differential equations: Euler's Method, Modified Euler's Method, Runge-Kutta Method of 4th order.

Module III: [10L]

Basic Graph Theory: Graph, Digraph, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub-graph, Walk, Path, Circuit, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph, Dijkstra's Algorithm for shortest path problem. Definition and properties of a Tree, Binary tree and its properties, Spanning tree of a graph, Minimal spanning tree, Determination of spanning trees using BFS and DFS algorithms, Determination of minimal spanning tree using Kruskal's and Prim's algorithms.

Module IV: [10L]

Laplace Transformation: Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. Introduction to integral transformation, Functions of exponential order, Definition and existence of Laplace Transform(LT) (statement of initial and final value theorem only), LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT, LT of periodic and step functions, Definition and properties of inverse LT, Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT

Text Books
1. Advanced Engineering Mathematics, E.Kreyszig, Wiley Publications
2. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning
3. Introduction to Graph Theory, D. B. West, Prentice-Hall of India

Reference Books
1. Introduction to Probability and Statistics for Engineers and Scientists, S. Ross, Elsevier
2. Engineering Mathematics, B.S. Grewal, S. Chand & Co.

Course Title : Introduction to Electronics Devices & Circuits					
Course Code : ECE1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

After going through this course, the students will be able to:

ECE1001.1 Categorize different semiconductor materials based on their energy bands and analyze the change in characteristics of those materials due to different types of doping.

ECE1001.2 Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode.

ECE1001.3 Design different application specific circuits using diodes.

ECE1001.4 Analyze various biasing configurations of Bipolar Junction Transistor.

ECE1001.5 Categorize different field-effect transistors and analyze their behavior.

ECE1001.6 Design and implement various practical electronic circuits.

Module I [10 L]
Basic Semiconductor Physics:
Crystalline materials, energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi energy level, intrinsic and extrinsic semiconductors, mass action law, drift and diffusion currents in semiconductor, Einstein relation.
Diodes and Diode Circuits:
Formation of p-n junction, energy band diagram, forward & reverse biased configurations, V-I characteristics,
DC load line, breakdown mechanisms - Zener and avalanche breakdown, voltage regulation using Zener diode.
Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency, rectifier output without and with filters. Light emitting diode.

Module II [8 L]
Bipolar Junction Transistors (BJT):
PNP & NPN BJT structures, different operating modes of BJT, current components in BJT, dc current gains in CE & CB configurations and their interrelation, input & output V-I characteristics of CE & CB configurations. Concept of Biasing: DC load line, Q-point, basic concept of amplification using BJT.

Module III [9 L]
Field Effect Transistors (FET):
Classification of FET, basic structure and operation of Junction Field Effect Transistor (n-channel) along with its V-I characteristics.
Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Enhancement & depletion type MOSFETs (forboth n & p channel devices), drain & transfer characteristics.

Module IV [9 L]

Feedback in amplifiers:

Concept of feedback, different feedback topologies using block diagram only, effects of negative feedback

(qualitative), Barkhausen criteria for sustained oscillation.

Operational Amplifier:

Usefulness of differential amplifier over single ended amplifier, ideal OPAMP characteristics, transfer characteristics of OPAMP, CMRR, slew rate,offset error voltages and current, concept of virtual ground.

Basic circuits using OPAMP:Comparator, inverting and non-inverting amplifiers, voltage follower, adder, subtractor, integrator, differentiator.

References:

1. Boylestad & Nashelsky:Electronic Devices & Circuit Theory

2. R.A Gayakwad:Op Amps and Linear IC's, PHI

3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications

4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering

5. Millman & Halkias: Integrated Electronics.

6. Salivahanan: Electronics Devices & Circuits.

7. Albert Paul Malvino: Electronic Principle.

Course Title : Universal Human Values and Professional Ethics					
Course Code : HUM1002					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

Students will be able to

HUM1002.1 Appreciate the essential complementarily between 'values and 'skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
HUM1002.2 Develop a Holistic perspective towards life and profession
HUM1002.3 Develop a correct understanding of the Human reality and the rest of existence
HUM1002.4 Appreciate the relationship of values in terms of ethical human conduct.
HUM1002.5 Understand the importance of trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
HUM1002.6 Differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them.

Detailed Syllabus

Module 1 – Introduction to Value Education (6hrs.)

Understanding Values: Historical perspective to the development of values and its importance for the integration and harmony of the self and body
Understanding Human being as the Co-existence of the Self and the Body
Exploring Harmony of Self with the Body
Distinguishing between the Needs of the Self and the Body
Understanding and appreciating basic human aspirations-Maslow's Hierarchy of Needs Theory
Strategies, Methods to Fulfil the Basic Human Aspirations
Continuous Happiness and Prosperity – the Basic Human Aspirations

Module 2 – Harmony in the Family and Society (10hrs.)

The self as a social being starting with the family as the smallest unit—the process of socialization.
Development of the self in relation to the society – Cooley's and Mead's theories of socialization.
Self and Integrated personality-Morality, Courage and Integrity
Conflict of interest at home and society and its resolution through the implementation of the Human Values
Societal Values – Justice, Democracy and Rule of law
Establishing harmony in the society with the help of ethical conduct based on values- Ethics of Rights and Duties, Ethics of care, Ethics justice and Fairness, Work Ethics and quality of life at work.
Value crisis- disharmony in relationships, understanding harmony in the society
Solutions - contribution of the individual in establishing harmony in the society.
'Trust' and 'Respect'--the Foundational Values in Relationship
Exploring the Feeling of Trust and Respect

Module 3 – Implications of the Holistic Understanding – a Look at Professional Ethics (10hrs.)

Ethics and Ethical Values
Principles and theories of ethics--Consequential and non-consequential ethics, Utilitarianism, Kant's theory and other non-consequential perspectives

Professional Ethics- Right understanding of Professional Ethics

Canons of professional Ethics

Technology – various perspectives - its use, overuse and misuse

Privacy, data security and data protection, Artificial intelligence-harmony or disharmony, misinformation, deep fake, cyber-crime - a sociological perspective.

Code of Ethics, Violation of code of ethics, Whistle blowing, Institutionalising Ethics

Vision for the Universal Human Order, Exploring Systems to fulfil Human Endeavours

Module 4 – Harmony in the Nature/Existence (10hrs.)

Understanding Harmony in the Nature -Ecological Ethics

Sustainable development- Definition and Concept

Strategies for sustainable development- Small is beautiful, Slow is Beautiful Sustainable Development- The Modern Trends

Sustainable Development Goals- Case studies and Best practices

Exploring the Four Orders of Nature -Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

The Holistic Perception of Harmony in Existence

Suggested Readings:

1. A Foundation Course in Human Values and Professional Ethics, R.R. Gaur, R. Asthana, G.P. Bagaria, Excel Books Pvt. Ltd. New Delhi
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumache
6. Slow is Beautiful - Cecile Andrews

Course Name: Physics I Laboratory					
Course Code: PHY1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes:

After successfully completing this course the students will be able to:

PHY1051.1 Applying practical knowledge using the experimental methods to correlate with the Physics theory.

PHY1051.2 Understanding the usage of electrical and optical systems for various measurements.

PHY1051.3 Applying the analytical techniques and graphical analysis to the experimental data.

PHY1051.4 Understanding measurement technology, usage of new instruments and real time applications in engineering studies.

PHY1051.5 Evaluating intellectual communication skills and discuss the basic principles of scientific concepts in a   group.

MINIMUM OF SIX EXPERIMENTS TAKING AT LEAST ONE FROM EACH OF THE FOLLOWING FOUR GROUPS:

Group I: Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of the given laser source by diffraction method

Group II: Electricity & Magnetism experiments

1. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
2. Determination of dielectric constant of a given dielectric material.
3. Determination of Hall coefficient of a semiconductor by four probe method.
4. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
5. Determination of Magnetic Field Measurement for a current carrying coil.
6. Determination of unknown resistance using Carey Foster's bridge

Group III: Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.

Course Title : Introduction to Electronics Devices & Circuits Laboratory					
Course Code : ECE1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcomes:

ECE1051.1. The students will correlate theory with diode behavior.

ECE1051.2. They will design and check rectifier operation with regulation etc.

ECE1051.3. Students will design different modes with BJT and FET and check the operations.

ECE1051.4. They will design and study adder, integrator etc. with OP-AMPs.

List of Experiments

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-metersetc.

2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.

3. Study of I-V characteristics of Junction diodes.

4. Study of I-V characteristics of Zener diodes.

5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.

6. Study of I-V characteristics of BJTs in CB mode

7. Study of I-V characteristics of BJTs in CE mode

8. Study of I-V characteristics of Field Effect Transistors.

9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.

10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.

11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

Course Name: Workshop /Manufacturing Practices					
Course Code: MEC1051					
Contact Hours per week	L	T	P	Total	Credit Points
	1	0	3	4	2.5

Course Outcomes:

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

MEC1051.1. Follow the various safety practices in workshop and personal protective elements.

MEC1051.2. Identify tools, work material and measuring instruments useful for fitting, carpentry and sheet metal practices.

MEC1051.3. Operate machine tools, components and processes to prepare jobs of specific shape and size.

MEC1051.4. Acquire knowledge of foundry process and casting of a product.

MEC1051.5. Perform welding, brazing and soldering processes.

MEC1051.6. Assemble a simple product.

Syllabus:

(i) Lectures: (13 hours)
Detailed contents
1. Introduction on Workshop   and familiarization with safety norms   **(1 lecture)**
2. Carpentry and Fitting   **(2 lectures)**
3. Sheet metal   **(1 lecture)**
4. Metal casting   **(1 lecture)**
5. Welding (arc welding & gas welding), brazing and soldering   **(2 lectures)**
6. Manufacturing Methods- machining (Lathe, Shaping and Milling)   **(4 lectures)**
7. Additive manufacturing   **(1 lecture)**
8**.** Assembling of a product   **(1   lecture)**

 (ii) Workshop Practice: (39 hours)
1. Safety practices in workshop   **(3 hours)**
2. Carpentry shop   **(3 hours)**
3. Fitting shop   **(6 hours)**
4. Foundry shop   **(3 hours)**
5. Machine shop   **(9 hours)**
6. Welding shop-Arc welding   **(3 hours)**
7. Sheet metal shop and brazing   **(6 hours)**
8. Soldering operation   **(3 hours)**
9**.** Assembling of a product   **(3 hours)**

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements ofWorkshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters andpublishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" PearsonEducation, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice HallIndia, 1998.
5. 5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,2017.

Course Name: Engineering Graphics & Design					
Course Code: MEC1052					
Contact hours per week:	**L**	**T**	**P**	**Total**	**Credit**
	1	**0**	**3**	**4**	**2.5**

Course Outcomes:

After going through the course, the students will be able to

MEC1052.1 Visualize the basic concept of engineering drawing.

MEC1052.2 Use engineering drawing tools (conventional / modern tools).

MEC1052.3 Apply the various standards and symbols followed in engineering drawing.

MEC1052.4 Implement the concept of projections used in engineering graphics.

MEC1052.5 Relate the concept of sections to determine its true shape.

MEC1052.6 Execute the concept of isometric projections.

Lecture Plan (13 L)

1. Importance and principles of engineering drawing   (1 L)
2. Lettering   (1 L)
3. Concepts of Scale, dimensioning and Conic sections   (3 L)
4. Introduction to concept of projection (Projections of points, lines and surfaces)   (3 L)
5. Definitions of different solids and their projections   (1 L)
6. Section of solids and sectional view   (1 L)
7. Isometric projection   (1 L)
8. Introduction to CAD   (1 L)
9. Viva-voce   (1 L)

Detailed contents of Laboratory hours (39 hours)

Module 1: Introduction to Engineering Drawing   **(3 hours)**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic sections like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

Module 2: Orthographic Projections   **(9 hours)**

Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes; Projection of lamina.

Module 3: Projections of Regular Solids   **(6 hours)**

Those axes inclined to both the Planes- Auxiliary Views.

Module 4: Sections and Sectional Views of Right Angular Solids   **(3 hours)**

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Sectional orthographic views of geometrical solids.

Module 5: Isometric Projections   **(6 hours)**

Principles of Isometric projection -Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

Module 6: Overview of Computer Graphics **(3 hours)**

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

Module 7: Customization & CAD Drawing **(3 hours)**

Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Module 8: Annotations, layering & other functions **(3 hours)**

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation.

Module 9: Demonstration of a simple team design project that illustrates **(3 hours)**

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

References:

1. Bhatt, N.D., Panchal V.M. & Ingle P.R., (2014) "Elementary Engineering Drawing"; Charotan Publishing House
2. Narayana, K.L. and Kannaaiah P "Engineering Graphics"; TMH
3. Lakshminarayanan, V. and Vaish Wanar, R.S "Engineering Graphics" Jain Brothers.
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
5. Agarwal B. & Agarwal C. M. (2012), Engineering graphics, TMH Publications.

DETAILED CURRICULUM

2nd Year 1st Semester

Course Name: Fundamentals of Strength of Materials					
Course Code: CIV2101					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2101. 1. Describe the concepts and principles of the equilibrium conditions and force resolutions on rigid bodies, understand the theory of elasticity including strain/displacement and Hooke's law relationships and perform calculations, relative to the strength and stability of structures. [*Understanding* (*LO*)]

CIV2101. 2. Determine the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods. [*Applying* (*IO*)]

CIV2101. 3. Analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle of stresses; locate shear centre of thin walled beams. [*Analyzing* (*IO*)]

CIV2101. 4. Measure the bending moment, shear force and deflection of beams along with developed strain energy under various loads and shear center and shear flow in prismatic sections. [*Evaluating* (*HO*)]

CIV2101. 5. Measure the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under symmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members; Calculate the buckling load of columns using Euler's theory for different support conditions. [*Evaluating* (*HO*)]

CIV2101. 6. After completing this course, the students should be able to relate various types of loads applied on various structural components and understand the nature of deflections, stresses and strains that will develop within the components. [*Applying (IO)*]

Module – I (10 hrs.)

Engineering Mechanics: Concept of different types of applied and reaction forces; Free body concept and diagrams; Equilibrium of three concurrent forces.

Concept of simple stress and strain: Concept of salient points in the stress-strain diagram of ductile and brittle materials, Various elastic constants (E,G, K and μ), Relation between various elastic constants, Composite section, thermal stress-strain.

Centre of gravity: Centre of gravity, centre of mass and centroid, centroid of various systems;

Moment of Inertia: Moment of Inertia of a plane figure; polar moment of inertia of a plane figure, parallel axis theorem

Module – II (12 hrs.)

Principal stress-strain: Introduction to principal stress, principal plane, combined direct and shear stress, Mohr's circle.

Stresses in thin cylindrical and spherical shells: Hoop and meridonial stresses thin cylindrical, conical and spherical shells.

Shear Force and Bending Moment: Introduction to the concept of shear force and bending moment for statically determinate beams subjected to various types of loading: concentrated, uniformly distributed loading, linearly varying loads, relationship between loads, shear force and bending moments.

Module – III (10 hrs.)

Bending of beams: Introduction to bending of beams, elastic flexural formula, Bending and shear stress, Shear centre and shear flow.

Truss Analysis: Introduction to basic concepts of equations of equilibrium for 2-D plane frames and trusses, Analysis of two dimensional truss analysis.

Torsion in circular shafts: Introduction to torsion equation, Torsion in circular solid and hollow shafts.

Module – IV (12 hrs.)

Slope-Deflection- Analysis of slope-deflection in beams using Double Integration method, Moment-Area method and Conjugate-Beam method.

Strain Energy: Introduction to concept of strain energy and complimentary energy, Strain energy due to axial load, bending and shear.

Buckling of columns: Fundamental concepts of buckling of columns, criteria for stability of columns, Euler's column buckling theory with different end conditions, Eccentric load and Secant formula.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	S.P Timoshenko and D.H. Young, '*Elements of Strength of material*', EWP Pvt. Ltd.
2.	E.P. Popov, '*Engineering Mechanics of Solids*', Pearson Education.
3.	S. Ramamrutham and R. Narayanan , 'Strength of Materials', Dhanpat Rai Publishing Company

REFERENCE BOOKS	
Sl. No.	**Name**
1.	R. Subramaniam, '*Strength of Materials*', Oxford University Press.
2.	S.S. Bhavikatti ''*Strength of Materials*', Vikas Publishing House Limited.
3.	I.H. Shames 'Engineering Mechanics', PHI

Web references:

1. https://nptel.ac.in/courses/112107146

2. https://www.youtube.com/@ICE_COMPETITION

Course Name: Fluid Mechanics					
Course Code: CIV2102					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2102. 1. Develop understanding of basic fluid properties (density, viscosity, bulk modulus), flow forces (pressure, shear stress, surface tension) and flow regimes (laminar/turbulent, compressible/incompressible, steady/unsteady). [Understanding (LO)]

CIV2102. 2. Apply Bernoulli's equations on steady and unsteady flow along and normal to a streamline. [Applying (IO)].

CIV2102. 3. Understand and impart the knowledge of conservation of mass and momentum through differential analysis in simple geometries. [Analyzing (IO)]

CIV2102. 4. Apply appropriate equations and principles to analyze pipe flow problems and open channel flow problems. [Evaluating (HO)]

CIV2102. 5. Understand the techniques of dimensional analysis, similitude and modeling and introduce the important non-dimensional groups in fluid mechanics.[Evaluating (HO)]

CIV2102. 6. Illustrate the characteristics of different types of turbines and pumps and application of principles of similarity on hydraulic machines in parallel and series. [Creating (HO)]

Module – I (10 hrs.)

Fluid Statics
Fluid pressure at a point, Variation of pressure within a static fluid, measurement of pressure, total fluid pressure on plane and curved areas, Center of pressure, buoyancy, stability of submerged and floating bodies, meta-centre.

Fundamentals of Open Channel Flow
Scope and importance, characteristics of open channel flow, distinction between pipe flow and open channel, types of flow: Steady, Unsteady; Uniform, Non uniform, Gradually varied flow, Rapidly varied flow (definition only), Numericals.

Steady Uniform Flow in Open Channel
Characteristics, Chezy's, Manning's formula, hydraulically efficient Rectangular and trapezoidal sections. Design features of rigid boundary channels, Numericals.

Module – II (10 hrs.)

Weirs and Notches
Types of weirs and notches, Rectangular, triangular, trapezoidal and Cipolletti notch, Numericals.

Flow through Pipes
Laminar and turbulent flow through pipes, Reynold's number, fluid friction in pipes, head loss due to friction. Darcy- Weisbach equation, Friction factors for commercial pipes, use of Moody's diagram, minor losses in pipes, basic concept of boundary layer, drag, lift, concept of water hammer and surge tank, Numericals.

Module – III (10 hrs.)
Specific Energy / Non-Uniform Flow in Open Channel
Definition, Diagram. Critical, Sub-critical and Supercritical Flows. Establishment of critical flow, Specific force: Definition and diagram, Hydraulic Jump, Numericals.
Dimensional Analysis and Model Studies
Dimensions and dimensional homogeneity, Importance and use of dimensional analysis. Buckingham Pi Theorem: Statement and application, Non Dimensional Numbers, Froude and Reynold model laws and applications, Numericals.
Module – IV (10 hrs.)
Machineries in Fluid Mechanics
Turbines, Classification and types, power and efficiency, Working Principles of Pelton, Francis and Kaplan turbines, draft tube, Cavitations in pumps and turbines, Numericals.
Application of principles of similarity of hydraulic machines, specific speed of pumps and turbines, centrifugal and reciprocating pumps, performance characteristics graph for head, discharge and efficiency, hydraulic machines in parallel and series, hydraulic Ram, Numericals.
RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Bansal R.K., *A textbook of Fluid Mechanics and Hydraulic Machines,* 9th edition, Laxmi Publications (P) Ltd.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Modi P.N. and Seth S.M., '*Hydraulics and Fluid Mechanics including hydraulics machines',* 19th edition, Standard Book House.
2.	Pati S., '*A textbook of Fluid mechanics and Hydraulic machines'*, 1st edition, McGraw Hill Education (India) Pvt Ltd.
3.	Som S.K., Biswas G. and Chakraborty S., '*Introduction to fluid mechanics and fluid machines',* 3rd edition, McGraw Hill Education (India) Pvt Ltd.
4.	Ojha C.S.P., Berndtsson R. and Chandramouli P.N., '*Fluid Machines and Machinery'*, 1st edition, Oxford University Press.
5.	Cengel Y. A. and Cimbala J. M., '*Fluid Mechanics: Fundamentals and Applications'*, 2nd edition, Tata McGraw Hill Education Private Limited.
6.	Pritchard P.J. and Leylegian J.C., *Fox and McDonald's Introduction to Fluid Mechanics,* 8th edition, John Wiley & Sons.

Web references:

1. https://archive.nptel.ac.in/courses/112/105/112105269/
2. https://nptel.ac.in/courses/112104118
3. https://nptel.ac.in/courses/105103192
4. https://onlinecourses.nptel.ac.in/noc22_ce85/preview

Course Name: Construction Materials and Technology					
Course Code: CIV2103					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2103.1. Examine various building and general construction products and their quality, durability and availability; identify relevant construction materials. [Remembering (LO)]

CIV2103. 2. Identify relevant natural construction materials and gain knowledge regarding the various types of properties, uses and variety of materials used in the construction industry. [Remembering (LO)]

CIV2103.3. Categorize various artificial construction materials and study the behavior of concrete at its fresh and hardened state. [Analyzing (IO)]

CIV2103. 4. Classify various components of building structures and propose suitable type of foundations for building structures. [Analyzing (IO)]

CIV2103. 5. Classify suitable type of masonry for various types of building structures.
 [Analyzing (IO)]

CIV2103. 6. After completing this course, the students should be able to relate various types of building materials (natural as well as artificial) with their applications in various construction applications [*Applying (IO)*].

Module – I (10 hrs.)

Natural Construction Materials I

Overview of Construction materials: Construction Material in Building Construction, Transportation Engineering, Environmental Engineering and Irrigation Engineering, Factors affecting selection of materials, Selection of materials based on

Bricks:
Introduction, Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick earth, Testing of bricks, Fly ash brick.
Cement:

Introduction, Chemical Composition of Cement, Hydration of Cement, Types of Portland cement, Tests on Cement and Cement Paste.

Aggregates:

Introduction, Classification of aggregates based on shape, size, texture, origin and density, Mechanical and Physical Properties, Deleterious Substances, Types of sand, Properties of good sand, uses of sand, Alkali-Aggregate Reaction, Testing of Aggregates.

Lime: Introduction, Properties of Lime, Types of Lime.

Module – II (12 hrs.)

Natural Construction Materials II

Timber: Structure of timber, Properties of good timber, Seasoning of Timber- Advantages and Methods, Defects in timber.
Ferrous and non-ferrous metals: Ferrous metals and their uses; Non-ferrous metals and their uses.
Asphalt, bitumen and Tar: Asphalt, Forms of Asphalt, Bitumen and Tar.
Tiles: Tiles, types of flooring tiles.
Plywood and allied products: Veneers and uses, Plywood, particle board, laminated Board.

Module – III (10 hrs.)

Construction Technology-I
Foundations: Function of Foundations, Essential requirement of good foundation, Different types of shallow and deep Foundations.
Brick masonry: Definitions, Rules for bonding, Type of bonds, Comparison of English Bond and Flemish Bond.
Walls, Doors and Windows: Load bearing wall, Partition wall, and Reinforced brick wall; Common types of doors and windows of timber and metal.

Module – IV (12 hrs.)

Stairs: Technical Terms, Requirements of good stair, Dimension of steps, Classification, Geometric design of a dog legged stair case.
Flooring: Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing.
Centering and Shuttering, Plastering and Pointing:
Plastering with cement mortar, Defects in plastering, pointing, White washing, colour washing, Distempering.
Roofs: Types, Pitched roofs and their sketches,
Truss: Various types of trusses,
Roof covering materials: AC sheets GI sheet

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Duggal S.K., Building Materials, New Age International.
2.	Varghese P.C., Building Materials, PHI Learning Pvt. Ltd-New Delhi.
3.	Punmia B.C., Building Construction, Laxmi Publications.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	S.C. Rangwala, Engineering Materials, Charotar Publishing.
2.	M. S. Shetty, Concrete Technology, S. Chand.

Course Name: Surveying					
Course Code: CIV2104					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2104. 1. Interpret linear and angular measurement procedures using various instruments including ground elevations. [*Understanding* (*LO*)]

CIV2104. 2. Apply the knowledge of linear and angular measurement procedure to compute area, volume of land. [*Applying* (*IO*)]

CIV2104. 3. Analyze the procedure of setting out of horizontal or vertical curve.. [*Analyzing* (*IO*)]

CIV2104. 4. Interpret various methods of hydrographic survey and areal photogrammetry. [*Evaluating* (*HO*)]

CIV2104. 5. Appraise the basic use of advanced instruments and fundamental concept of remote sensing. [*Evaluating* (*HO*)]

CIV2104. 6. Develop an overall sense of various surveying methods, which can be utilized in their professional career in real life projects. [*Creating* (*HO*)]

Module – I (10 hrs.)

Introduction to Surveying: Definition, principles of surveying, types of scales (numerical problems), basic concepts of plans and maps.
Basic concepts of linear and angular measurements using chain and compass.
Plane Table Surveying: Principle, equipment and methods.
Levelling and Contouring: Definitions and terminology, types and methods of levelling, use of Dumpy level, Auto level and supporting accessories, different terms used in contouring, characteristics of contour and contour interval.

Module – II (10 hrs.)

Theodolite Surveying and Tacheometry: Components of Theodolite, adjustments, measurement of vertical and horizontal angels, concepts of trigonometric levelling, definitions and principles of tacheometry and stadia system, fixed hair stadia method, calculation of horizontal and vertical distance using tacheometer.
Computation of Area and Volume: Computation of area using trapezoidal rule and Simpson's 1/3rd rule. Computation of volume of different cross sections.

Module – III (10 hrs.)
Setting out of Horizontal Curves: Elements of simple circular curves and methods of setting out simple circular curve by linear and angular methods. Requirements, types and elements of transition curve.
Setting Out Of Vertical Curves: Introduction to vertical curves and its types.
Triangulation: Concepts of triangulation and triangulation systems in brief.

Module – IV (10 hrs.)

Hydrographic Survey: Shoreline survey, soundings, locating soundings and reduction of soundings, basic concept of Mean sea level, bathymetry.

Aerial Photogrammetry: Terminology, equipments and photo-theodolite.

Measurement Procedure Using Advanced Instruments: Principle of EDM, Total Station and its different parts, practical application of Total Station. Basic principle of GPS.

Remote sensing: Basic principles of remote sensing, platform and sensors, softwares used in remote sensing.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name
1.	S. Ramamrutham, '*Plane and Geodetic Surveying*', Dhanpat Rai Publishing Company.
2.	B. C. Punmia, A. K. Jain and A. K. Jain, '*Surveying*' (Vol-1, 2 ,3), Laxmi Publications (P) Ltd.

REFERENCE BOOKS	
Sl. No.	Name
1.	N. R. Chandak and H. R. Kumavat, '*Surveying (Fundamentals and Advanced Practices)*', S. K. Kataria & Sons.
2.	R. Subramanian, '*Surveying and Levelling*', Oxford university Press.
3.	A. Bannister, S. Raymond and R. Baker. '*Surveying.*', Pearson India.
4.	S. K. Roy. '*Fundamentals of Surveying*', PHI Learning Pvt. Ltd-New Delhi.
5.	S. K. Duggal, '*Surveying (Vol-1 and 2)*', McGraw Hill Education (India) Pvt Ltd.
6.	P. K. Garg, 'Surveying and Geomatics', AICTE-e-KUMBH

Web references:

1. https://nptel.ac.in/courses/105104101
2. https://nptel.ac.in/courses/105107122

Course Name: Design Thinking					
Course Code: CIV2105					
Contact hrs. per week:	L	T	P	Total	Credit points
	1	0	0	1	1

Course Description:

Students start in the field, where they discover the needs of target audience. Then they iterate the ideas to teams to develop a range of promising possible solutions, create rough prototypes to take back out in the field, and test with real people in the target audience.

This course describes the different ways of design thinking, steps and stages of design thinking and evaluating the design.

Course Outcomes:

After going through this course, the students will be able to:

CIV2105.1. Explain the principles of design thinking and approaches and list down the steps involved in design thinking   [*Understanding* (*LO*)]

CIV2105.2. Develop an idea, build a prototype and test in design thinking context.   [*Creating (HO)*]

CIV2105.3. Judge various design alternatives through the creation and testing of prototypes.
[Evaluating (IO)]

CIV2105.4.Integrate design and demonstrate innovative ideas using prototype and apply design thinking for product innovation.   [*Creating (HO)*]

CIV2105.5. Describe the concept and need for obtaining IPR and patents.   [*Understanding* (*LO*)]

CIV2105.6. Design feasible and user-focused solutions to complex problems in design; implement the principles of design thinking to ideate and build a prototype model.   [*Creating (HO)*]

 Module – I *(10 hrs.)*

Introduction to Design Thinking: Introduction to Design Thinking, Origin of Design thinking, Importance of design thinking in engineering problems, Design Thinking vs Engineering Thinking, Design vs Human centered thinking, Understanding Design Thinking and it's process models, Application of Design Thinking, Wicked problems, Application of Design Thinking, Design Thinking approaches,

Module – II *(8 hrs.)*

Design Thinking approaches: Design Thinking and know your stakeholders, Role of human-centered design, Role of empathy in design thinking, Research participant map, Empathy tools, Empathy map.
Ideation: Ideation methods, brain storming, advantages of brain storming, methods and
tools of ideation, prototyping and methods of prototyping, User testing methods, Advantages and disadvantages of user Testing/Validation.

Module – III *(10 hrs.)*

Idea generation in Design Thinking: Defining the problem statement, creating personas, Point of View, The five stages of Design Thinking, Design inclusions, Idea Evaluation, Double Diamond approach, Mind map, Introduction to visual collaboration and Brainstorming tools.
Prototyping and Testing: Need for Prototype in Engineering Design, Principles of prototyping, Types of Prototyping- rapid (Throwaway) prototyping, Evolutionary prototyping, Incremental prototyping, Extreme prototyping; Steps in prototyping
Module – IV *(8 hrs.)*
Prototyping and Testing: Critical Thinking, Critical vs Design Thinking, Skills in Critical thinking,
Argument and Logical Thinking: Argument, claim and statement, argument diagrams.

Intellectual property Rights (IPR): Introduction to Intellectual Property Rights (IPR), basic concepts and need for Intellectual property- patents, copyrights, Geographical Indications; Nature of intellectual Property, Industrial Property, Technological Research, Inventions and Innovations- Important examples of IPR.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Idris Motee, *'Design Thinking for Strategic Innovation'*, 2013, John Wiley & Sons Inc.
2.	Tim Brown, *'Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation',* Harper Collins Publishers Ltd.
3.	*'Design Thinking- The Guide Book',* Facilitated by the Royal Civil Service Commission, Bhutan

REFERENCE BOOKS	
Sl. No.	**Name**
1.	George, E, Dieter Linda, C, Schmidt (2017), *'Engineering Design'*, McGraw Hill Publisher 4th edition, pp-67-93.
2.	Kathryn, Christopher (2019), *'Design Thinking in Engineering'*, Kendall/Hunt Publishing Co., 1st edition, pp-67-93.

Web references:

1. https://nptel.ac.in/courses/105105168
2. https://archive.nptel.ac.in/courses/105/104/105104147/
3. https://archive.nptel.ac.in/courses/105/101/105101084/

Subject Name: Environmental Sciences					
Subject Code: EVS2016					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	**0**	**0**	**2**	**0**

Course outcome:

The subject code EVS2016 corresponds to basic environmental chemistry for the 2nd year B.Tech. students, which is offered as Environmental Sciences and is mandatory for all branches of engineering. The course provides basic knowledge of various environmental pollutions as well as its impact and ways to curb it. The course outcomes of the subject are

EVS2016.1: Understand the natural environment and its relationships with human activities.
EVS2016.2: Characterize and analyze human impacts on the environment.
EVS2016.3: Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
EVS2016.4: Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
EVS2016.5: Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
EVS2016.6: Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Module 1

Socio Environmental Impact   **6L**

Basic ideas of environment and its component
Population growth: exponential and logistic; resources; sustainable development.   3L
Concept of green chemistry, green catalyst, green solvents
Environmental disaster and social issue, environmental impact assessment, environmental audit, environmental laws and protection act of India.   3L

Module 2   **6L**

Air Pollution
Structures of the atmosphere, global temperature models
Greenhouse effect, global warming; acid rain: causes, effects and control.   3L
Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution.   3L

Module 3   **6L**
Water Pollution
Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts.
Biochemical effects of heavy metals; eutrophication: source, effect and control.   2L
Water quality parameters: DO, BOD, COD.
Water treatment: surface water and waste water.   4L

Module 4   **6L**
Land Pollution
Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal.   3L
Noise Pollution
Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control.   3L

Text/Books
1. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.
2. A. K. De, "Environmental Chemistry", New Age International.
3. A. K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd

References/Books

1. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
2. D. De, D. De, Fundamentals of Environment & Ecology, S. Chand & Company Ltd.

Course Name: Strength of Materials Laboratory					
Course Code: CIV2151					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

After going through this course, the students will be able to:

CIV2151.1. Perform various lab/field tests by following the instructions. [*Imitation*]

CIV2151.2. Execute tests ethically in diverse teams under multidisciplinary environment.

[*Manipulation*]

CIV2151.3. Excel expertly in the execution of various experiments. [*Precision*]

CIV2151.4. Create graphical representation of test data and prepare lab report efficiently.

[*Articulation*]

CIV2151.5. Develop leadership and communication skills, and engage in life-long learning.

[*Naturalization*]

List of experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	Tension test on structural materials: Mild steel and TMT bar.	CO1, CO2, CO3, CO4, CO5
2.	Compression test on structural materials: Timber, bricks and concrete cubes.	CO1, CO2, CO3, CO4, CO5
3.	Bending test on mild steel beam and concrete beam.	CO1, CO2, CO3, CO4, CO5
4.	Torsion test on mild steel circular bar.	CO1, CO2, CO3, CO4, CO5
5.	Hardness tests on ferrous and non-ferrous metals: Brinnel and Rockwell tests.	CO1, CO2, CO3, CO4, CO5
6.	Test on closely coiled helical spring / leaf spring.	CO1, CO2, CO3, CO4, CO5
7.	Impact tests: Izod and Charpy	CO1, CO2, CO3, CO4, CO5
8.	Demonstration of Fatigue test.	CO1, CO2, CO3, CO4, CO5

Web references:

https://sm-nitk.vlabs.ac.in/Introduction.html

Course Name: Fluid Mechanics Laboratory					
Course Code: CIV2152					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	2	2	1

Course Outcomes:

After going through this course, the students will be able to:

CIV2152.1. Perform various lab tests by following the instructions. [*Imitation*]

CIV2152.2. Execute tests ethically in diverse teams under multidisciplinary environment. [*Manipulation*]

CIV2152.3. Excel expertly in the determination of the fluid properties from the completed laboratory tests. [*Precision*]

CIV2152.4. Create fluid lab test report efficiently. [*Articulation*]

CIV2152.5. Develop leadership and communication skills, and engage in life-long leaning. [*Naturalization*]

List of experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	Determination of the coefficient of discharge for an Orifice meter.	CO1, CO2, CO3, CO4, CO5
2.	Calibration of V- Notch and determination of the coefficient of discharge.	CO1, CO2, CO3, CO4, CO5
3.	Determination of Co-efficient of Discharge for Venturimeter.	CO1, CO2, CO3, CO4, CO5
4.	Measurement of velocity of fluid in pipe using a Pitot tube.	CO1, CO2, CO3, CO4, CO5
5.	Determination of efficiency of a Centrifugal pump.	CO1, CO2, CO3, CO4, CO5
6.	Determination of efficiency of a Pelton wheel Turbine.	CO1, CO2, CO3, CO4, CO5
7.	Determination of efficiency of a Francis Turbine.	CO1, CO2, CO3, CO4, CO5

Web references:

1. https://bmsce.ac.in/Content/ME/Fluid_Mechanics_Lab_Manual_(1).pdf
2. https://jru.edu.in/studentcorner/lab-manual/btech/ME/3rd-sem/fluid%20mechanics%20lab.pdf
3. https://www.mitmuzaffarpur.org/wp-content/uploads/2019/02/Fluid-Mechanics-Lab-Manual.pdf
4. https://mlritm.ac.in/assets/civil/civil_manuals/R20_civil_labmanuals/R20%20FM%20&%20HM%20Final%20Lab%20Manual%20(1)%20(1).pdf

Course Name: Engineering Drawing					
Course Code: CIV2156					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

After going through this course, the students will be able to:

CIV2156.1. Draw the plan, section and elevation of a building, both manually and by software (AutoCAD) and select, construct and interpret appropriate drawing scale as per the situation.
CIV2156.2. Layout development of solids for practical situations, architectural and engineering scales will increase.
CIV2156.3. Have knowledge in details about every individual section of a building, truss, doors and windows and detailed information about the different types of foundation.
CIV2156.4. Have the ability to perform basic sketching techniques.
CIV2156.5. Convert sketches to engineering drawings and become familiar with office practice and standards.

List of topics with COs:

Sl. No.	Name of the topics	Mapped COs
1.	**FOUNDATIONS:** To draw footing for a RCC column and Brick wall, Combined footing, Strip footing, Raft foundation, RCC Pile Foundation, both manually and by software (AutoCAD).	CO1, CO2, CO3, CO4, CO5
2.	**DOORS, WINDOWS AND STAIRS:** To draw glazed and paneled doors of standard sizes, Glazed and paneled windows of standard sizes, Proportioning and planning of dog-legged and open well staircase, both manually and by software (AutoCAD).	CO1, CO2, CO3, CO4, CO5
3.	**ROOFS AND TRUSSES:** To draw different types of sloping roofs, lean-to-roofs, RCC roof, King post and Queen post trusses, both manually and by software (AutoCAD).	CO1, CO2, CO3, CO4, CO5
4.	**FUNCTIONAL DRAWING OF BUILDINGS:** To draw the line diagram, plan, elevation and section of Residential Buildings (flat, pitched and combined roofs), Office Buildings (flat roof) showing positions of various components including lift well and their sizes, load bearing wall and column, both manually and by software (AutoCAD). Details of plumbing and sanitary lines, septic tank.	CO1, CO2, CO3, CO4, CO5

Course Name: CAD Laboratory					
Course Code: CIV2157					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	2	2	1

Course Outcomes:

After going through this course, the students will be able to:

CIV2157. 1. Summarize and understand the fundamentals of building drawings and understand CAD software for drawing. [*Understanding* (*LO)*]

CIV2157. 2. Apply various draw, edit and modify commands in AutoCAD drawings. [*Applying* (*IO)*]

CIV2157. 3. Apply basic concept to drawing, edit, dimension, hatching etc. to develop 2D Modeling. [*Applying* (*IO)*]

CIV2157. 4. Devise Geometric Plan, Sections and Elevations for single and multi-storied building with suitable scale and dimensions. [*Applying (IO)*]

CIV2157. 5. Sketch the building components and sectional view of doors, windows and trusses. [*Applying* (*IO)*]

CIV2157. 6. Sketch the drawings of various trusses like King post truss, Queen post truss and North light truss. [*Applying (IO)*]

List of topics with COs:

Sl. No.	Name of the topics	Mapped COs
1.	Study of capabilities of software for drafting and modeling - Coordinate systems, simple figures like polygon and multiline figures.	CO1, CO2, CO3, CO4, CO5, CO6
2.	Drawing of Title Block with necessary text and projection symbol.	CO1, CO2, CO3, CO4, CO5, CO6
3.	Drawing of curves like circular, parabolic, spiral using polylines and Bspline.	CO1, CO2, CO3, CO4, CO5, CO6
4.	Drawing of front and top views of simple solids like prism, pyramid, cylinder, cone and dimensioning.	CO1, CO2, CO3, CO4, CO5, CO6
5.	Drawing of architectural plan, sectional elevation, front elevation, side elevation and foundation plan of a residential building (two bedroom, kitchen, toilet, dining hall and verandah).	CO1, CO2, CO3, CO4, CO5, CO6
6.	Drawing of a simple steel truss.	CO1, CO2, CO3, CO4, CO5, CO6

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	James D. Bethune, *Engineering Graphics with Auto Cad 2015*, Pearson Publication House.
2.	Mercury Learning, *AutoCAD 2016 Beginning and Intermediate*, BPB Publications.
3.	Donnie Gladfelter, *AutoCAD 2016 and AutoCAD LT 2016*, Sybex

References: National Building Code (NBC), Kolkata Municipal Corporation (KMC) rules, Building bye-laws.

Course Name: Idea Laboratory					
Course Code: CIV2158					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	2	2	0

List of Experiments:
Any of the following experiments will be conducted by students.

1. Steel Braced Frame Subjected to Lateral Loading: An experimental Study:

In this project one bay – one story bare frames will be fabricated from steel material. Two types of brace arrangements will be used like single diagonal and cross bracing. One frame will be fabricated without brace members and three frames will be fabricated with brace members. Angle section will be used as brace members. For beams and columns of frame, ISMB section will be used. For using appropriate ISMB and angle section, bare frame and brace frame will be designed for lateral load. After fabrication of all frames, they will be tested under the effect of lateral load.

2. Digital Interface for measuring deflection of cantilever beam:

A cantilever beam size of 300 mm × 200 mm × 400 mm will be used for the experimental setup. Load is applied at any longitudinal section of the beam and deflection corresponding to the load at free support can be measure using LVDT. The load can be measured by load cell. Both the circuits are connected to LCD screen using Arduino to fetch the real time data. Live plot of load verse deflection will be prepared and simultaneously bending moment and shear force diagram can be plotted corresponding to applied load. Analytical results will be calculate with the help of theoretical calculation and same will be compare with experimental results which can be achieved by this setup. This instrumental setup can be used as laboratory instrument to measure load, deflection and corresponding error for cantilever beam.

3. Alkali activated concrete with steel fibres and/or polypropylene fibres with variation in source material at ambient curing:

Steel fibers are used in concrete as fibres. This project aims to establish mix design for steel fibre reinforced alkali activated concrete. The alkali activation will be done at ambient curing. Variation will be done by using different source materials like fly ash and slag cured at ambient curing. Various mechanical properties like compressive strength, tensile strength, flexural strength and modulus of elasticity will be tested. Beside this, bond test, abrasion resistance and impact test will be carried out to determine its resistance and will be compared with concrete without fibers. This project aims to improve flexural and crack propagation in concrete which will help in pavement design**.**

4. Bio bricks using sludge:

This study focuses on the use of sludge in production of brick. Different series of sludge and various ingredients mixture proportions were studied. Various physical and environmental tests were conducted. While testing various parameters it has been observed that good quality Slu-brick can be produced up to 30 percent utilization of sludge in brick manufacturing. Replacing clay with sludge helps in the conservation of naturally available resources and improves the environmental quality.

5. Development of Sustainable Blocks Using Various Waste Materials:

Use of red bricks in construction industry has been reduced with the use of of various waste materials for manufacturing of bricks and blocks. Red Bricks is produced from clay under high temperature which further produced pollution. Carbon Footprints of red Bricks is also high. Primary focus is to produce a low cost solution for Red bricks and having very less environmental effect.

6. Low cost Geopolymer Bricks:

The purpose of this particular study is to explore the performance of Geopolymer brick consists of fly ash as one of its chief material. The bricks were casted with clay soil to fly ash in the different proportion. Sodium fume solution was applied as an alkaline-activator and a ratio 1:2 of water to NaOH solution was used as the binder solution. With an optimum water/binder ratio, the experimental outcomes will be compared with locally available conventional bricks.

7. Improvement of physical and mechanical properties of soil using filler additives: The aim of this project is improve various physical and mechanical properties of black cotton soil using various types of filler additives.

8. Waste Plastic Bonded Bricks: The aim of this project is to replace cement with plastic waste in paver block and to reduce the cost of paver block when compared to that of convention concrete paver blocks. At present nearly 56 lakhs tones of plastic waste is produced in India per year. The degradation rate of plastic waste is also a very slow process. Hence the project is helpful in reducing plastic waste in a useful way. In this project we will use plastic waste in different proportions with quarry dust, coarse aggregate and ceramic waste. The paver blocks will be prepared and tested and the results will be discussed.

9. Effect of different values of pH of water on properties of fresh concrete and hardened concrete:

Under this project, test cubes, beams and cylinders of concrete will be made by using portable water, tap water, RO waste water, saline water and a combination of saline water and RO reject water. Testing of different properties like setting time, compression, tensile and flexural strength will be done on the components and their results will be compared. As abstracted from literature, the use of RO reject water increases the strength of cement paste. It is expected that the strength of concrete will be increased when RO reject is used. The use of saline water for concreting may lead to effloresce due to excess amounts of salts, which may decrease the strength of concrete.

10. Shake table with periodic and random motions:

The shake table is an indispensable testing facility for development of earthquake resistance techniques. A shaking table is a platform exited with servo motor to simulate different types of periodic and random motions, such as artificial earthquakes and other dynamic testing signals of inertia forces.

The displacement and acceleration of the stage are measured by the on-board encoder and the accelerometer sensors. The encoder and accelerometer are connected to the DAQ and their signals, which can be displayed and processed further.

The shake table can be utilized for verification of earthquake resistance buildings, other structures, mechanical components, devices, etc.

DETAILED CURRICULUM

2nd Year 2nd Semester

Paper Name: **Mathematical Methods**					
Paper Code: **MTH2001**					
Contact hours per week:	L	T	P	Total	Credit Points
	4	0	0	4	4

Course Outcomes: After completion of this course, students will be able to:

MTH2001.1 Develop a computational understanding of second-order differential equations with analytic coefficients.

MTH2001.2 Find power series solutions about ordinary points and singular points.

MTH2001.3 Understand Legendre, Bessel and Hermite equations with their corresponding recurrence relations.

MTH2001.4 Apply a range of techniques to find solutions of standard Partial differential equations.

MTH2001.5 Classify PDEs, apply analytical methods for solving them.

MTH2001.6 Master how partial differentials equations can serve as models for physical processes such as vibrations, heat transfer etc.

Module- I
Ordinary Differential Equations (ODE)-I: 10L

Series solution of ODE: ordinary point, singular point and regular singular point; series solution when $x = a$ is an ordinary point; Frobenius method: series solution about regular singular point $x = 0$, series solution about regular singular point $x = a$; series solution about regular singular point at infinity.

Module- II
Ordinary Differential Equations (ODE)-II: 10L

Legendre's Equation: Legendre's polynomial of degree n, generating function, recurrence relations, orthogonal properties of Legendre's polynomial; Bessel's equation: Bessel's function of first kind, generating function, recurrence relations; Hermite equation: Hermite polynomial of degree n, generating function, recurrence relations.

Module- III
Partial Differential Equations (PDE)-I: 10L

Prerequisites; Introduction and classification of PDEs: formation of PDEs; method of characteristics: elliptic, parabolic and hyperbolic partial differential equations of order 2; linear equations of 1st order: Lagrange's method of solution; non-linear equations of 1st order: Charpit's method.

Module- IV   10L
Partial Differential Equations (PDE)-II:

Second order partial differential equations with constant coefficients; method of separation of variables; illustration of wave equation, one dimensional heat equation, Laplace's equation, boundary value problems and their solution by the method of separation of variables; solution of boundary value problems by Laplace transform.

Text Books:
1. Ordinary and Partial Differential Equations, M. D. Raisinghania, S. Chand.
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers.

Reference Books:

1. Elements of Partial Differential Equation, Ian Naismith Sneddon, Dover Publications.
2. Advanced Engineering Mathematics, Kreyszig, Willey.
3. An introduction to differential equations, R.K. Ghosh and K.C Maity, New Central Book Agency Ltd.

Course Name: Structural Analysis I					
Course Code: CIV2201					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2201. 1. Illustrate the properties of statically determinate and indeterminate structures of engineering fundamentals. [*Understanding* (*LO*)]

CIV2201. 2. Identify the methods to analyze determinate and indeterminate structures. [*Applying* (*IO*)]

CIV2201. 3. Analyze various types of determinate and indeterminate structures. [*Analyzing* (*IO*)]

CIV2201. 4. Interpret the deflection of determinate structures by various methods. [*Evaluating* (*HO*)]

CIV2201. 5. Analyze various types of determinate and indeterminate structures by using software. [*Analyzing* (*IO*)]

CIV2201. 6. Explain Influence line for various determinate and indeterminate structures. [*Creating* (*HO*)]

Module – I (16 hrs.)
BASICS OF STRUCTURAL ANALYSIS: Concept of static and kinematic indeterminacy, Determination of degree of indeterminacy for different types of structures. Methods of analysis-Theorem of minimum potential energy, law of conservation of energy, principle of virtual work, the first theorem of Castigilano, Betti's law, Clark Maxwell's theorem of reciprocal deflection.
Analysis of Determinate Structures- Portal Frames, Three hinged arches, Cables.
Deflection of Determinate Structures- Energy methods. Unit Load method for beams, Deflection of trusses and Simple Portal Frames.

Module – II (6 hrs.)

INFLUENCE LINE DIAGRAM: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shear.
Module – III (16 hrs.)
THEOREM OF THREE MOMENTS:
Introduction to statically indeterminate structures, advantages of indeterminate structures over determinate structures, solved simple numerical problems on computation of static indeterminacy, Clapeyron's theorem of three moments, derivation of three moment equation, solved numerical problems of continuous beams based on different support conditions and support settlement.
STRAIN ENERGY: Castigliano's 2nd Theorem, illustrate numerical problems.
ANALYSIS OF STATICALLY INDETERMINATE BEAMS BY FORCE METHOD

Basic introduction to force method of analysis, analysis of statically indeterminate beams by force method, Solved examples, Theorem of Least work, numerical problems on theorem of least work

TWO HINGED ARCHES:

Analysis of two hinged arch, solved problems on two hinged arch.

Module – IV (6 hrs.)

INFLUENCE LINE DIAGRAM OF INDETERMINATE STRUCTURES:

Influence lines for statically indeterminate beams, Muller-Breslau Principle, ILD for continuous beams, Problems on ILD for continuous beam, trusses etc

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	C. S. Reddy, 'Basic Structural Analysis', Tata McGraw Hill
2.	C. K .Wang, 'Statically Indeterminate Structures', McGraw Hill

REFERENCE BOOKS	
Sl. No.	**Name**
1.	A. Ghali and A. M.Neville, 'Structural Analysis-A unified Classical and Matrix Approach', E & FN SPON.
2.	Timoshenko and Wang, 'Theory of Structures', Tata McGraw Hill
3.	E. P. Popov, 'Engineering Mechanics of Solids', Pearson Education

Web references:

https://archive.nptel.ac.in/courses/105/105/105105166/
https://onlinecourses.nptel.ac.in/noc22_ce29/preview

Course Name: Soil Mechanics					
Course Code: CIV2202					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2202. 1. Illustrate physical properties i.e., hydraulic and strength characteristics of soils on the basis of knowledge of mathematics, science and engineering fundamentals.

CIV2202. 2. Evaluate index properties of soils for soil identification and classification according to standard methods.

CIV2202. 3. Analyze one- and two-dimensional flow problems by applying fundamental concept of effective stress, permeability and seepage.

CIV2202. 4. Interpret soil behavior due to compaction and consolidation.

CIV2202. 5. Determine the relevant increase in vertical stress due to various types of loading and footing shapes.

CIV2202. 6. Estimate shear strength parameters from different tests based on the fundamental concept of shear strength principles including the Mohr-Coulomb failure criterion.

Module – I (10 hrs.)

Properties and classification of soils: Introduction to soil mechanics, soil formation and soil type; Solids- Water –Air Relations and Index properties of soils – Phase diagram, simple definitions and their relationships, index properties, of soils, determination of various index properties; Soil identification and classification – introduction, field identification of soil, soil classification – Textural, Indian Standard Soil Classification System (ISSCS) and Unified Soil Classification System (USCS) classification systems, application of soil classification system; Soil structure and clay mineralogy – Introduction, clay minerals, clay particle interaction, soil structure and fabrics.

Module – II (10 hrs.)

Soil-water system: Concept of total stress, effective stress and pore water pressure, effective stress under flow and no-flow conditions, seepage pressure, quick sand condition, capillary phenomena, permeability - Darcy's Law, factors affecting permeability, laboratory and field determination of permeability, permeability of stratified deposits, seepage - Two-dimensional flow, Laplace's equation, construction and use of flow net, piping and heaving, prevention of erosion – protective filters.

Module – III (10 hrs.)

Compaction and Consolidation: Compaction – introduction, laboratory tests, factors affecting compaction, compaction specification and field control; Consolidation – fundamentals of consolidation, One –Dimensional Laboratory consolidation Test, void ratio - effective pressure relationship for normally and overconsolidated soils, determination of settlement from one-dimensional primary consolidation, compression index and swell index, Terzaghi's theory of one-dimensional consolidation, time rate of consolidation, coefficient of consolidation, time factor, degree of consolidation.

Module – IV (10 hrs.)
Stress Distribution in Soil and Shear Strength:
Stress distribution - Introduction, Boussinesq's and Westergaard's theories, vertical stress beneath loaded areas, approximate stress distribution methods for loaded areas, isobar and pressure bulb, contact pressure distribution and settlement profile.
Shear strength - Basic concept of shearing resistance and shear strength of soil, Mohr circle of stress, Mohr - Coulomb failure theory, relationship between principal stresses, determination of shear strength from laboratory tests, Skempton's pore pressure parameters.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	V.N.S. Murthy, '*Textbook of Soil Mechanics and Foundation Engineering*' (Geotechnical Engineering Series), CBS Publishers and Distributors Pvt. Ltd.
2.	G. Ranjan and A. S. R. Rao, '*Basic and Applied Soil Mechanics*', New Age International Pvt. Ltd.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	R. D. Holtz, W. D. Kovacs, and T. D. Sheahan, '*An Introduction to Geotechnical Engineering*', Pearson Publication.
2.	K. Terzaghi, R. B. Peck and G. Mesri, '*Soil Mechanics in Engineering Practice*', A Wiley Interscience Publication (John Wiley & Sons, Inc.).
3.	B. M. Das, '*Principles of Geotechnical Engineering*', Thomson Brooks / Cole.
4.	N. Sivakugan, and B. M. Das, '*Geotechnical Engineering – A Practical Problem Solving Approach*', J. Ross Publishing.
5.	T. W. Lambe and R. V. Whitman, '*Soil Mechanics*', Wiley Eastern Ltd.
6.	B. C. Punmia and A. K. Jain, '*Soil Mechanics and Foundations*', Laxmi Publications (P) Ltd.

Web references:

1. https://nptel.ac.in/courses/105105168
2. https://archive.nptel.ac.in/courses/105/104/105104147/
3. https://archive.nptel.ac.in/courses/105/101/105101084/

Course Name: Highway and Traffic Engineering					
Course Code: CIV2203					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2203.1. Plan highway networks and Design highway geometrics.

CIV2203.2. Characterize the properties of soil, aggregate, bitumen, and bituminous mixes.

CIV2203.3. Analyze and design rigid and flexible pavement (IRC Method).

CIV2203.4. Understand the principles of construction, maintenance and safety of highways.

CIV2203.5. Conduct traffic studies, analyze traffic data and design intersections.

CIV2203.6. Design traffic signal and analyze parking & accidents.

Module – I (12 hrs.)

Highway Network Planning:
Different modes of transportation, Role & Development of highway transportation, Classification, Network patterns, Planning surveys, Evaluation by saturation system, Introduction to highway economics.

Highway Alignment:
Factors controlling alignments, Principles of highway alignment, engineering surveys for highway alignment and location.

Highway Geometric Design:
Importance of geometric design, design controls, pavement cross-sectional elements, PIEV theory, Sight distance, Design of horizontal alignments, Design of vertical alignments, Geometric Design of Hill Roads.

Module – II (12 hrs.)

Pavement Materials:
Types and component parts of pavement and their functions, highway and airport pavement materials, basic soil & aggregate properties relevant to pavement application, basic properties of bitumen and tar, Modified Bitumen (PMB, CRMB) tests on pavement materials, Use of geo-synthetics.

Design of Pavements:
Design factors, classification of axle types, contact pressure, EWLF & ESAL concept, Traffic analysis: vehicle damage factor.
Flexible Pavement Design: Design of flexible pavements (GI method, CBR method, Triaxial method -only introduction), IRC method of design.
Rigid Pavement Design: Design considerations, Westergaard's theory and assumptions, Design of dowel and tie bars, Joints in Rigid Pavements, IRC method of design.

Module – III (8 hrs.)

Highway Construction:
Construction of earth roads, gravel roads, WBM roads, Cement Concrete Pavements, Bituminous pavements.

Highway Maintenance:
Pavement failures, causes of failure, routine and periodic maintenance of highways.

Highway Drainage:
Importance of highway drainage, surface and sub-surface drainage, drainage of slopes and erosion control, road construction in water logged areas.

Highway Safety:
Introduction to highway safety, accident characteristics and factors, accident recording and analysis, road safety audit, safety education, traffic law enforcement, elements of highway safety management system, road safety management system.

Module – IV (10 hrs.)

Traffic Engineering:

Introduction, road users and vehicle characteristics, microscopic and macroscopic flow characteristics, time headways, interrupted and un- interrupted traffic, speed and travel time variation, travel time and delay studies, flow and density measurement techniques, highway capacity and level of service, level of service estimation, traffic signs.

Traffic Signal Design and Design of at grade Intersections:

Signal phasing, cycle length, fixed and vehicle actuated signal, Webster method, IRC method, signal co-ordination and problems on signal design, types of intersections, rotary and round-about, design aspects.

Parking and Accident Analysis:

Parking inventory study, on street and off street parking facilities, introduction to Intelligent Transport System, accident characteristics, accident recording and analysis.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	High Way Engineering, Khanna & Justo, Nemchand & Brothers, Roorkee.
2.	Transportation Engineering- C.J Khisty & B.K Lall., PHI.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Principles of Transportation Engineering, P. Chakraborty & A. Das – PHI.
2.	Kadiy.ali L.R. Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, India,1997

CODES FOR REFERENCE:

I.S Specifications on Concrete, Aggregate & Bitumen Bureau of Indian Standard, Relevant latest IRC Codes (IRC-37 – 2001, IRC-37 – 2012, IRC 58 – 2011, IRC 73- 1980, IRC 86 - 1983, IRC 106 – 1990, IRC 64 – 1990, IRC 15- 2002 - Indian Road Congress.

Course Name: **CONCRETE TECHNOLOGY**					
Course Code: **CIV2204**					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**1**	**0**	**4**	**3**

Course Outcomes:

After going through this course, the students will be able to:

CIV2204.1 Describe the properties of the constituent materials of concrete. [*Remember* (*LO*)]

CIV2204.2 Explain the physical and mechanical properties of concrete [*Understand* (*LO*)]

CIV2204.3 Identify the behavior of concrete at its fresh and hardened state. [*Understanding* (*LO*)]

CIV2204.4 Explain the factors effecting strength of concrete. [*Applying (IO)*]

CIV2204.5 Distinguish the factors influencing concrete mix & know the IS method of mix design. [*Evaluate* (*HO*)]

CIV2204.6 Classify various types of special concrete and their application for practical purpose. [*Understand* (*LO*)]

Module – I (9 hrs.)

CONCRETE AS A STRUCTURAL MATERIAL: Chemical Composition of Cement, Hydration of Cement, Heat of Hydration and Strength.
Classification of Aggregate, strength and mechanical properties of aggregates.

QUALITY OF WATER: Mixing water, Curing Water, Harmful Contents

PROPERTIES OF FRESH CONCRETE: Workability, Factors Affecting Workability, Slump test, Compacting Factor Test, Flow Table Test, Segregation, Bleeding, Setting time, Mixing and Vibration of Concrete, Mixers and Vibrators, Curing Methods, Maturity.

Module – II (9 hrs.)

STRENGTH OF CONCRETE: Water/Cement ratio, Gel/Space ratio, Strength in Tension, Compression, Effect of Age on Strength, Relation between Compressive and Tensile Strength, Fatigue Strength, Stress-Strain Relation and Modulus of Elasticity, Poisson's Ratio, Shrinkage and Creep, Compression Test on Cubes, Cylinders, Introduction to Non-Destructive Tests (Rebound Hammer & Ultrasonic Pulse Velocity)

Module – III (9 hrs.)

ADMIXTURES: Different types, Effects, Uses, Retarders and Super Plasticizers.

Mix Design by I.S. 10262(2009)

Module – IV (9 hrs.)

SPECIAL CONCRETE & CONCRETING TECHNIQUES:

Light- weight Concrete, Polymer Concrete, Fibre-reinforced Concrete, Waste Material Based
Concrete, Shotcrete, Ferro cement, Self-Compacting Concrete, Foam Concrete
Modification in the Microstructure.
Deterioration of Concrete and its Prevention
Repair Technology and its Strengthening.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Concrete Technology by M.S.Shetty. S Chand publishers
2.	Concrete Technology by M.L.Gambhir. Tata Mc.Graw Hill publishers

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Concrete Technology by A.M.Neville, Pearson Education.
2.	Concrete Technology ,A.R. Santakumar ,Oxford University Press
3.	Text book of concrete technology by P.D. Kulkarni, Tata Mc.Graw Hill.

Course Name: Environmental Engineering					
Course Code: CIV2205					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV2205. 1. Identify the nature and quality of water & waste water as per its characteristics like physical, chemical & biological. **[*Understanding (LO)*]**

CIV2205. 2. Estimate the future water demand by using various population forecasting methods. **[*Applying (IO)*]**

CIV2205. 3. Define & design in detail about the various water treatment units. **[*Analyzing (IO)*]**

CIV2205. 4. Define & design in detail about the various waste water treatment units.

 [*Create (IO)*]

CIV2205. 5. Estimate the quantity of sewage produced and design the sewerage system. **[*Evaluating (HO)*]**

CIV2205. 6. Analysis and design of water distribution networks. **[*Analyzing (IO)*]**

Module – I (10 hrs.)

Water Demand: Per capita demand; Variations in demand; Factors affecting demand; Design period; Population Forecasting Methods.

Sources of water: Surface and ground water.

Water Distribution: Analysis of pipe networks, Storage and distribution of water; Estimation of reservoir capacity.

Module – II (12 hrs.)

Water Quality Parameter: Physical and Chemical water quality parameters; Sources, impacts and methods of measurement

Water Treatment: Typical flow chart for ground and surface water treatments; Unit Processes- Aeration, Plain sedimentation, coagulation & flocculation, Water Softening, Filtration, Disinfection.

Module – III (8 hrs.)

Conveyance of Waste Water:

Definition of Common Terms, Quantity of sewage and storm sewage.

Sewer Design: Hydraulic design of sewers, Analysis of partial flow diagrams and Nomograms.

Module – IV (10 hrs.)

Wastewater Quality Parameters: Physical, chemical and biological.

Wastewater treatment: Typical flow chart for municipal wastewater treatment; Primary, Secondary & Tertiary Treatments: Unit Processes- Activated Sludge Process, Trickling Filter Process, Septic Tank, Advance Methods of Wastewater treatment.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name
1.	Environmental Engineering. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, McGraw-Hill.
2.	Water Supply Engineering (VOL I) by Santosh Kr Garg, Khanna Publishers.

REFERENCE BOOKS	
Sl. No.	Name
1.	Wastewater Engineering by Metcalf & Eddy, McGraw-Hill.
2.	Environmental Engineering, N. N. Basak, McGraw-Hill.
3.	Wastewater Engineering by B.C. Punmia & A.K. Jain, Laxmi Publications.

Course Name: Soil Mechanics Laboratory – I					
Course Code: CIV2252					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	3	3	1.5

Course Outcomes:

After going through this course, the students will be able to:

CIV2252.1. To perform various lab/field tests by following the instructions. [*Imitation*]

CIV2252.2. To execute tests ethically in diverse teams under multidisciplinary environment. [*Manipulation*]

CIV2252.3. To excel expertly in the determination of the soil properties from the completed laboratory tests. [*Precision*]

CIV2252.4.To create soil lab test report efficiently. [*Articulation*]

CIV2252.5. To develop leadership and communication skills, and engage in life-long leaning. [*Naturalization*]

List of experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	Field identification of different types of soil as per Indian Standards [collection of field samples and identifications without laboratory testing].	CO1, CO2, CO3, CO4, CO5
2.	Determination of natural moisture content of soil.	CO1, CO2, CO3, CO4, CO5
3.	Determination of specific gravity of cohesionless and cohesive soils.	CO1, CO2, CO3, CO4, CO5
4.	Determination of grain size distribution by sieve analysis and hydrometer analysis.	CO1, CO2, CO3, CO4, CO5
5.	Determination of Atterberg limits (liquid limit, plastic limit & shrinkage limit).	CO1, CO2, CO3, CO4, CO5
6.	Determination of co-efficient of permeability by constant and variable head permeability tests.	CO1, CO2, CO3, CO4, CO5
7.	Determination of in-situ density by core cutter method and sand replacement method.	CO1, CO2, CO3, CO4, CO5

Web references:

1. https://nptel.ac.in/courses/105101160
2. https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ce36/
3. https://elearn.nptel.ac.in/shop/nptel/geotechnical-engineering-laboratory/
4. https://www.vlab.co.in/broad-area-civil-engineering

Course Name: Concrete Technology Laboratory					
Course Code: CIV2254					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	3	3	1.5

Course Outcomes:

After going through this course, the students will be able to:

CIV2254.1. To perform various laboratory experiments by following the instructions. [*Imitation*]

CIV2254.2. To execute lab experiments to identify materials used for concrete. [*Manipulation*]

CIV2254.3. To perform lab experiments to determine properties of materials required for concrete. [*Precision*]

CIV2254.4. To create concrete lab experimental report efficiently. [*Articulation*]

CIV2254.5. To develop leadership and communication skills, and engage in life-long leaning. [*Naturalization*]

List of experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	**Tests on cement** – specific gravity, fineness, soundness, normal consistency, setting time, compressive strength on cement mortar cubes	CO1, CO2, CO3, CO4, CO5
2.	**Tests on fine aggregate** – specific gravity, bulking, sieve analysis, fineness modules, moisture content, bulk density and deleterious materials	CO1, CO2, CO3, CO4, CO5
3.	**Tests on coarse aggregate** - specific gravity, sieve analysis, fineness modulus and bulk density.	CO1, CO2, CO3, CO4, CO5
4.	**Tests on Fresh Concrete**: Workability: Slump, Vee-Bee, Compaction factor tests	CO1, CO2, CO3, CO4, CO5
5.	**Tests on Hardened Concrete**: Compressive strength on Cubes, Split tensile strength, Static modulus of elasticity, Flexure tests, Non-destructive testing (Rebound hammer & Ultrasonic pulse velocity)	CO1, CO2, CO3, CO4, CO5
6.	**Mix Design of Concrete**.	CO1, CO2, CO3, CO4,

References:

1. Relevant latest IS codes on Aggregates, Cement & Concrete [269, 383, 2386, 10262(2009), SP23]
2. Laboratory manual of concrete testing by V.V. Sastry and M. L. Gambhir

Web references:
1. https://nptel.ac.in/courses/105102012
2. https://archive.nptel.ac.in/courses/105/104/105104030/

Course Name: Surveying Laboratory					
Course Code: CIV2256					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**3**

Course Outcomes:

After going through this course, the students will be able to:

CIV2256.1. Perform various lab/field tests by following the instructions. [*Imitation*]

CIV2256.2. Execute tests ethically in diverse teams under multidisciplinary environment. [*Manipulation*]

CIV2256.3. Excel expertly in the calculation of linear and angular measurements. [*Precision*]

CIV2256.4. Create execution drawing from the collected field data and prepare lab report efficiently. [*Articulation*]

CIV2256.5. Develop leadership and communication skills, and engage in life-long learning. [*Naturalization*]

List of experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	**Chain and Compass survey:** Preparation of maps, method of ranging-method of taking offsets, measurement of bearings, chain and compass traverse	CO1, CO2, CO3, CO4, CO5
2.	**Levelling:** Temporary adjustment of Dumpy level, Differential leveling, Profile leveling and plotting of long and cross sections.	CO1, CO2, CO3, CO4, CO5
3.	**Theodolite survey:** Traversing using theodolite, preparation of Gale's traverse table using the field data.	CO1, CO2, CO3, CO4, CO5
4.	**Curve setting:** Setting out of simple circular curve and transition curve by angular method.	CO1, CO2, CO3, CO4, CO5
5.	**Setting out of building:** Setting out procedure of building layout	CO1, CO2, CO3, CO4, CO5
6.	**Total station:** Demonstration of the instrument and perform Levelling using it.	CO1, CO2, CO3, CO5

Web references:
1. Welcome to Virtual Labs - A MHRD Govt of india Initiative (vlabs.ac.in)

Course Name: Quantity Survey & Estimation Laboratory					
Course Code: CIV2257					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	2	2	1

Course Outcomes:

After going through this course, the students will be able to:

CIV2257. 1. Understand and apply different types of estimates in different situations
[*Understanding* (*LO*)]

CIV2257. 2. Prepare estimates for various structural components of a building, roads, rails, and canal works. [*Applying* (*IO*)]

CIV2257. 3. Calculate the quantity of materials required for engineering works as per specifications. [*Applying* (*IO*)]

CIV2257. 4. Justify the concepts of specification writing. [*Evaluating* (*HO*)]

CIV2257. 5. Interpret valuation of various construction works and evaluate contracts and tenders in construction practices. [*Evaluating* (*HO*)]

CIV2257. 6. Interpret various concept of quantity estimation, specifications and valuation used in various construction works such as foundations, building works, canal works and road works. [*Applying (IO)*]

COURSE CONTENT:

1. Introduction to Quantity Survey and Estimation, Various types of Estimates, Basic requirements of Detailed Estimate.

2. Various Items of work, various units of measurement and payment of various items of works and materials.

3. Quantity Estimation of an Isolated Stepped Footing.

4. Concept of Centerline Method and Long wall-short wall method; Estimation of quantities for a two-roomed plan using Long wall and Short wall method.

5. Estimation of quantities of a two-roomed plan building (Using Centerline Method); Quantity Estimation of various items of works.

6. Introduction to fundamental concepts of Bar Bending Schedule (B.B.S.); Quantiy estimation of B.B.S. for a Lintel with Chajja (Sloped Chajja).

7. Quantity estimation of amount of reinforcement required in a R.C.C. beam

8. Quantity estimation of reinforcement required in a R.C.C. slab.

9. Quantity estimation of area of shuttering and concrete volume for R.C.C. Lintel Chajja, beam, slab.

10. Introduction to concepts of Valuation, Concept of price, value and cost. Purpose of valuation; free hold and lease hold properties; market value, present value; sinking fund; year's purchase.

11. Different methods of land valuation, Different methods of valuation of real properties; Outgoing, appreciation, depreciation, different methods for fixation of rents; Valuation of plants and machineries.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Estimating, costing, Specification and Valuation in Civil Engineering by M. Chakraborty
2.	Estimating and Costing in Civil Engineering" by B.N. Dutta, USB Publishers & Distributers

References:

1. IS CODE SP34

2. National Building Codes (NBC)

3. Kolkata Municipality Corporation (KMC) bye-laws.

DETAILED CURRICULUM

3rd Year 1st Semester

Course Name: Structural Analysis - II					
Course Code: CIV3101					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Course Outcomes:

After going through this course, the students will be able to:

CIV3101. 1. Describe the concepts and principles to analyze the indeterminate structures. Learn Slope-Deflection Method and Moment Distribution Method to analyze indeterminate structures. *[Understanding (LO),Analyze(IO)]*

CIV3101.2. Analyze the concept of three hinged and two hinged suspension bridge with stiffening girders. [*Analyze (IO)*]

CIV3101.3. Develop the concept in bending of unsymmetrical beams and determine the concept of curved beam in hooks, rings and bow girders. [*Evaluate (HO)*]

CIV3101.4. Develop the fundamental concepts of plastic analysis using kinematic method and apply them in frames and continuous beam analysis. [*Analyze (IO)*]

CIV3101. 5. Develop and analyze the portal frames using Portal and Cantilever method.
[*Analyze (IO)*]

CIV3101. 6. Develop and analyze the indeterminate structures (continuous beams and frames) using flexibility and Stiffness methods [*Analyze (IO)*]

Module – I (12 hrs.)
Analysis of statically Indeterminate Structures: Moment distribution method-solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway. Basics of Substitute Frame method.
Slope deflection method: Describe method and application in continuous beams and frames.
Suspension Bridge and stiffening girders: Method and Analysis

Module – II (12 hrs.)
Curved Beam analysis: Hooks, rings and Bow girders.
Unsymmetrical bending of beam: Method and Analysis

Module – III (8 hrs.)
Plastic analysis of structures: beams and portal frames.

Module – IV (10 hrs.)
Approximate method of analysis of structures: Portal and Cantilever methods.
Matrix methods of structural analysis: Stiffness and flexibility approaches for analysis of beam.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name
1.	M. Vijayanand Dr. K.U. Muthu, Dr. H. Narendra, Dr. Maganti Janardhana , *Indeterminate Structural Analysis*, Wiley Publications..
2.	C.S.Reddy, *Basic Structural Analysis,* Tata Mc. Graw Hill Publishing House.
3.	A. Ghali and A.M. Neville, *Structural Analysis-A unified Classical and matrix approach*.,E & FN SPON Publishing House.

REFERENCE BOOKS	
Sl. No.	Name
1.	Timoshenko and Wang, *Theory of structure,* Tata McGraw Hill Publishing House
2.	S.Ramamruthum, *Theory of Structures*, Dhanpat rai Publishing House.
3.	V. N. Vazirani, M. M. Ratwani, et al., *Analysis of Structures (Theory, Design & Details of Structures) – Vil. 1 and Vol.2,* Dhanpat Rai Publishing House.

Web references:

1. https://archive.nptel.ac.in/courses/105/105/105105109/
2. https://archive.nptel.ac.in/courses/105/101/105101086/

Course Name: Design of RCC Structures					
Course Code: CIV3102					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3102. 1. Describe the material properties, design methodologies and components of reinforced concrete structures. [*Understand* (*LO*)]

CIV3102. 2. Identify the different type of loads on reinforced concrete structures, understand the load transfer mechanism and perform the load combinations. [*Remember* (*LO*)]

CIV3102. 3. Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members. [*Apply* (*IO*)]

CIV3102. 4. Analyse and design of various structural elements of reinforced concrete building like beam, slab, column, staircase, RCC footing and pile foundation based on both strength and serviceability criteria. [*Create* (*HO*)]

CIV3102. 5. Describe the basic concept and mechanical behaviour of prestressed concrete. [*Understand* (*LO*)]

CIV3102. 6. Develop design document, GA and detail drawings of RCC multi-storied building, reinforcement schedule, both manually and using software. [*Create* (*HO*)]

Module – I (10 hrs.)
Introduction: Introduction to structural components of building, gravity and lateral loads on the structure and load combinations, mechanical properties of reinforced concrete structures, design philosophy of reinforced concrete structures - working stress and limit state method of design.
Working stress method of design: Basic concepts of balanced, under-reinforced and over-reinforced beam section by working stress method. Analysis and design of beams and columns.
Limit State Method of Design: Basic concepts of balanced, under-reinforced and over-reinforced beam section by limit state method and IS Code Provisions (IS: 456 2000) for Design against Strength and Serviceability Limit States.

Module – II (11 hrs.)
Analysis, design and detailing of singly and doubly reinforced rectangular beam and flanged beam sections by limit state collapse- flexure, shear and torsion and limit state of serviceability- deflection.
Concepts of bond stress and development length; Use of 'design aids for reinforced concrete' (SP: 16).
Design and detailing of continuous beams and as per IS code provisions

Module – III (10 hrs.)
Classification of slabs,
Design and detailing of one way, two way and continuous slabs.
Design and detailing of staircase.

Module – IV (11 hrs.)
Design and detailing of reinforced concrete short columns of rectangular and circular cross-sections under axial load.

Design of short columns subjected to axial load with moments (uniaxial and biaxial bending) – using SP 16.

Design and detailing of reinforced concrete footing and pile foundation as per IS code provisions by limit state method.

Prestressed concrete - Basic introduction and classification.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Reinforced Concrete Design by Pillai and Menon
2.	RCC Design and Drawing by Neelam Sharma
3.	Limit State Design of Reinforced Concrete by P. C. Varghese
4.	Reinforced concrete Design by S. N. Sinha

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Fundamental Design of Reinforced Concrete by N. C. Sinha & S.K. Roy
2.	Reinforced Concrete Design by Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain
3.	R. Park and T. Pauley, 'Reinforced Concrete Design', Wiley publication.

REFERENCE IS CODES	
Sl. No.	**Name**
1.	IS: 456:2000,"Indian Standard for Plain and reinforced concrete – code of practice"
2.	SP: 16 Design Aid to IS 456
3.	IS: 1343-1980, "Indian Standard Prestressed Concrete — code of practice."
4.	IS: 2911-2010, "Design and construction of pile foundations".

Web references:

1. https://archive.nptel.ac.in/courses/105/105/105105105/

Course Name: Foundation Engineering					
Course Code: CIV3103					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3103. 1. Apply knowledge of mathematics, science, engineering fundamentals, principles of soil mechanics to analyze retaining walls, stability of slopes and foundations (shallow and deep) for bearing capacity and settlement.

CIV3103. 2. Estimate various pressures (due to soil, surcharge and water) acting on retaining wall and its stability against different modes of failure.

CIV3103. 3. Illustrate various methods, types of sampler and samples, sub-soil investigation report related to site investigation to carry out geotechnical analysis.

CIV3103. 4. Interpret the stability of finite and infinite slopes.

CIV3103. 5. Estimate the bearing capacity and settlement of shallow foundations.

CIV3103. 6. Predict the load carrying capacity of individual pile, pile group and group settlement under different soil conditions.

Module – I (10 hrs.)
Earth Pressure & Stability of Retaining Walls: Introduction, earth pressure under at-rest condition, active and passive pressures, Rankine's and Coulomb's theory, total pressure on retaining wall under different conditions, stability checks for retaining wall against overturning, sliding and bearing capacity failure.

Module – II (10 hrs.)
Subsurface Exploration & Slope Stability Analysis: Introduction, objectives of exploration, planning of exploration program, methods of boring and sampling, in-situ tests: SPT, SCPT, DCPT, PLT, bore log, soil report, stability of earth slopes, finite and infinite slopes, stability of cohesive slopes under undrained condition, Taylor's stability number, stability analysis by Ordinary or Swedish or Fellenius method of slices.

Module – III (10 hrs.)
Shallow Foundation: Introduction, bearing capacity, factors affecting bearing capacity, modes of failures, methods for determining bearing capacity of soils, allowable bearing pressure and settlement analysis, immediate and consolidation settlements, rigidity and depth factor corrections, settlement values as per IS code recommendations.

Module – IV (10 hrs.)
Deep Foundation: Pile foundation, types of piles, individual pile capacity under vertical loading, static and dynamic formulae, capacity and settlement of pile group, negative skin friction, pile load test, lateral load capacity of piles.

RECOMMENDED BOOKS:

TEXT BOOKS:	
Sl. No.	**Name**
1.	V.N.S. Murthy, '*Textbook of Soil Mechanics and Foundation Engineering'* (Geotechnical Engineering Series), CBS Publishers and Distributors Pvt. Ltd.
2.	G. Ranjan and A. S. R. Rao, '*Basic and Applied Soil Mechanics*', New Age International Pvt. Ltd.

REFERENCE BOOKS:	
Sl. No.	**Name**
1.	J. E. Bowels, '*Foundation Analysis & Design'*, McGraw-Hill Book Company.
2.	N. Sivakugan, and B. M. Das, '*Geotechnical Engineering – A Practical Problem Solving Approach*', J. Ross Publishing.
3.	B.M. Das, '*Principles of Foundation Engineering*', Thomson Brooks / Cole.
4.	B. C. Punmia and A. K. Jain, '*Soil Mechanics and Foundations*', Laxmi Publications (P) Ltd.
5.	A. Singh and P. Rastogi, '*Modern Geotechnical Engineering*', CBS Publishers & Distributors.

CODES:	
Sl. No.	**Name**
1.	IS: 2131 – 1981 (Reaffirmed 2002), '*Method for Standard Penetration Test for Soils*', Bureau of Indian Standards, New Delhi.
2.	IS: 4968 (Part – I) – 1976 (Reaffirmed 2007), '*Method for subsurface sounding for soils - Dynamic method using 50 mm cone without bentonite slurry*', Bureau of Indian Standards, New Delhi.
3.	IS: 4968 (Part – II) – 1976 (Reaffirmed 2007), '*Method for subsurface sounding for soils: Dynamic method using cone and bentonite slurry*', Bureau of Indian Standards, New Delhi.
4.	IS: 4968 (Part – III) – 1976 (Reaffirmed 2007), '*Method for subsurface sounding for soils: Static Cone Penetration Test*', Bureau of Indian Standards, New Delhi.
5.	IS: 1888 – 1982 (Reaffirmed 2002), '*Method of Load Test on Soils*', Bureau of Indian Standards, New Delhi.
6.	IS: 6403 – 1981 (Reaffirmed 2002), '*Code of Practice for determination of Bearing Capacity of Shallow Foundations*', Bureau of Indian Standards, New Delhi.
7.	IS: 2911 (Part I to IV) – 2010, '*Code of Practice for Design and Construction of Pile Foundations*', Bureau of Indian Standards, New Delhi.
8.	IS: 8009 (Part – I) – 1976 (Reaffirmed 2003), '*Code of Practice for calculation of Settlement of Foundations, Part – I: Shallow Foundations subjected to Symmetrical Static Vertical Loads*', Bureau of Indian Standards, New Delhi.
9.	IS: 8009 (Part – II) – 1980 (Reaffirmed 2006), '*Code of Practice for calculation of Settlement of Foundations, Part – II: Deep Foundations subjected to Symmetrical Static Vertical Loads*', Bureau of Indian Standards, New Delhi.

Web references:

1. https://archive.nptel.ac.in/courses/105/105/105105176/
2. https://nptel.ac.in/courses/105105185
3. https://www.digimat.in/nptel/courses/video/105105039/L10.html

Course Title: Data Structure and RDBMS					
Course Code: CSE3106					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcomes:

After completion of the course, students will be able to:

CSE3106.1: Analyze and remember the basics of data structures along with terminology, features, classifications, and characteristics embodied in database systems.

CSE3106.2: Understand the significance and utility of different data structures and the context of their application.

CSE3106.3: Evaluate an understanding of the relational data model.

CSE3106.4: Analyze and remember the behaviour of different data structures in algorithms.

CSE3106.5: Analyze and apply using SQL and relational algebra, solutions to a broad range of query and data update problems.

CSE3106.6: Evaluate different types of solutions (e.g. sorting in data structure, complex querying in dbms) to the same problem.

Module I: [12L] Linear Data Structures

Singly Linked List- Insertion at the beginning, at the end, and any position of the List. Deletion by value, by position: beginning, end, and any position of the List Stack and Queue: Both array and Linked Representation, Circular queue using array only. Application of stack: Infix to postfix conversion, Evaluation of postfix expression.

Module II: [12L] Recursion, Non-Linear Data Structures

Recursion: Design of Recursive algorithm. Non-Linear Data Structures: Trees: Binary Trees: Array and Linked representation, Binary tree Traversal Techniques, reconstruction of binary tree using traversal sequence. Binary Search Trees - Insertion and Deletion algorithms. Sorting Algorithms: Bubble sort, Insertion sort, Selection sort, Quick sort and their comparison. Searching Algorithms: Linear search, Binary search, and their comparison.

Module III: [12L] Database Concept

Introduction to Database Concepts, File Processing System and Database Management System, DBMS Architecture, and Data Independence. Data Model: Basic Concepts, Entity-Relationship Diagram, Keys, Cardinality, Weak Entity Set. Introduction to relational algebra & SQL: Operators like select, project, rename, Cartesian product, join, union, intersect, minus, DDL, and DML.

Module IV: [12L] Relational Database Design

Relational Database Design: Functional Dependencies, Normalization: Different anomalies in database designing 1NF, 2NF, 3NF, and BCNF. Introduction to Transaction Processing Concepts: ACID properties, Serializability and Recoverability.

Text Books
1. Data Structures – Seymour Lipschutz
2. Data Structures and Program Design in C – Kruse Robert L., Robert Kruse, ClTondo
3. Fundamentals of Database Systems – Elmasri Ramez and Navathe Shamkant
4. Database System Concepts – A. Silberschatz, H.F Korth, S.Sudarshan

Reference Books

1. Data Structures using C – Tanenbaum A. S, Langsam Y., Augenstein M. J
2. The Art of Computer Programming – Donald E. Knuth
3. Introduction to Database Management – Date C. J.

Course Name: Air & Noise Pollution					
Course Code: CIV3131					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3131. 1. Understand the basic concepts of environmental pollution. **[*Understanding (LO)*]**

CIV3131. 2. Design and demonstrate the use of pollution control equipment. **[*Create (HO)*]**

CIV3131. 3. Ability to identify air pollution problems. **[*Understanding (LO)*]**

CIV3131. 4. Understand industry specific treatment technologies. **[*Apply (IO)*]**

CIV3131. 5. Assess the various aspects of noise pollution and understand the different environmental laws. **[*Apply (IO)*]**

CIV3131.6. Understand various ways to manage solid waste. **[*Understanding (LO)*]**

Module – I (10 hrs.)
Introduction: Overview on Environmental Pollution-Air, Water, Solid waste. Concept of Pollution control- Air, Water, Solid waste.

Air Pollution: Air Pollutants: Types- Primary and secondary pollutant, Sources, Effects; Air quality standard. Meteorological aspect of Air Pollution: Lapse Rate, Inversion, Plume Pattern; Air Pollution Dispersion Model: Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height.

Module – II (12 hrs.)
Air pollution Control: Self cleansing mechanism of the environment; Dilution method; Engineered Control of Air Pollutants: Control of the particulates, Control of Gaseous Pollutants, Control of Air pollution from Automobiles.

Industrial Water pollution control: Characteristics of various industrial waste water, physical and chemical. Specific treatment technologies- physical, chemical and biological, Management of treatment plant sludge.

Module – III (8 hrs.)
Noise Pollution: Definition; Sources of noise, characteristics of noise; Sound Pressure, Power and Intensity level; Noise Measurement: Relationships among Pressure, Power and Intensity Levels, Frequency Band, Decibel Addition, Measures of community Noise i.e. LN, Leq, Ldn, Lnp; strategies for noise pollution control.
Global Environmental Issues: Ozone Depletion, Acid Rain, Global Warming-Green House Effects, Eutrophication, photochemical smog.

Module – IV (10 hrs.)
Administrative Control on Environment: Functions of Central and State Pollution Control Boards; Environmental Clearance Process for Industries and Infrastructural Projects.
Environmental Laws: Relevant Water Acts, Air Acts, Motor Vehicle Acts, solid and hazardous waste acts.

Urban Waste Management: Introduction, Source, Quality and composition of municipal solid waste, Collection, transfer, processing and transportation, Method of disposal- Sanitary landfill, Composting, Incineration, Pyrolysis, Anaerobic digestion and Energy recovery.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Environmental Engineering, Vol. II , S. K. Garg, Khanna Publishers
2.	Sewage Treatment & Disposal And Wastewater Engg, P. N. Modi, Standard Book House

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Water Supply, Waste Disposal and Environmental Pollution Engineering, A. K. Chatterjee, Khanna Publishers
2.	Introduction to Environmental Engineering and Science, G. Masters, W. Ela, PHI
3.	Environmental Engineering: A Design Approach, A. Sincero, G. Sincero, PHI

Course Name: Structural Dynamics and Earthquake Engineering					
Course Code: CIV3132					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3132. 1. Understand the basics of engineering seismology, including ground motion characteristics. [*Understanding* (*LO*)]

CIV3132. 2. Find response of free and force vibration (harmonic, periodic and transient) of SDOF system. [Remembering (*LO*)]

CIV3132. 3. Adopt suitable models for different structures and determine the seismic loads on the same following codal provisions. *[Creating (HO)]*

CIV3132. 4. Design and detail of seismic resistance structures. *[Creating (HO)]*

CIV3132. 5. Identify common causes of damages in structures subjected to earthquake shaking. *[Applying (IO)]*

CIV3132. 6. Comprehend the principles of seismic protective systems such as base isolation and passive energy dissipation systems. [*Understand* (*LO*)]

Module – I (10 hrs.)
Theory of vibration: Introduction, Fundamentals: Elastic Rebound Theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc. Seismograph, Seismic zoning. Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system

Module – II (10 hrs.)
Response of single degree freedom system due to harmonic loading: Undamped Harmonic excitation, Damped harmonic excitation.

Response due to Transient loading: Duhamel's Integral, Response due to constant force, rectangular load, Introduction to numerical evaluation of Duhamel's integral of un-damped system.

Response Spectrum – construction, PSV, PSA, SD, characteristics, tripartite plot, design spectrum

Module – III (10 hrs.)
Principles of Earthquake Resistant Design: Terminology, General Principles and Philosophy of earth quake resistant design, Methods of analysis, Equivalent lateral force method and response spectrum method of analysis for multistoried building as per Indian Standard Code of Practice.

Module – IV (10 hrs.)
Identification of Seismic Damages in R.C. buildings – soft storey failure, floating columns, effect of other structural irregularities
Earthquake Resistant Design of Masonry Buildings.
Ductile detailing considerations as per IS 13920.
Overview of earthquake protective systems.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Structural Dynamics (Theory and computation), Mario Paz, CBS Publishers and Distributor.
2.	Dynamics of Structures, Clough and Penzien, Computers & Structures, Inc. 1995 University Ave. Berkeley, CA 94704USA

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Dynamics of Structure (Theory and application to earthquake engineering), A. K. Chopra, Pearson Education.
2.	Dynamics of Structures, Ashok K. Jain, Pearson Education.
3.	Earthquake resistant design of Structures, Agarwal and Shrikhande, PHI.
4.	Earthquake-resistant design of structures, S.K. Duggal, Oxford University Press.
5.	IS1893: PartI, 2002, IS 13920:1993, IS4326:1993.

Course Name: Rock Mechanics					
Course Code: CIV3133					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:
After going through this course, the students will be able to:

CIV3133. 1. Apply knowledge of mathematics, science and engineering fundamentals to characterize rock masses and assess the stability of foundation and slope constructed in rock.

CIV3133. 2. Identify rock on the basis of its characteristics.

CIV3133. 3. Interpret type of rock on the basis of field exploration.

CIV3133. 4. Illustrate nature of rock mass and its engineering properties.

CIV3133. 5. Estimate strength and failure of rocks by different theories.

CIV3133. 6. Analyze and design foundations and slopes on rock.

Module – I (10 hrs.)
Introduction to rock mechanics: Introduction, relevance of rock mechanics, application of rock mechanics, classification of intact rock, compressive strength of weak rock, origins of shear strength in intact rock, shear strength parameters, stability of a cut slope in weak rock, discontinuities in rock masses, importance of discontinuities to stability, load changes, different methods of rock exploration, rock exploration by direct penetration, methods of geophysical prospecting, in-situ tests on rock.

Module – II (10 hrs.)
Characteristics of rock masses: Introduction, earth stresses, faults, folding, rock textures, fabrics and effect on properties, rock joints and other discontinuities, Major geological structures.
Physical and Mechanical Properties of Rocks: Introduction, porosity, density, moisture content, degree of saturation, permeability, electrical and thermal properties, swelling, anisotropy, durability, compressive and tensile strength of rock, elasticity, plasticity, Poisson's ratio, hardness.

Module – III (10 hrs.)
Strength and Failure of Rocks: Types of failure, yield criterion or failure theories, types of failures in rock material, Griffith's theory of fracture, initiation in the Rock Mass, relation between grain size and strength of rock.
Improvement in Properties of Rock Mass: Introduction, grouting, grouting materials, grouting operations, methods of grouting, mechanism of rock bolting, principles of design, cable, anchorage.

Module – IV (10 hrs.)
Stability of Slopes and Foundations on Rock: Introduction, foundation on rocks, shallow foundations, pile foundations, foundation construction, allowable bearing pressure.
Stability of rock slopes, modes of failure, methods of analysis, prevention and control of rock slope failure.

RECOMMENDED BOOKS:

TEXT BOOKS:	
Sl. No.	**Name**
1.	Steve Hencher, '*Practical Rock Mechanics*', CRC Press (Taylor and Francis Group).
2.	Debasis Deb and Abhiram Kumar Verma, '*Fundamentals and Applications of Rock Mechanics*', PHI.
3.	Richard E. Goodman, '*Introduction to Rock Mechanics*', Wiley.
4.	B. P. Verma, '*Engineering Geology and Rock Mechanics*', Khanna Publishers.
5.	J. C. Jaeger, Neville. G. W. Cook and R. Zimmermann, '*Fundamentals of Rock Mechanics*', Wiley Blackwell.

REFERENCE BOOKS:	
Sl. No.	**Name**
1.	Nagaratnam Sivakugan, Sanjay Kumar Shukla and Braja M. Das, '*Rock Mechanics: An Introduction*', CRC Press (Taylor and Francis Group).
2.	Lianyang Zhang, '*Engineering Properties of Rocks*: *An Introduction*', Butterworth-Heinemann.
3.	Charles Jaegar, '*Rocks Mechanics and Engineering*', Cambridge University Press.

Web references:

1. https://archive.nptel.ac.in/courses/105/105/105105212/
2. https://archive.nptel.ac.in/courses/105/107/105107208/
3. https://nptel.ac.in/courses/105105212

Course Name: Offshore Structures					
Course Code: CIV3134					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3134.1 Describe the basic concept of wave force, wave formulation sand determine the forces due to ocean waves [*Remember* (*LO*), *Evaluate* (*HO*)]

CIV3134.2 Estimate the various components of operational loads on offshore structures [*Evaluate (HO)*]

CIV3134.3 Classify the different types of offshore structures [*Understand* (*LO*)]

CIV3134.4 Analysis of various structural elements of offshore structures [*Analyze (IO)*]

CIV3134.5 Understand the basic concepts and necessary requirements for construction of offshore structures and marine pipelines. [*Understand* (*LO*)]

CIV3134.6 Design of offshore structures like platform, helipads, jackets, towers etc. [*Create* (*HO*)]

Module – I (14 hrs.)

WAVE THEORIES: Wave generation process, small, finite amplitude and nonlinear wave theories.

FORCES ON OFFSHORE STRUCTURES: Wind forces, wave forces on small bodies and large bodies - current forces - Morison equation.

Module – II (10 hrs.)

OFFSHORE SOIL AND STRUCTURE MODELLING: Different types of offshore structures, foundation modeling, fixed jacket platform structural modeling.

Module – III (10 hrs.)

ANALYSIS OF OFFSHORE STRUCTURES: Static method of analysis, foundation analysis and dynamics of offshore structures.

Module – IV (10 hrs.)

DESIGN OF OFFSHORE STRUCTURES: Design of platforms, helipads, Jacket tower, analysis and design of mooring cables and pipelines.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name of the Books
1.	API RP 2A-WSD, Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design - API Publishing Services, 2005
2.	Chakrabarti, S.K., Handbook of Offshore Engineering by, Elsevier, 2005.
3.	Chakrabarti, S.K., Hydrodynamics of Offshore Structures, WIT press, 2001.
4.	Dawson.T.H., Offshore Structural Engineering, Prentice Hall Inc Englewood Cliffs, N.J. 1983.
5.	James F. Wilson, Dynamics of Offshore Structures, John Wiley & Sons, Inc, 2003.
6.	Reddy, D.V. and Arockiasamy, M., Offshore Structures, Vol.1 and Vol.2, Krieger Publishing Company, 1991.
7.	Reddy.D.V and Swamidas A.S.J.,Essential of offshore structures.CRC Press.2013
8.	Turgut Sarpkaya, Wave Forces on Offshore Structures, Cambridge University Press, 2010.

Course Name: Repair & Rehabilitation of Structures					
Course Code: CIV3121					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3121.1. Identify various damages to concrete structures. [*Understanding* (*LO*)]

CIV3121.2. Predict damage assessment of any building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration. [*Applying* (*IO*)]

CIV3121.3. Operate a detailed knowledge of the concrete repair industry equipped with variety of repair materials and techniques. [*Analyzing* (*IO*)]

CIV3121.4. Discover various types of newly developed repair materials in the process repair and rehabilitation of structures. [Understanding (*LO*)]

CIV3121.5.Examine and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures. [*Applying* (*IO*)]

CIV3121. 6. Illustrate various types of damages on steel and RCC structures and various repair and retrofitting techniques loads applied on various structural. [*Applying (IO)*]

Module – I *(12 hrs.)*
Durability and Deterioration of Structures:
Introduction to repair, rehabilitation and retrofitting of structures.
Causes of Deterioration:
Physical causes - Weathering action, creep, shrinkage, temperature effect, fire damage, foundation settlement, accidental loading.
Chemical causes - Chloride and salt attack, sulphate attack, alkali reaction, biological attack.
Corrosion effect on RCC structures:
Corrosion process and mechanism, damage due to corrosion, causes and prevention of corrosion.
Structural health monitoring through instrumentation, introduction of retrofitting of steel structure.

Module – II *(12 hrs.)*
Damage Assessment & Repair Materials:
Damage Assessment:
Visual Investigation, Site survey, workmanship, cracks and pattern of cracking, erosion, spalling, joint leakage and seepage non-destructive, semi-destructive and destructive testing.
Repair Materials:
Function of repair materials, chemical admixtures, patching, sealing, watering proofing and bonding materials.

Special type of repair materials:

Chemical admixtures, mineral admixtures, epoxy resin, polymeric materials, fiber reinforcement, ferro-cement.

Module – III *(10 hrs.)*
Planning for repair: Identification of the causes for deterioration, planning for the repair methods.
Repair of cracks and damages: Repair procedure, methods of repair, concrete removal and preparation for repair, guniting and shotcreting, stitching, routing, sealing, polymer impregnation, vacuum impregnation, external stressing, bonding.
Restoration of original strength: Strengthening of RC members.

Module – IV *(10 hrs.)*
Techniques for Retrofitting:

Introduction, structural concrete strengthening, strengthening with external reinforcement, external post tensioning, section enlargement, seismic rehabilitation of existing building.

Retrofitting of RCC structures:

Structural deficiencies retrofit strategies.

Retrofitting of foundations:

Identification of the deficiencies, methods of execution.

Retrofitting using FRP composites:

Strengthening of masonry walls, RCC beams, columns.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Bhattacharjee J. Concrete Structures: *Repair, Rehabilitation and Retrofitting*, CBS Publishers & Distribution Pvt. Ltd.
2.	Gambhir M.L. *Concrete Technology- Theory & Practice,* Tata McGraw Hill Education Pvt. Ltd.
3.	*Handbook on Repair & Rehabilitation of R.C.C. Buildings,* Central Public Works Department.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Grantham M.G. *Concrete Repair- A practical guide*, Taylor & Francis Pvt. Ltd.
2.	Bungey J.H., Millard S.G. & Grantham M.G., *Testing of Concrete in structures*, 4th Edition, Taylor and Francis Publishing House, London and New York, 2006.
3.	*Handbook on causes and prevention of cracks in buildings,* Bureau of Indian Standards

Web references:

1. https://archive.nptel.ac.in/courses/105/105/105105213/

2. https://archive.nptel.ac.in/courses/105/106/105106202/

Course Name: Sustainable Construction Methods					
Course Code: CIV3122					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3122. 1. Discover an understanding on sustainability and appraise appropriateness and sustainability of materials for construction projects.   [*Understanding* (*LO*)]

CIV3122.2. Generalize the green building rating systems and its contribution to sustainability.
                                                                                    [*Understanding* (*LO*)]

CIV3122.3. Examine the properties of common construction materials and understand the transition toward sustainable materials, along with their behaviors under different environments, short- or long-term.   [*Applying* (*IO*)]

CIV3122. 4. Establish the sustainable materials based on the international standard practices and certification   [*Applying* (*IO*)]

CIVL3122.5. Establish the understanding of building materials and construction technique that are sustainable and energy efficient and apply alternate building materials in the construction of low-cost house.   [*Applying* (*IO*)]

CIV3122.6. Prepare the basic need of sustainability in construction sector along with enhance knowledge on green buildings and it's international and national guidelines; in-depth knowledge on application of cost-effective and sustainable materials in building low-cost house.   [*Applying (IO)*]

Module – I (11 hrs.)

Issues in sustainability:

Principles of Sustainable Construction; Economic development along with energy use and carbon emission, energy conservation and renewable energy, energy and construction.

Alternative construction materials, sustainability and resources of construction materials.

Module – II (11 hrs.)

Sustainable development:

LEED and GRIHA rating systems, alternative materials for brick, mortar and concrete. Alternative roofing system, curved roof surfaces.

Green building and energy conservation, Alternative construction technologies.

Module – III (10 hrs.)

Renewable construction materials:

Mud block, stone block, bamboo based materials, pre-cast construction materials.

Alternative structural materials, timber structures, timber and steel.

Low cost housing.

Module – IV (12 hrs.)

Alternative construction materials:

Lime stone, pozzolana, fly ash, rice husk, blast furnace slag.

Lime pozzolana cement, Lime pozzolana mortar, lime fly ash mortar.

Stone construction, rubble masonry.

Low cost earthquake resistance building.

Cast-in-situ roofs.

Utilization of "Construction and demolition" wastes, filler slab.

Application of Stainless Steel.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name
1.	Jason F. McLennan, *The Philosophy of Sustainable Design*, Ecotone Publishing co., 2004.
2.	Mike Montoya, *Green Building Fundamental*, Pearson, 2nd edition, 2010.

REFERENCE BOOKS	
Sl. No.	Name
1.	Charles J. Kibert, *Sustainable Construction - Green Building Design and Delivery*, John Wiley & Sons, 2nd edition, 2008.
2.	Regina Leffers, *Sustainable Construction and Design*, Prentice Hall, 2009.

Web references:
1. https://onlinecourses.swayam2.ac.in/arp19_ap75/preview

Course Title : Indian Constitution and Civil Society					
Course Code : INC3016					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	0

Course Outcomes:

After the completion of the course, students will be able to

- analyse the historical, political and philosophical context behind the Indian Constitution-making process
- appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions
- understand the contemporaneity and application of the Indian Constitution in present times
- critique the contexts for constitutional amendments in consonance with changing times and society
- establish the relationship between the Indian Constitution and civil society at the collective as well as the individual levels
- consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work

Module 1- 6L
Introduction to the Constitution of India- Historical Background
Making of Indian Constitution -the process of framing the constitution, the constituent assembly
Module II- 6L
Salient Features of the Indian constitution
Comparison with the constitutions of other countries
Module III- 6L
Relevance of the Constitution of India
Constitution and Governance
Constitution and Judiciary
Constitution and Parliament- Constitutional amendments
Module IV-6L
Constitution and Society-democracy, secularism, justice
Constitution and the individual citizen- Fundamental Rights, Directive Principles of state policy and Fundamental Duties

Reference Books
C. M. Elliot, (ed.), Civil Society and Democracy, OUP, Oxford, 20012.
David Held et.al (ed), The Idea of the Modern State, Open Univ. Press, Bristol, 1993
Neera Chandoke, State and Civil Society, Sage, Delhi, 19953

Course Name: R.C.C. Design And Detailing Laboratory Course Code: CIV3152					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**1.5**

Course Content:

Analysis, design and detailing of multistoried R.C.C. framed building with brick wall.

References:

I.S- 456-2000, SP 34, SP 16, I.S. 875 (part I and II) – 1987, I.S. 875 (part III) – 2015, IS 1893-2016

Standard text books of RCC design.

Course Title : Soil Mechanics Laboratory - II					
Course Code : CIV3153					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcomes:

After going through this course, the students will be able to:

CIV3153.1. To perform various lab/field tests by following the instructions. [*Imitation*]

CIV3153.2. To execute tests ethically in diverse teams under multidisciplinary environment. [*Manipulation*]

CIV3153.3. To excel expertly in the determination of the soil properties from the completed laboratory tests. [*Precision*]

CIV3153.4.To create soil lab test report efficiently. [*Articulation*]

CIV3153.5. To develop leadership and communication skills, and engage in life-long leaning. [*Naturalization*]

List of Experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	Determination of compaction characteristics of soil by standard proctor compaction test.	CO1, CO2, CO3, CO4, CO5
2.	Determination of compressibility characteristics of soil by oedometer test.	CO1, CO2, CO3, CO4, CO5
3.	Determination of undrained shear strength of soil by vane shear test.	CO1, CO2, CO3, CO4, CO5
4.	Determination of shear strength parameters of soil by direct shear test.	CO1, CO2, CO3, CO4, CO5
5.	Determination of unconfined compressive strength of soil by unconfined compression test.	CO1, CO2, CO3, CO4, CO5
6.	Determination of shear strength parameters of soil by unconsolidated undrained triaxial test.	CO1, CO2, CO3, CO4, CO5
7.	Determination of California Bearing Ratio (CBR) of soil.	CO1, CO2, CO3, CO4, CO5

Web references:
1. https://nptel.ac.in/courses/105101160
2. https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ce36/
3. https://elearn.nptel.ac.in/shop/nptel/geotechnical-engineering-laboratory/
4. https://www.vlab.co.in/broad-area-civil-engineering

Course Name: Environmental Engineering Laboratory					
Course Code: CIV3154					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	3	3	1.5

Course Outcomes:

After going through this course, the students will be able to:

CIV3154.1. Perform various lab tests by following the instructions. [*Imitation*]

CIV3154.2. Execute tests ethically in diverse teams under multidisciplinary environment. [*Manipulation*]

CIV3154.3. Estimate the different important water quality parameters, and understand their relevance to human health and in treatment processes. [*Precision*]

CIV3154.4. Understand the permissible limits of different water and waste-water quality parameter as per the standards. [Co*mprehension*]

CIV3154.5. Develop leadership and communication skills, and engage in life-long learning. [*Naturalization*]

List of experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	Determination of Color & Turbidity in an aqueous sample.	CO1, CO2, CO3, CO4, CO5
2.	Determination of pH and various solids (Total solids, Total suspended solids, Total dissolved solids and Volatile Solids) in an aqueous sample.	CO1, CO2, CO3, CO4, CO5
3.	Determination of electrical conductivity and chloride in an aqueous sample.	CO1, CO2, CO3, CO4, CO5
4.	Determination of Total & Phenolphthalein alkalinity in an aqueous sample and speciation of different alkalinities.	CO1, CO2, CO3, CO4, CO5
5.	Determination of Total, Magnesium and Calcium hardness in an aqueous solution.	CO1, CO2, CO3, CO4, CO5
6.	Determination of concentration of fluorides in an aqueous solution.	CO1, CO2, CO3, CO4, CO5
7.	Determination of Iron in an aqueous sample.	CO1, CO2, CO3, CO4, CO5
8.	Determination of the optimum coagulant dose for a given sample of water through Jar test.	CO1, CO2, CO3, CO4, CO5

9.	Determination of chlorine demand of a contaminated water sample.	CO1, CO2, CO3, CO4, CO5
10.	Determination of Dissolve oxygen (DO) in a given wastewater sample.	CO1, CO2, CO3, CO4, CO5
11.	Determination of chemical oxygen demand for a given wastewater sample.	CO1, CO2, CO3, CO4, CO5
12.	Determination of biochemical oxygen demand (BOD_5 at 20°C) for a given wastewater sample.	CO1, CO2, CO3, CO4, CO5
13.	Determination of bacteriological quality of water: presumptive test, confirmative test and determination of Most Probable Number (MPN).	CO1, CO2, CO3, CO4, CO5

Web references:

1. Welcome to Virtual Labs - A MHRD Govt of India Initiative (vlabs.ac.in)

Course Name: RDBMS Laboratory					
Course Code: CSE3156					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	3	3	1.5

Course outcomes:

CSE3156.1. Identify entities and attributes of each entity from a real life system and understand the relationships between different entities.

CSE3156.2. Understanding different types of constraints and applying them to maintain consistency and data integrity.

CSE3156.3. Build tables for each entity with appropriate field level constraints using SQL DDL following third normal form and modifying the table structure already containing data with constraints.

CSE3156.4. Manipulate data in the table using SQL DML maintaining all constraints already imposed.

CSE3156.5. Query data from the RDBMS using simple query commands and joining (inner, left outer and right outer join) tables.

CSE3156.6. Query data from RDBMS using subqueries and accessing individual record from table using cursor and PL/SQL statements.

Syllabus:

Experiments on Database on RDBMS Platform (Oracle): DDL Commands: Creating Tables along with constraints like: Primary Key, Foreign Key, unique, Not Null, Check. Altering Table Structure like adding and modifying constraints, adding and modifying column data types, etc.

DML: Inserting rows, Updating rows, Deleting rows

SQL Query: Cartesian Product, All types of Join, Union, Intersect, Minus, Single Row functions, multiple row functions using GROUP BY clause, ORDER BY Clause, Nested Sub-Queries

Introduction to PL/SQL: Programming Language Constructs in PL SQL like variable declaration, Conditional Statements, different types of loop structures, functions, etc.

Programming using Cursors.

Books:
DBMS Laboratory
Title: SQL, PL/SQL: The Programming Language Of Oracle (With CD-ROM) (English) 4th Revised Edition
Author: Ivan Bayross
Publisher: BPB Publications

DETAILED CURRICULUM

3rd Year 2nd Semester

Course Name: Design of Steel Structures					
Course Code: CIV3201					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course outcome:
After going through this course, the students will be able to:

CIVL3201. 1. Understand the basic concepts of Limit State Method along with the structural properties of steel.   [*Understand* (*LO*)]
CIVL3201. 2. Analyse and design the simple and moment-resistant connections, both bolted and welded.   [*Analyze* (*IO*)]
CIVL3201. 3. Design of tension and compression members, struts and columns, beam-column and built-up columns along with base connection following Indian standard design guidelines.   [*Create* (*HO*)]
 CIVL3201. 4. Comprehend the differences between laterally supported and unsupported flexure members and design of the flexure members using Indian codes of practice.
                                                                                    [*Understand* (*LO*), *Create* (*HO*)]
CIVL3201. 5. Estimate shear force and bending moment on rolled and built up girders and design of Beams, Purlin, Plate Girder, Gantry Girder etc. following Indian standard design guidelines.   [*Evaluate* (*HO*)]
CIVL3201. 6. Develop design document, GA and detail drawings of steel industrial factory shed, both manually and using software.   [*Create* (*HO*)]

Module – I (10 hrs.)

Materials and Specification: Rolled steel sections, mechanical properties of steel and their specifications for structural use. Codes of practices.
Structural connections: Bolted and welded connections: Introduction to different types of connectors, types of bolted and welded joints, assumptions, failure and efficiency of joints. Design of bolted and welded connections for axial load, torsion and shear, tension and shear, interaction check. High strength friction grip bolted joints.

Module – II (11 hrs.)

Tension members: Working stress and limit state design of tension members, I.S code provisions, design rules, examples.
Compression members: Effective lengths about major and minor principal axes, I.S code provisions. i) Design of axially loaded compression member: Working stress and limit state design of axially loaded compression members using rolled steel and built up sections. Examples. ii) Design of beam – column: Design of rolled steel and built up columns under eccentric loading, design of lacing and batten plates. Design of column bases: Design of slab base, gusseted base, connection detailing.

Module – III (10 hrs.)

Beams: Working stress and limit state design in bending, compression and tension. Design of rolled steel sections, plated beams, concepts of curtailment of flanges.
Plate girders: Design of web, flanges and stiffeners. Splices and connections using bolts and welding.

Module – IV (11 hrs.)

Gantry system: Design gantry girder and gantry column considering I.S code provisions.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	N. Subramanian , "Design of steel structures", Oxford University Press
2.	A.S. Arya and J.L. Ajmani, " Design of steel structures", Nemchand and Bros.
3.	Limit State Design of Reinforced Concrete by P. C. Varghese
4.	S.K. Duggal, "Limit state design of steel structures (2nd edition)", McGraw Hill India, New Delhi.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	M.L. Gambhir , "Fundamentals of structural steel design", McGraw Hill India, New Delhi
2.	Karuna Moy Ghosh , "Analysis and design of steel structures, 2nd ed.", Prentice Hall,
3.	Steel Designers' Manual.

REFERENCE IS CODES	
Sl. No.	**Name**
1.	IS: 800 – 2007
2.	SP 6 (I) – 1964
3.	SP 38 – 1987

Web references:

https://archive.nptel.ac.in/courses/105/105/105105162/

Course Name: Water Resources Engineering					
Course Code: CIV3203					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3203. 1. Develop understanding about different components of the hydrological cycle. [*Understanding* (*LO*)]

CIV3203. 2. Estimate precipitation, runoff, infiltration, evaporation, ground water flow and peak floods. [*Applying* (*IO*)]

CIV3203. 3. Understand the value of probability and statistical analysis in deriving precipitation and stream flow data and hydrograph theories. [*Analyzing* (*IO*)]

CIV3203. 4. Impart the knowledge of irrigation techniques, efficiencies, optimal irrigation of the fields, consumptive water requirements of the crops and crop types. [*Evaluating* (*HO*)]

CIV3203. 5. Understand the distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals system. [*Evaluating* (*HO*)]

CIV3203. 6. Master the concept of water logging and drainage systems. [*Understanding* (*LO*)]

Module – I (10 hrs.)
Catchment area and Hydrologic cycle, Measurement of rainfall: Rain gauges, Estimation of missing rainfall data, checking of consistency, Optimum number of Rain gauges. Calculation of average rainfall over area – different methods, Frequency analysis of rainfall intensity duration curve. Rainfall mass curve, hyetograph. Examples.

Module – II (10 hrs.)
Evaporation, Evapo-transpiration and Infiltration: Processes, Factors affecting runoff, estimation of run-off, rainfall runoff relationship.

Stream flow measurement: Direct and indirect methods, Examples. Stage discharge relationships, back water effect, unsteady flow effect.

Hydrographs: characteristics: Base flow separation. Unit Hydrographs. Derivation of unit hydrographs, S-curve.

Module – III (10 hrs.)
Types of Irrigation systems, methods of irrigation: Water requirements of crops: Crop period or Base period, Duty & Delta of a crop, relation between Duty & Delta, Duty at various places, flow Duty & quantity Duty, factors affecting Duty, measures for improving Duty of water, crop seasons. Examples.

Module – IV (10 hrs.)
Canal Irrigation: Introduction, classification of irrigation canals, efficient section, certain important definitions, Time factor, Capacity factor, full supply coefficient, Nominal duty, Channel losses, Examples.

Water logging and drainage: Causes, effects and prevention of waterlogging. Type of drains-open drains and closed drains (introduction only), Discharge and spacing of closed drains. Examples.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name
1.	K Subramanya, '*Engineering Hydrology*', Mc Graw Hill Education, New Delhi.

REFERENCE BOOKS	
Sl. No.	Name
1.	Dr. P.N Modi, '*Irrigation, Water Resource & Water Power Engineering*', Standard Book House-New Delhi.
2.	P. Jaya Ram Reddy, '*A Text Book of Hydrology*', Laxmi Publications-New Delhi.
3.	G.L. Asawa, '*Irrigation and Water Resources Engineering*', New Age International Publishers, New Delhi.
4.	S.K. Garg, '*Irrigation Engineering and Hydraulic structures*', Khanna Publishers, NewDelhi.

Web references:

1. https://archive.nptel.ac.in/courses/105/105/105105110/
2. https://archive.nptel.ac.in/courses/105/104/105104103/

Course Name : Economics for Engineers					
Course Code: HUM3201					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	0	0	3	3

Course Outcomes:

After the completion of the course, students will be able to

HUM3201.1. Evaluate a project and estimate the total cost of the project.

HUM3201.2. Apply financial analytical methodologies to prepare a report regarding the financialperformance of an organisation.

HUM3201.3. Participate actively in an organisation's capital budgeting process.

HUM3201.4. provide vital inputs regarding the pricing of a product.

HUM3201.5. Apply the knowledge of the interplay of various economic variables and indicators in the workplace.

HUM3201.6. Provide insight about different accounting concepts and apply broader concepts likecosts, revenues, assets, liabilities, capital, profit, investment and interest.

Module 1: (6L)

Market: Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolisticand Oligopoly market.

The basic concept of economics – needs, wants, utility.

National Income- GDP, GNP. Demand & Supply, Law of demand, Role of demand and supplyin price determination, Price Elasticity.

Inflation: meaning, reasons, etc.

Module II: (4L)

Business: Types of business, Proprietorship, Partnership, Joint-stock company, and cooperativesociety – their characteristics.

Banking: role of commercial banks; credit and its importance in industrial functioning. Role ofcentral bank: Reserve Bank of India.

International Business or Trade Environment.

Module III: (14L)

Financial Accounting-Journals. Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet.Financial Statement Analysis (Ratio and Cash Flow analysis).

Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs.Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis.

Marginal Cost based decisions.

Module IV: (12L)

Time Value of Money: Present and Future Value, Annuity, Perpetuity.Equity and Debt, Cost of Capital.

Capital Budgeting: Methods of project appraisal - average rate of return - payback period - discounted cash flow method: net present value, benefit cost ratio, internal rate of return.

Depreciation and its types, Replacement Analysis, Sensitivity Analysis.

Suggested Readings:

1. R. Narayanswami, *Financial Accounting- A Managerial Perspective.* Prentice-Hall ofIndia Private Limited. New Delhi
2. Horne, James C Van, *Fundamentals of Financial Management*. Prentice-Hall of IndiaPrivate Limited, New Delhi
3. H. L. Ahuja., *Modern Economic Theory*. S. Chand. New Delhi.
4. Newman, Donald G., Eschenbach, Ted G., and Lavelle, Jerome P. *Engineering EconomicAnalysis.* New York: Oxford University Press. 2012.

Course Name: Prestressed Concrete Structures					
Course Code: CIV3231					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3231.1 Understand the general and mechanical behavior of prestressed concrete. [*Remember* (*LO*)]

CIV3231.2 Perform analysis and design of prestressed concrete members and connections. [*Analyze (IO)*]

CIV3231.3 Identify and interpret the appropriate relevant design code. [*Evaluate (HO)*]

CIV3231.4 Understand the methods of the design and fabrication of prestressed concrete members. [*Evaluate (HO)*]

CIV3231.5 Perform an industry relevant design project in a team. [*Understand* (*LO*)]

CIV3231.6 Develop their professional and ethical issues and lifelong learning of the importance of prestressed concrete. [*Understand* (*LO*)]

Module – I (12 hrs.)

Introduction of Prestressed Concrete: Materials, Prestressing System, Advantages of Prestressing, Analysis of Prestress and Bending Stress, Losses

Deflections of Prestressed Concrete Members: Importance, Factors, Short term and Long term Deflection

Module – II (12 hrs.)

Shear and Torsional Resistance: Design of Shear Reinforcement, Design of Reinforcement for Torsion, Shear and Bending.

Limit State Design Criteria: Inadequacy of Elastic and Ultimate Load Methods, Criteria for Limit States, Strength and Serviceability.

Design of Prestressed Concrete Section: for Flexure by Lin and Magnel.

Module – III (10 hrs.)

Anchorage Zone Stresses in Post Tensioned Members: Stress Distribution in End Block, Anchorage Zone Reinforcement

Statically Indeterminate Structures: Advantages of Continuous Member, Effect of Prestressing,

Methods of Achieving Continuity and Method of Analysis of Secondary Moments

Module – IV (8 hrs.)

Composite Construction of Prestressed and In-situ Concrete: Types, Analysis of Stresses

Prestressed Concrete Poles and Sleepers: Design of Sections for Compression and Bending.

Introduction to Partial Prestressing.

RECOMMENDED BOOKS:

CODE: IS 1343:2012	
TEXT BOOKS	
Sl. No.	Name of the Books
1.	N. Krishna Raju, "Prestressed Concrete", Fourth Edition, McGraw Hill.
2.	N.C.Sinha and S.K.Roy, "Fundamentals of Prestressed Concrete", S. Chand Publishing.
3.	S. Ramamurtham, "Prestressed Concrete", Dhanpat Rai Books.
REFERENCE BOOK	
1.	T. Y. Lin and N. H. Burns, "Design of Prestressed Structures", Wiley Eastern Ltd.

Course Name: Solid and Hazardous Waste Management					
Course Code: CIV3232					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3232. 1. Review the components and characteristics of a solid waste management system. **[*Analyze (IO)*]**

CIV3232. 2. Identify the various collection, transfer and transport mechanisms of municipal solid waste management. **[*Understanding (LO)*]**

CIV3232. 3. Design and operate various processing, material and energy recovery facilities. **[*Create (HO)*]**

CIV3232. 4. Design and operate solid waste landfill. **[*Create (HO)*]**

CIV3232. 5. Identify the different industrial solid waste pollutants and their minimization and recovery technologies. **[*Analyze (IO)*]**

CIV3232. 6. Understand the processing and handling of hazardous and radio-active waste management. **[*Understanding (LO)*]**

Module – I (8 hrs.)
Fundamentals of Solid Waste Management and ISWM system: Sources and types of Municipal Solid Waste, waste generation rates, factors affecting generation, composition, characteristics, methods of sampling, effects of improper disposal of solid waste, functional elements of solid waste management, Municipal Solid Waste Rules; concept of ISWM system, source reduction of waste — reduction, reuse, recycling, onsite storage methods, handling and segregation of wastes at source.

Module – II (10 hrs.)
Waste collection and Transportation: Methods of collection of municipal solid wastes, collection vehicles, primary and secondary collection, manpower, collection routes, vehicle routing, transfer station – location and operation.

Module – III (14 hrs.)
Waste processing techniques: Objectives of waste processing, component separation and volume reduction, various processing technologies — biological and chemical conversion methods, resource and energy recovery from composting, bio-methanation, thermal processing methods, design of a composting facility and incinerator.

Landfill design and operation: Various disposal methods, landfills — site selection, site infrastructure, essential components of landfill; types of landfilling methods, landfill planning – phased operation, leachate management and gas control; Environmental

monitoring systems for landfill sites, closure and post-closure plans for landfills, landfill site rehabilitation, reclamation and remediation.

Module – IV (8 hrs.)
Hazardous Waste Management: Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects. Chemical and thermal treatment of hazardous waste – Solidification, chemical fixation and encapsulation, incineration.
Bio medical waste: Generation and characteristics, segregation, different management practices, colour codes, disposal and treatments.
Radioactive Waste Management – Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name
1.	Tchobanoglous G., Theisen H., Vigil S.: Integrated Solid Waste Management Engineering Principles and Management Issues (McGraw Hill Education).

REFERENCE BOOKS	
Sl. No.	Name
1.	CPHEEO, Ministry of Urban Development: Manual on Municipal Solid Waste Management 2000
2.	CPHEEO, Ministry of Urban Development: Manual on Municipal Solid Waste Management 2016 25

Course Name: Advanced Structural Analysis					
Course Code: CIV3233					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3233. 1. Apply stiffness and flexibility method to analyse structural system. [*Apply (IO)*]

CIV3233. 2. Define three dimensional states of stress and strains, equilibrium and compatibility. [*Remember* (*LO*)]

CIV3233. 3. Derive the governing equations and application to problems in plane stress state, plane strain state, torsion, bending. [*Create* (*HO*)]

CIV3233. 4. Solving one dimensional and two dimensional structural engineering problems. [*Apply* (*IO*)]

CIV3233. 5. Develop skill in understanding the behavior of plates and shells and analytical techniques to solve the two dimensional structural engineering problems. [*Create* (*HO*)]

CIV3233. 6. Application of finite element method in structural analysis using software. [*Apply* (*IO*)]

Module – I (12 hrs.)
Introduction: Matrix methods of structural analysis: Application of matrix methods to plane truss, beams, continuous frames.

Module – II (10 hrs.)
Theory of Elasticity: Three dimensional stress and strain analysis, stress strain transformation, stress invariants, equilibrium and compatibility equations. Two dimensional problems in cartesian and polar coordinates. Plane stress, plane stain problems, St. Venant's principle. Elasticity problems using Airy's stress function. Failure theories for homogeneous isotropic materials-Von Mises criteria, Tresca's criteria etc.

Module – III (10 hrs.)
Theory of plate bending: Navier's Solutions. Levy's solution. Plate buckling problem. Membrane theory of domes and cylindrical shells.

Module – IV (10 hrs.)
Introduction to Finite Element analysis. Finite element formulation for two dimensional stress analysis and axi-symmetric problems, Solutions of structural instability problems.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	M. Mukhopadhyay, Matrix, finite element, computer and structural analysis, ANE Books Ltd.
2.	P.N.Godbole, R.S. Sonparote, S.U.Dhote, Matrix method of Structural Analysis, PHI.
3.	Timoshenko & Krieger, Theory of Plates and Shells, Mc-Graw-Hill
4.	Timoshenko &Goodier, Theory of Elasticity, Mc-Graw-Hill
5.	Mukhopadhyay M. and Hamid S. A., Matrix and Finite Element Analyses of Structures, ANE Books Ltd.
6.	Reddy J.N., An Introduction to the Finite Element Method, 3rd edition, McGraw Hill Publication.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	C. K. Wang, Intermediate Structural analysis, McGraw Hill Publication.
2.	Krishnamoorty C. S., Finite Element Analysis: Theory and Programming, 2nd edition, McGraw Hill Publication.
3.	Chandrupatla T. R. and Belegundu A. D., Introduction to Finite Elements in Engineering, 4th edition, Prentice Hall India Learning Private Limited group.

Web references:

1. https://archive.nptel.ac.in/courses/111/107/111107112/

Course Name: Advanced Foundation Engineering					
Course Code: CIV3234					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3234. 1. Determine bearing capacity of shallow foundation under different soil and loading conditions by various established theories.

CIV3234. 2. Develop concept of analysis of beams on elastic foundation and apply it for the analysis of mat foundation.

CIV3234. 3. Estimate the load carrying capacity and settlement of pile and drilled pier foundations under different soil and loading conditions.

CIV3234. 4. Evaluate the stability conditions for well foundation and cellular cofferdams.

CIV3234. 5. Analyze braced excavation and design its various components.

CIV3234. 6. Illustrate the effects on foundations constructed on expansive soils and required treatments.

Module – I (12 hrs.)
Shallow foundation: Terzaghi's, Meyerhoff's, Hansens's bearing capacity theories, bearing capacity based on SPT, bearing capacity in layered soils, under eccentric and inclined loads.
Advanced Method of Analysis: Beams on elastic foundation, infinite beam, finite beam, Modulus of subgrade reaction, factors affecting modulus of subgrade reaction.
Combined and mat foundation: Introduction, safe bearing pressures for mat foundation, eccentric loading, proportioning of cantilever footing, analysis of combined footings and mat foundation by conventional rigid method, analysis of combined footings by elastic line method, analysis of mat foundation by approximate flexible methods, settlement of mat foundation, floating foundation.

Module – II (12 hrs.)
Pile foundation: Introduction, vertical load carrying capacity, estimation of point load by Vesic's and Meyerhoff's methods, correlation of point load with SPT and CPT results, frictional resistance in clay and sand, point load, tension and laterally loaded piles, Brom's method, efficiency and settlement of pile group in multi-layered deposits, eccentric and inclined loads on pile group, pile load test and cyclic load test, bearing capacity of piles resting on rock, under-reamed piles.
Drilled pier foundation: Introduction, types, advantages and disadvantages, design parameters, vertical bearing capacity, settlement at working loads, uplift capacity.

Module – III (8 hrs.)
Caisson (well) foundation: Introduction, types of wells or caissons, stability analysis of well foundations, limit equilibrium method for determining grip length of wells in cohesionless

and cohesive soils, determination of scour depth in cohesionless soil, thickness of steining of wells.

Cellular cofferdams: Introduction, components, dimensions, stability analysis.

Module – IV (8 hrs.)
Braced excavation: Introduction, pressure envelope for braced cut design, pressure envelope for cuts in layered soil, design of various components of braced cut, bottom heave of a cut in clay, stability of the bottom of a cut in sand, lateral yielding of sheet piles and ground settlement.

Foundation on Expansive (swelling) soils: General characteristics, mechanism of swelling, evaluation of swelling potential by single index method, classification of swelling soils by indirect measurement, swelling pressure, estimation of magnitude of swelling, design of foundation in swelling soil.

RECOMMENDED BOOKS:

TEXT BOOKS:	
Sl. No.	**Name**
1.	J. E. Bowels, '*Foundation Analysis and Design'*, McGraw-Hill Book Company.
2.	Braja M. Das, '*Principles of Foundation Engineering'*, Thomson Book.
3.	N. Som and S.C. Das, '*Advanced Foundation Engineering'*, PHI Learning Pvt. Ltd.
4.	V. N. S. Murthy, '*Advanced Foundation Engineering'*, CBS Publishers

REFERENCE BOOKS:	
Sl. No.	**Name**
1.	P. C. Varghese, '*Foundation Engineering'*, PHI Learning Pvt. Ltd.
2.	M. Gunaratne, '*The Foundation Engineering Handbook'*, Taylor and Francis group.
3.	R. W. Day, '*Foundation Engineering Handbook'*, McGraw-Hill Book Company.

Web references:

1. https://archive.nptel.ac.in/courses/105/105/105105207/
2. https://archive.nptel.ac.in/courses/105/105/105105039/
3. https://archive.nptel.ac.in/courses/105/108/105108069/

Additional Readings:

Journal papers in the area of Advanced Foundation Engineering.

Course Name: Irrigation Engineering					
Course Code: CIV3241					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

1. CIV3241. 1. Develop the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth. [*Understanding* (*LO*)]
2. CIV3241. 2. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production. [*Applying* (*IO*)]
3. CIV3241. 3. Analyze the different types of irrigation systems and their performances based on a service-oriented approach. [*Analyzing* (*IO*)]
4. CIV3241. 4. Know the basic requirements of irrigation and various irrigation techniques, requirements of the crops. [*Evaluating* (*HO*)]
5. CIV3241. 5. Understand the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector. [*Evaluating* (*HO*)]
6. CIV3241. 6. Explain the distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals design. [*Understanding* (*LO*)]

Module – I (10 hrs.)

Introduction to irrigation: Definition, necessity, benefits and ill-effects of irrigation, Types of Irrigation systems, classification of methods of irrigation, Surface, Sub-surface and Sprinkler irrigation methods, Problems.

Module – II (10 hrs.)

Water requirement of crops: Crop period or Base period, Duty & Delta of a crop, relation between Duty & Delta, Duty at various places, flow Duty and quantity Duty, factors affecting Duty, measures for improving Duty of water, crop seasons, Consumptive use of water-evapotranspiration, Irrigation efficiencies, Problems.

Module – III (10 hrs.)

Canal Irrigation: Introduction, classification of irrigation canals, Efficient section, certain important definitions, Time factor, Capacity factor, full supply coefficient, Nominal duty, Channel losses, Examples.

Lift Irrigation: Classification, Location, Water lifting arrangement, Yield of wells.

Module – IV (10 hrs.)

Flow Irrigation: Procedure of design of irrigation channel by Kennedy's theory, Lacey's theory, Comparison of two theories, Drawbacks in Lacey's theory, Problem related to

Kennedy's theory, Lacey's theory Longitudinal section of a channel, Balancing depth, Losses in channels, Maintenance of irrigation channels.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name
1.	K Subramanya, '*Engineering Hydrology*', Mc Graw Hill Education, New Delhi.

REFERENCE BOOKS	
Sl. No.	Name
1.	Dr. P.N Modi, '*Irrigation, Water Resource & Water Power Engineering*', Standard Book House-New Delhi.
2.	P. Jaya Ram Reddy, '*A Text Book of Hydrology*', Laxmi Publications-New Delhi.
3.	G.L. Asawa, '*Irrigation and Water Resources Engineering*', New Age International Publishers, New Delhi.
4.	S.K. Garg, '*Irrigation Engineering and Hydraulic structures*', Khanna Publishers, NewDelhi.

Web references:

1. https://archive.nptel.ac.in/courses/126/105/126105010/
2. https://archive.nptel.ac.in/courses/105/104/105104103/
3. https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ag03/

Course Name: Design of Tall Structures					
Course Code: CIV3242					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

1. CIV3242.1. Demonstrate the requirements and types of tall buildings and explain the parameters involved in analysis and design of the same. [*Applying* (*IO*)]
2. CIV3242.2. Describe and analyze some of the structural forms used in the construction of tall building. [*Applying* (*IO*)]
3. CIV3242.3. Analyze tall buildings under wind load by gust factor method following latest IS code and explain the procedure of wind tunnel test in brief.[*Analyzing* (*IO*)]
4. CIV3242.4. Understand and explain the concepts of basics of structural dynamics, SDOF and MDOF systems, response spectrum analysis following latest IS codes to address the dynamic nature of seismic excitations [*Understand* (*LO*)]
5. CIV3242.5. Understand and demonstrate the concepts of requirement of ductile detailing in reinforcement in accordance with National standards and apply the procedure of ductile detailing in practical design for tall buildings; Analyze and design of shear walls and flat slabs in tall buildings. [*Analyzing* (*HO*)]
6. CIV3242. 6. After completing this course, the students should be able to grasp the concepts of analysis and design of tall bulidngs subjected to severe lateral forces such as wind forces and seismic forces. [*Applying (IO)*]

Module – I *(10 hrs.)*

Introduction

Concept of tall buildings, factors affecting growth, height and structural forms.

Tall building structure- design process, strength and stability, stiffness and drift limitation, creep, shrinkage and temperature effects.

Basic Structural Forms

Braced frame structures, Rigid frame structures, In-filled frame structure, Flat plate and flat- slab structures, Shear wall structures, Wall- frame structures, Framed-tube structures, Outrigger –braced structures, Suspended structures, Core- structures, Space and hybrid structures.

Module – II *(12 hrs.)*
Wind Analysis
Design considerations for nature of wind, use of Gust Factor Method to assess the dynamic effect of wind on structures. Numerical problem solve using latest IS codes. Introductory concept of wind tunnel test, objectives of wind tunnel tests.

Module – III *(10 hrs.)*
Seismic Analysis
Introduction to Structural Dynamics, SDOF and MDOF systems, Behaviour of Tall building during seismic loadings. Introduction of various static and dynamic analyses of structures.

Use of Equivalent Static analysis, Response Spectrum Method to assess the dynamic effect of earthquake on structures. Basic concept of Time History Analysis.

Module – IV *(12 hrs.)*

Design Philosophy of a Tall Buildings with shear walls

Introduction to concept of P-Δ effects in tall buildings. Introduction to various concepts of ductile detailing of building referring to IS 13920-2016.

Detailed concept of shear walls and flat slabs in tall buildings. Analysis and design of shear walls and flat slabs.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	B. S. Taranath, "Structural Analysis and Design of Tall Buildings- Steel and Composite Construction", CRC Press, 2012.
2.	P. Agarwal and M. Shrikhande, "Earthquake Resistant Design of Structures", PHI Learning Pvt. Ltd, 2006.
3.	S. N. Manohar, "Design and Construction of Tall Chimneys", McGraw-Hill Book Co., New York, 1972.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Bryan S. Smith and Alex Coull., "Tall Building Structures: Analysis and Design", John Wiley & Sons, Inc, New York, 1991.
2.	M. Sarkisian, "Designing Tall Buildings- Structure as Architecture", Routledge, 2012.
3.	D. Parker and A. Wood, "The Tall Buildings-Reference Book, Routledge", 2013.

CODES:

IS 875 (Part-3): 2015, IS 1893 (Part-1): 2016, IS 1893 (Part 4): 2005, IS 4998 (Part 1): 1992, IS 13920:2016, IS 16700: 2017.

Web references:

1. https://www.youtube.com/watch?v=-syqppgcoV

Course Name: Advanced Highway and Traffic Engineering					
Course Code: CIV3243					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3243.1. Understand the geometric design policies, design control and factors affecting it.
CIV3243.2. Design the geometric elements of highway.
CIV3243.3. Understand highway location, alignment design, project preparation and design principles of intersection.
CIV3243.4. Conduct traffic studies, analyze traffic data and design traffic signals.
CIV3243.5. Analyze parking & accidents; understand traffic impacts, traffic management techniques.
CIV3243.6. Understand traffic management and intelligent transportation system.

Module – I (11 hrs.)
Highway geometric design:
Introduction to highway geometric design:
Highway geometric design policies as per IRC guidelines, Definition and scope of geometric design, Primary and dependent design controls.
Human and vehicle factors:
Human factors and typical vehicle factors applied in geometric design.
Elements of design:
Sight distances; horizontal alignment; transition curves, super elevation and side friction; Vertical alignment: - grades, crest and sag curves; Highway cross-sectional elements and their design for rural highways, urban streets and hill roads.

Module – II (11 hrs.)
Highway project preparation:
Survey and investigation – importance, types, traffic survey, guidelines for alignment and route selection, desk study, photogrammetry in highway location, conventional ground study, drainage study, aspect of soil investigation related to pavement, pavement design investigation. Design, drawing, estimates, earthwork quantities, project report, stages in project preparation.
Intersection Design:
Types of intersections, conflicts at Intersections, Requirements of at grade intersection types of at grade intersections, channelization traffic islands; types of grade separated intersections; Rotary intersection concept of rotary, design factors of rotary Advantages and limitations of rotary intersections.

Module – III (12 hrs.)
Traffic Engineering I:
Organization of traffic engineering department and its importance under Indian conditions, Road user and vehicle characteristics, Traffic flow parameters - Speed, density and volume relationships, headway, spacing, delay.

Traffic measurement techniques, highway capacity and level of service (LOS).
Traffic signal design:
Design Principles of Traffic Signal, Evaluation of a traffic signal: Delay models.

Module – IV (10 hrs.)

Traffic Engineering II:

Traffic impact, Parking studies, Accident studies- accident characteristics, Road safety principles and practice, Identification of hazardous locations.

Traffic Management:

Traffic management strategies, Traffic management techniques, Work zone traffic management, Traffic calming, Congestion studies and road pricing.

Intelligent Transportation System (ITS):

Introduction, Integrated components of ITS, Major areas of application and working process of ITS.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	L. R Kadiyali. Traffic Engineering and Transportation Planning. Khanna Publishers, New Delhi, 2008.
2.	C. JotinKhisty, B. Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 2003.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Khanna, Justo, and Veerararagavan. Highway Engineering (Revised 10th Ed.), Nemchand& Bros., Roorkee.
2.	F. L. Mannering, S. S. Washburn and W. P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India, 2011.
3.	C. S. Papacostas and P. D. Prevedouros. Fundamentals of Transportation Engineering. PrenticeHall, New Delhi, 2009.
4.	Dr. L. R Kadiyali. Principles and Practice of Highway Engineering, Khanna Publishers.
5.	M A Chowdhary and A Sadek. Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003.
6.	T. R. Currin, Introductions to Traffic Engineering: A Manual for Data Collection and Analysis. Brooks/Cole Thomason Learning, Canada, 2001.

CODES/STANDARDS FOR REFERENCE:

A policy on geometric design of highways and streets, American Association of State Highway Officials, 2011.

Geometric design standards for urban roads in plains (IRC: 86- 1983), The Indian Roads Congress, 1983.

Geometric design standards for rural (non-urban) highways (IRC: 73-1980), The Indian Roads Congress, 1980.

Guidelines for expressways – Part I, Ministry of Road Transport & Highways, 2010.

Various other relevant codes on geometric design such as IRC: SP:87-2010, IRC: SP:84-2009, IRC: SP:48-1998, IRC:92-1985.

Highway Capacity Manual. Transportation Research Board. National Research Council, Washington, D.C., 2010.

Course Name: ENVIRONMENTAL IMPACT ASSESSMENT					
Course Code: CIV3244					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

After going through this course, the students will be able to:

CIV3244.1: Learn and understand the basics of ecology and environment.[*Understanding (LO)*]

CIV3244.2: Characterize the different types of ecosystem and their inter-relationship. [*Understanding(LO)*]

CIV3244.3: Assess risks posing threats to the environment. [Analyzing(HO)]

CIV3244.4: Assess different case studies/examples of EIA in practice. [Analyzing(IO)]

CIV3244.5: Assess the importance of stakeholders in the EIA process. [Analyzing(HO)]

CIV3244.6: Understand and implement the analysis of EIA for various projects. [*Apply (IO)*]

Module I [8L]
Environment & its components:-
Concept of Environment and Ecology. Classification of Ecology, Ecological Imbalances, Sustainable Development, Eco-system- Structure, Function & productivity. Pyramid of energy. Different types of eco-system- Forest, Grassland, Dessert, marine etc. Analysis of eco-system. Inter-relationship in an eco-system.

Module II [12L]
Introduction to EIA:-
EIA functions, Social Impact Analysis, Basic Principles, Procedure, Objectives of EIA, Essential Components- Environmental planning, MIS (Management Information System), Monitoring, Research, Performance review. Methodology of EIA, Limitations of EIA, contents of EIA documentation.

Module III [12L]
EIA of Various Projects:-
EIA of Thermal Power Plants, Mining & Water Resources project, EIA- Case study of projects.
Risk Analysis:-
EIA Specialized areas like Environmental health impact assessment, Environmental risk analysis, Economic valuation methods, Cost-benefit analysis. Prediction and assessment of impacts on physical, biological and socio-economic environment. Resettlement and rehabilitation.

Module IV [14L]
Legislation:-
National & International laws, India's impact assessment notification (1994, 2006). Role of Control boards for obtaining environmental clearance, Role of general public, post project monitoring by government bodies .

RECOMMENDED BOOKS:

TEXT BOOKS

Sl. No.	Name
1.	Larry.W.Canter, '*Environmental Impact Assessment,*' McgrawHill,New York
2.	John Glasson,Riki Therivel,Andrews Chadwick, '*Introduction to Environmental Impact Assessment'* UCL PRESS.
3	M.Anji Reddy. ' *Environmental Impact Assessment -Theory and practice '* BS Publication India.

REFERENCE BOOKS

Sl. No.	Name
1.	Eugene Odum ' *Fundamental of Ecology'* Thomson Books ,Singapur
2.	Kormondy,Edward J, ' *Concepts Of Ecology'* Prentice Hall
3.	P.D.Sharma, ' *Fundamentals Of Ecology'* Rastogy Publication,UP. India
4.	R.K.Jain, ' *Environmental Assessment'* , Mcgraw Hills

Web references:

1. https://nptel.ac.in/courses/127106004
2. https://archive.nptel.ac.in/courses/ 127/106/127106104/

Course Name: Project Planning & Management					
Course Code: CIV3221					
Contact hrs. per week:	L	T	P	Total	Credit points
	2	0	0	2	2

Course Outcomes:

After going through this course, the students will be able to:

CIV3221. 1. Develop the bar chart for the project. **[*Create (HO)*]**

CIV3221. 2. Compile the tender documents. **[*Apply (IO)*]**

CIV3221. 3. Estimate the critical path of the project i.e. the maximum duration which the project require for completion. **[*Understanding (LO)*]**

CIV3221. 4. Understand the uses of various construction equipments at site and the preparation of concrete. **[*Apply (IO)*]**

CIV3221. 5. Make use of the bylaws of different authorities to get the approval of drawings for construction. **[*Apply (IO)*]**

CIV3221.6. Understand the process of arbitration in case the projects suffer from disputation. **[*Understanding (LO)*]**

Module – I (8 hrs.)
Planning: General consideration, Definition of aspect, prospect, roominess, grouping, circulation, Privacy.
Regulation and Bye laws: Bye Laws in respect of side-space, Back and front space, Covered areas, height of building etc., Lavatory blocks, ventilation, Requirements for stairs, lifts in public assembly building, offices
Fire Protection: Firefighting arrangements in public assembly buildings, planning, offices, and auditorium.

Module – II (8 hrs.)
Construction plants & Equipment: Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses.
Plants &Equipment for concrete construction: Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.

Module – III (8 hrs.)
Planning by CPM: Preparation of network, Determination of slacks or floats. Critical activities. Critical path. Project duration.
Planning by PERT: Expected mean time, probability of completion of project, Estimation of critical path, problems.

Module – IV (14 hrs.)
Management: Professional practice, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contract.

Departmental Procedures: Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbitration.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Estimating, costing, Specification and Valuation in Civil Engineering by M. Chakroborty
2.	Construction Planning, Equipments and methods Puerifoy, R.L. McGraw Hill

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Management in construction industry P. P. Dharwadkar Oxford and IBH Publishing company, New Delhi
2.	Project planning and control with PERT and CPM Construction equipments and its management B. C. Punmia, K. K. Kandelwal and S. C. Sharma
3.	PERT and CPM L. S. Srinath

Course Name: Principles of Sustainable Engineering					
Course Code: CIV3222					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

CIV3222. 1. Understand the relevance and concept of sustainability and reasons of unsustainability. [*Understanding (LO)*]

CIV3222.2.Examine the green building rating systems and its contribution to sustainability; recognize and communicate sustainability issues. [*Applying (IO)*]

CIV3222.3 Explain local and global environmental issues; relate the understanding of building materials and construction technique that are sustainable and energy efficient and interpret life-cycle report. [*Applying (IO)*]

CIV3222. 4. Estimate the environmental and economic impacts of material and energy use. [*Applying (IO)*]

CIV3222.5. Differentiate between carbon emissions for regular and sustainable cities and explain different practices to move industries towards sustainability; discuss different renewable resources and explain methods to implement green technology. [*Applying (IO)*]

CIV3222. 6. After completing this course, students should be able to grasp the burning issues of sustainability, propose and evaluate solutions for sustainable products and processes for industries in order to implement sustainable technologies. [*Applying (IO)*]

Module – I (12 hrs.)

Issues in sustainability:
Principles of Sustainable Engineering: practices and principles.

Economic development along with energy use and carbon emission, energy conservation and renewable energy, energy and construction.

Environmental Ethics and Legislations

Environmental ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India – The Water Act, The Air Act, The Environment Act.

Module – II (12 hrs.)

Sustainable Habitat

Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment (GRIHA) , leadership in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable pavements, case studies in sustainability engineering: Green building, sustainable city, sustainable transport system.

Sustainable Industrialization and Urbanization – Sustainable urbanization, industrialization, material selection, pollution prevention, industrial ecology, industrial symbiosis, poverty reduction.

Module – III (10 hrs.)

Local Environmental Issues

Solid waste, impact of solid waste on natural resources, zero waste concept and three R concept, waste to energy technology: thermo-chemical conversion, biochemical conversion.

Global Environmental Issues

Resource degradation: deterioration of water resources, land degradation, air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

Life Cycle Assessment:

Life Cycle assessment: Quantitative approach of decisions,

Module – IV (10 hrs.)

Renewable energy resources

Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydro plants, biogas systems, biofuels, energy from ocean, geothermal energy, conservation of energy.

Green Technology and Green Business

Sustainable business, green technology, green energy, green construction, green transportation, green chemistry, green computing

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name**
1.	Jason F. McLennan, *The Philosophy of Sustainable Design*, Ecotone Publishing co., 2004.
2.	R. L. Rag and Lekshmi Dinachandran Remesh, *Introduction to Sustainable Engineering*, 2nd Edition, PHI Learning Pvt. Ltd., 2016.
3.	Mike Montoya, *Green Building Fundamental*, Pearson, 2nd edition, 2010.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	D. T. Allen and D. R. Shonnard. *Sustainability Engineering: Concepts, Design and Case Studies*, 1st Edition, Prentice Hall, 2011.
2.	A.S. Bradley, A. O. Adebayo, P.Maria. *Engineering applications in sustainable design and development*, 1st edition, Cengage Learning, 2016

Web references:
1. https://onlinecourses.swayam2.ac.in/arp19_ap75/preview

Course Name: Industrial Structure Design and Detailing Laboratory					
Course Name: CIV3251					
Contact hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Content:

Analysis, design and detailing of different components of a factory shed and gantry girder as per IS800-2007.

References: I.S. 875 (part I and II) – 1987, I.S. 875 (part III) – 2015, I.S: 800-2007, SP: 6 (I) – 1964, SP: 38 (1987).

TEXT BOOKS:	
Sl. No	**Name**
1.	N. Subramanian, "Design of steel structures", Oxford University Press
2.	A.S. Arya and J.L. Ajmani, " Design of steel structures", Nemchand and Bros.
3.	S.K. Duggal, "Limit state design of steel structures (2nd edition)", McGraw Hill India, New Delhi.

REFERENCES:	
Sl. No.	**Name**
1.	M.L. Gambhir , "Fundamentals of structural steel design", McGraw Hill India, New Delhi
2.	Karuna Moy Ghosh , "Analysis and design of steel structures, 2nd ed.", Prentice Hall, India
3.	Ramachandra and V. Gehlot. "Design of steel structure (Vol. I and II)", Scientific Publisher.

Course Name: Computer-aided Structural Analysis and Design Laboratory					
Course Code: CIV3254					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	3	3	1.5

Course Content:

1. Study on capabilities of STAAD software for modeling and design – Radial and Cartesian coordinate systems, generating simple structures like two dimensional and three dimensional frames and truss.
2. Generation of model using command file and graphical user interface.
3. Learn to apply different types of tools and options for geometry generation and assignment of different types of loading -member load, floor load etc., material properties and sections.
4. Definition and analysis of wind and seismic loads as per relevant IS Codes and error source identification and solving.
5. Analysis and design of multistoried RCC building for gravity and lateral loads and error source identification and solving.
6. Analysis and design of steel roof truss and error source identification and solving.
7. Report generation and documentation using STAAD software.

Course Name: Highway Engineering Laboratory					
Course Code: CIV3255					
Contact hrs. per week:	L	T	P	Total	Credit points
	0	0	2	2	1

Course Outcomes:

After going through this course, the students will be able to:

CIV3255.1. Perform various lab/field tests by following the instructions. [*Imitation*]

CIV3255.2. Gather knowledge about the quality control techniques of various aggregates and pavement materials.

CIV3255.3. Design and test bituminous mix.

CIV3255.4. Understand the factors influencing road vehicle performance characteristics and design and assess the quality of different bitumen grade.

CIV3255.5. Develop leadership and communication skills, and engage in life-long learning.

List of experiments with COs:

Sl. No.	Name of the experiment	Mapped COs
1.	Impact Value Test of aggregates.	CO1, CO2, CO3, CO4, CO5
2.	Los Angeles Abrasion Value Test of aggregates.	CO1, CO2, CO3, CO4, CO5
3.	Water Absorption and Specific Gravity of aggregates.	CO1, CO2, CO3, CO4, CO5
4.	Elongation and Flakiness Index (Shape Test of aggregates).	CO1, CO2, CO3, CO4, CO5
5.	Specific Gravity Test of bitumen.	CO1, CO2, CO3, CO4, CO5
6.	Penetration Value Test of bitumen.	CO1, CO2, CO3, CO4, CO5
7.	Softening Point Test of bitumen.	CO1, CO2, CO3, CO4, CO5
8.	Loss on Heating Test of bitumen.	CO1, CO2, CO3, CO4, CO5
9.	Flash and Fire point Test of bitumen.	CO1, CO2, CO4
10.	Stripping Value Test.	CO1, CO2, CO4
11.	Bituminous Mix Design by Marshall Stability Method	CO1, CO2, CO4

References:

1. BIS Codes on Aggregates and Bituminous Materials.

2. Highway Material Testing (Laboratory Manual) by S.K. Khanna and CE. G. Justo.

3. Relevant IS and I.R.C codes.

APPENDIX – A

Point Description for Mandatory Additional Requirement (MAR)

Sl. No.	Name of the Activity	Points	Maximum Points allowed
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2	Tech Fest / Teachers Day / Freshers Welcome		
	(i) Organizer	05	10
	(ii) Participants	03	06
3	Rural Reporting	05	10
4	Tree Plantation (per tree)	01	10
5	Participation in Relief Camps	20	40
6	Participation in Debate/Group Discussion/ Tech quiz	10	20
7	Publication of Wall magazine at Institutional level (magazine/article/internet)	10	20
8	Publication in News paper, Magazine & Blogs	10	20
9	Research Publication (per publication)	15	30
10	Innovative Projects (other than course curriculum)	30	60
11	Blood donation camp		
	(i) Donor	08	16
	(ii) Camp Organizer	10	20
12	Participation in Sports/Games		
	(i) College Level	05	10
	(ii) University Level	10	20
	(iii) District Level	12	24
	(iv) State Level	15	30
	(v) National / International Level	20	40
13	Cultural programme (Dance, Drama, Elocution, Music etc.)	10	20
14	Member of Professional Society	10	20
15	Student Chapter Activities / Seminars		
	(i) Participant	05	20
	(ii) Presentation	10	20
	(iii) Organizer	10	20
16	Relevant industry visit & report	10	20
17	Activities in different clubs at HIT (Photography Club, Cine Club etc.)	05	10
18	Participation in Yoga Camp	05	10
19	Self-Entrepreneurship programme	20	20
20	Adventure sports	10	20
21	Training to under privileged / Physically challenged	15	30
22	Community Service & Allied Activities	10	20
23	Hackathon (State / National Level)		
	(i) Participation in Hackathon	10	20
	(ii) Qualifier for final round (not prize winner) in Hackathon	20	40
	(iii) Prize Winners of Hackathon	30	60

Format for Report Submission

Name   :

Department   :

Year/Semester   :

Title of the Activity   :

Date   :

Name of the organization   :

Report   :

Signature
(Coordinator / Competent Authority)

Points earned:

Signature of the Mentor

APPENDIX – B

Bloom's Taxonomy

CREATE — **Produce new or original work**
Design, assemble, construct, conjecture, develop, formulate, author, investigate

EVALUATE — **Justify a stand or decision**
Appraise, argue, defend, judge, select, support, value, critique, weigh

ANALYSE — **Draw connections among ideas**
differentiate, organise, relate, compare, contrast, distinguish, examine, experiment, question, test

APPLY — **Use information in new situation**
Execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

UNDERSTAND — **Explain ideas or concepts**
Classify, discribe, discuss, explain, identify, locate, recognize, report, select, translate

REMEMBER — **Recall facts and basic concepts**
define duplicate, list, memorise, repeat, state