ASANSOL ENGINEERING COLLEGE

CIVIL ENGINEERING DEPARTMENT

Curriculum– R25

Detailed Syllabus

B.Tech

in

in

Civil Engineering

Effective for 2025 Admission Batch Onwards

L – Lecture; T- Tutorial; P- Practical

[1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1st Year 1st Semester (Gr-B)									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CE101	Introduction to Civil Engineering -I	3	0	0	3	3
2	ENGG	Minor	CS102	Introduction to Artificial Intelligence	2	0	0	2	2
3	SCI	Multidisciplinary	CH101	Engineering Chemistry	2	0	0	2	2
4	SCI	Multidisciplinary	M101	Engineering Mathematics- I	3	0	0	3	3
5	HUM	Value Added Courses	HU105	Constitution of India and Professional Ethics	1	0	0	1	1
6	HUM	Ability Enhancement Course	HU103	Design Thinking and Innovation	1	0	0	2	1
B. PRACTICAL									
1	ENGG	Major	CE191	Introduction to Civil Engineering Lab-I	0	0	3	3	1.5
2	ENGG	Minor	CS192	Artificial Intelligence Lab	0	0	3	3	1.5
3	SCI	Skill Enhancement Course	CH191	Engineering Chemistry Lab	0	0	2	2	1
4	ENGG	Skill Enhancement Course	ME193	IDEA LAB Workshop	0	0	3	3	1.5
MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	MC181	Induction Program	0	0	0	0	0	0
Total of Theory, Practical								23	17.5

COURSE NAME: INTRODUCTION TO CIVIL ENGINEERING - I
COURSE CODE: CE101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisites: A basic knowledge in 10+2 Science subjects.

Course Objective: The concepts developed in this course will aid in quantification of several concepts in Civil Engineering based on previous knowledge science at the 10+2 levels in schools. Technology is being increasingly based on the basics of Civil Engineering, broad area of Civil Engineering and their application.

Course Outcomes (COs):

After completion of this course students will be able to:

CO1: Describe the fundamentals of Civil Engineering and their broad areas.

CO2: Apply fundamental concepts of Civil Engineering in different engineering applications.

CO3: Apply the knowledge of various specializations and concept of Civil Engineering to different industries.

CO4: Evaluate theoretical and practical aspects related to the various aspects of Civil Engineering in Structural Engineering, Soil Engineering, etc. to the industrial scale, in accordance with current needs.

COURSE CONTENT –

Module 1: Introduction and Scope of Civil Engineering: 2L

Function of Civil Engineering, Broad disciplines of Civil Engineering; Impact of Infrastructural Development on the Economy of a Country; Importance of Civil Engineering; Possible scopes for a career in Civil Engineering

Module 2: History and Fundamentals of Civil Engineering – 4L

Relevance of Civil Engineering in the overall infrastructural development of the country, Types and classification of structures - buildings, towers, chimneys, bridges, dams, retaining walls, water tanks, silos, roads, railways, runways and pipelines (Brief description only)- Definition and types of buildings as per National Building Code of India (brief description only) - Selection of site - Components of a building and their functions – Setting out of a building.

Module 3: Introduction to building Materials: 7L

Cement: Basic Ingredients — Manufacturing process - Grades – Properties - Uses, Aggregates: Fine and coarse aggregate - Properties – Uses; Brick Masonry: Types - Bond - Introduction to all types of bonds; Introduction to stones masonry, Timber: Properties - Uses - Classification - Seasoning - Defects - Preservation; Hard board and Particle board - Manufacture and use; Steel: Structural steel and steel as reinforcement - Types - Properties - Uses - Market forms; Floors and Flooring materials: Different types and selection of floors and floor coverings; Roofs and roof coverings: Different types of roofs - Suitability – Types and selection of roofing materials.

Module 4: Elements of Building Construction & Planning: 7L

General Requirement of Building, Elementary principles and basic requirements of a building Planning, Importance of Planning, Layout of residential & industrial buildings, Introduction to Plan, Elevation & Section of

Residential Building Construction: Classification of buildings based upon occupancy, Types of Structures, Design Loads acting on the structure, Elements of building drawing. Introduction on NBC Code.

Module 6: Fundamentals of Structural Engineering: 8L

Objective of Structural Engineering, Types of Loads on Structure, Types of structure, Structural idealization, Load paths in structures, Characteristics of force system, Moments and Reactions, Types of Structural Members, Column and Footing, Types of beams, Types of slabs, Fundamentals of support and reactions

Module 7: Fundamentals of Geotechnical Engineering: 8L

Introduction to Geotechnical Engineering, Nature of Soil and rock materials, Approach to study Geotechnical Engineering, Soil formation and nature of soil Constituents, Introduction and classification properties of soils, Basic definitions and Phase relations.

Reference Books

1) Chen, W. F. and Liew, J. Y. R., (Eds.), The Civil Engineering Handbook, Second Edition, CRC Press (Taylor and Francis)

2) Dalal, K. R., Essentials of Civil Engineering, Charotar Publishing House

3) Gopi, S., Basic Civil Engineering, Pearson Publishers

4) Kandya, A. A., Elements of Civil Engineering, Charotar Publishing house

5) Mamlouk, M. S. and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers.

6) Mondal, A. and Dey, S., Fundamentals of Civil Engineering: Principles, Practices, and Applications, Chyren Publication

7) McKay, W. B. and McKay, J. K., Building Construction Volumes | to 4, Pearson India Education Services 8) Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house

9) Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	2	2	1	1	2	3	3	2	2
CO2	3	2	1	2	1	2	2	2	1	2	3	2	3	2
CO3	3	2	1	2	1	2	3	1	2	2	3	3	2	2
CO4	3	2	1	2	1	3	3	2	2	2	3	2	2	2

Course Name **Introduction to Artificial Intelligence**
Course Code **CS102**
Contact Hours (Period/week) **2**
Total Contact Hours **30**
Credit **2**

Course Objectives:

The objectives of this course are to enable students to

1. Comprehend the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context.
2. Formulate a problem as State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.
3. Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute-force techniques.
4. Design AI-Frameworks for Inferencing based on knowledge base.
5. Analyze the effectiveness of AI-Inferencing Model in offering solutions to the respective problem.

Course Outcomes (COs):

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

CO1	**Understand and explain** the fundamental concepts of **Knowledge Representation** and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem primarily to fit a State-Space Exploration Framework or an Inferencing **Model/Agent** Design Framework within the scope of Artificial Intelligence paradigm.
CO3	**Explore** relevant literature and **apply** the concept of Heuristic Techniques of Artificial Intelligence to **solve** problems.
CO4	**Develop** Inferencing Models for **proposing** solutions to the problems of Artificial Intelligence.
CO5	**Implement** Inferencing Models of Artificial Intelligence through **developing** feasible algorithms and **investigate** their effectiveness by **analyzing** their performances in solving the relevant problems.

Course Contents:

Module 1: Introduction to Artificial Intelligence (3 Lectures)
Why AI • Definition of AI • Goals of AI • History and evolution of AI • Types of AI: Narrow, General, Super • Human vs Artificial Intelligence • Applications of AI in various domains • AI for social good

Module 2: Intelligent Agents and Logic-Based Thinking (8 Lectures)
Intelligent systems • Agents and environments • Decision making using rules and logic • Symbolic AI concepts • Propositional Logic: Knowledge Representation and Inference using Propositional Logic • Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic

Module 3: Overview of AI Branches and Perception (8 Lectures)
Machine learning • Deep learning • Natural language processing • Computer vision • Expert systems • Fuzzy logic • Evolutionary algorithms • Reinforcement learning • Planning and scheduling • Human-AI collaboration

Module 4: **Basics of Machine Learning (6 Lectures)**
What is machine learning • AI vs ML • Types of learning: supervised, unsupervised • Concept of dataset, features, and labels • ML model and prediction flow • Common ML applications • Introduction to decision trees (concept only) • ML pipeline overview.

Module 5: **Applications and Ethics of AI (5 Lectures)**
AI in robotics and automation • AI-enabled smart applications • Industry 4.0 and intelligent systems • AI in different sectors: healthcare, agriculture, transport, education, etc. • Human-AI teamwork • Basics of AI ethics: bias, fairness, privacy • Career opportunities and future scopes in AI.

Textbook:

Saptarsi Goswami , Amit Kumar Das , Amlan Chakrabarti - **AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI),** Pearson**.**

Rich, E., Knight, K and Shankar, B. 2009. **Artificial Intelligence**, 3rd edition, Tata McGraw Hill.
Russell , S. and Norvig , P. 2015. **Artificial Intelligence - A Modern Approach**, 3rd edition, Prentice Hall.

Reference Books:
Reema Thareja, **Artificial Intelligence**: Beyond Classical AI, Pearson.
Patterson , **Introduction to Artificial Intelligence and Expert Systems,** Pearson.

CO–PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	3	2	2	3
CO2	2	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	2	2	3	2	-	-	-	-	-	-	-	2	3	2
CO4	2	2	2	3	-	-	-	-	-	-	2	2	2	2
CO5	2	2	3	3	2	-	-	-	-	-	2	3	2	2

Course Name: ENGINEERING CHEMISTRY
Paper Code: CH 101/CH 201
Total Contact Hours: 24
Credit: 2
Prerequisites: 10+2

COURSE OBJECTIVE

- Understand the basic principles of atomic structures and periodic properties of elements, different engineering materials, advanced polymers.
- Apply the knowledge of free energy, energy storage device and semiconductors to design environment friendly and sustainable devices.
- Apply the concept of corrosion and fuel to improve its efficacy and application for industrial purpose.
- Analyze the organic reaction with the structure of organic molecules by applying the knowledge of different spectroscopic techniques.
- Evaluate the electrical, optical, and structural properties of semiconductors to analyze their potential applications in modern electronic and energy devices

COURSE OUTCOME

CO1. Able to understand the basic principles of atomic structures and periodic properties of elements, different engineering materials, advanced polymers.

CO2. Able to apply the knowledge of free energy, energy storage device and semiconductors to design environment friendly and sustainable devices.

CO3. Able to apply the concept of corrosion and fuel to improve its efficacy and application for industrial purpose.

CO4. Able to analyze the organic reaction with the structure of organic molecules by applying the knowledge of different spectroscopic techniques.

CO5. Able to evaluate the electrical, optical, and structural properties of semiconductors to analyze their potential applications in modern electronic and energy devices.

COURSE CONTENT

Module 1

Quantum Properties of Atoms (4 L)

Schrodinger Wave Equation (time independent – basic principles only), de Broglie Equation, Heisenberg Uncertainty Principle, Quantum Numbers, Effective nuclear charge, Slater's rule, penetration of orbitals, variations of orbital energies in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, oxidation properties.

Chemistry of materials (2L)

Semiconductor-Based Memory Materials (Si & Ge) [Introduction, Properties and role of Si & Ge), Intensive & Extensive semiconductor,

Module II

Chemical Thermodynamics (5L)

1st & 2nd Law of Thermodynamics, Tendency for maximum randomness, Carnot Heat Engine [Derivation], Entropy characteristics, Mathematical explanation & physical significance of Entropy, Entropy change of ideal gas for isothermal reversible process, Gibbs free Energy Function, Standard free Energy, Criterion of spontaneity.

Electricity production through chemical reactions (2L)

Electrochemical Cell, writing of cell notation, free energy and EMF, Criterion of spontaneity in terms of Cell,

Nernst equation (only expression, no derivation) and applications, calculation of EMF of a cell, calculation of single electrode potential, calculation of Kc, calculation of Kc from G^0.

Working principle and applications of Lithium-ion batteries

Module III

Polymers for Engineering Applications (3L)

Polymers and their classifications (based on origin, chemical structure, polymeric structure, tacticity and molecular forces)

Commercially important polymers: Synthesis and applications of Bakelite, nylon 6,6, HDPE & LDPE

Conducting polymers –Types examples and applications.

Biodegradable polymers –definition, example and uses

Industrial Chemistry (3L)

Types of corrosion, Electrochemical theory of corrosion, rusting of iron, comparison of chemical & electrochemical corrosion. [Mechanism excluded]

Factors affecting the rate of corrosion; nature of metal (physical state, purity, position in Galvanic series) & environment.

Corrosion control: Cathodic protection, anodic protection, Inorganic coatings.

Classification of Fuel (LPG, CNG, BIOGAS), Calorific value, Octane number, Cetane number, HCV, LCV. [Definition only]

Module IV

Organic Reactions & synthesis of drugs (3L)

Acidity and basicity comparison of organic compounds (acids, alcohols & amines), Nucleophilic Substitution reaction and Electrophilic Addition reactions, Markonikov's rule, peroxide effect, Synthesis of Paracetamol & Aspirin and uses.(Name reactions are not in syllabus)

Spectroscopy (2L)

Electromagnetic spectrum, Lambert-Beer Law, Finding of λ max value & concentration of the unknown solution, Applications of UV-VIS spectroscopy, Chromophores & Auxochromes.

Applications of IR spectroscopy, Fingerprint region

Suggested Text Books

- Chemistry –I, Gourkrishna Das Mohapatro
- A text book of Engineering Chemistry, Dr. Rajshree Khare
- Engineering Chemistry, U. N. Dhar
- Physical Chemistry, P.C. Rakshit

Reference Books

- Engineering Chemistry, Jain & Jain
- Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishna
- Text book of Engineering Chemistry, Jaya Shree Ani reddy

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	3	2	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3	2	2
CO3	3	2	3	2	-	-	-	-	-	-	2	2	3	2
CO4	2	3	2	3	-	-	-	-	-	-	2	3	2	2
CO5	2	2	3	3	2	-	-	-	-	-	3	2	2	2

Course Name: ENGINEERING MATHEMATICS - I

Paper Code: M 101
Contact (L: T: P): 3 : 0 : 0
Total Contact Hours: 36
Credit: 3

Prerequisites:

The students to whom this course will be offered must have the understanding of (10+2) standard algebraic operations, coordinate geometry, and elementary calculus concepts including limits, continuity, differentiation, and integration.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1. Apply linear algebra methods to perform matrix operations, classify matrix structures, solve systems of linear equations, and compute eigenvalues and eigenvectors in engineering contexts.
CO2. Apply differential and integral calculus to evaluate and approximate the behavior of single-variable and multivariable real-valued functions relevant to engineering scenarios.
CO3. Analyze the properties of eigenvalues and eigenvectors to assess matrix diagonalizability and interpret linear transformations using the Cayley-Hamilton theorem in engineering systems.
CO4. Analyze single-variable and multivariable real-valued functions using differential and integral calculus to model and interpret complex behavior in engineering applications.

Course Content:

Module I: Liner Algebra (11L)
Echelon form and normal (canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrix, Cayley-Hamilton theorem.

Module II: Single Variable Calculus (5L)
Rolle’s Theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Taylor's series.

Module III: Multivariable Calculus (Differentiation) (13L)
Function of several variables; Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; chain rules, Derivatives of implicit functions Euler’s theorem on homogeneous function; Jacobian; Maxima and minima of functions of two variables.

Module IV: Multivariable Calculus (Integration) (7L)
Double Integral, Triple Integral; Change of order in multiple integrals; Line Integral, Surface Integral, Volume Integral. Change of variables in multiple integrals.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
6. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
7. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
8. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
9. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
10. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.

CO-PO/PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	1	2	3	3
CO2	3	2	-	-	-	-	-	-	-	-	1	2	2	3
CO3	3	3	1	1	-	-	-	-	-	-	2	3	3	2
CO4	3	3	1	1	-	-	-	-	-	-	2	3	3	2

Paper Name: **CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS**
Paper Code: HU105
Contact: 1:0:0
Credit: 1
Total Lectures: 12

Prerequisites:

Basic knowledge (10+2 level) of the Indian Constitution and moral science.

Course outcome: On completing this course the student will be able to

CO1: Identify, define and understand the significance of the Constitution of India, its spirit and values and the fundamental rights and duties as a responsible citizen.
CO2: define and discover core ethical concepts, the basic perception of profession, and professional ethics that shape the ethical behavior of an engineer.
CO3: identify, examine and apply codes of engineering ethics, engineers' social responsibilities and industrial standards and ethical dilemmas.
CO4: consider, correlate and appraise ethical leadership and principles in addressing gender issues, concerns of IPR and industrial responsibilities.

COURSE CONTENT

Module 1: **2L**

Preamble: Salient Features, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliament -Powers and Functions –Executive- President -Governor - Council of Ministers.

Module 2: **3L**

Introduction to Ethical Thinking; what is Ethics, Work ethics; Scope of Professional Ethics, Values and Characteristics, Types of values: Negative and positive values, Ethical values for Professional success.

Module 3: **4L**

Engineering Ethics, Ethical theories: a brief overview; utilitarianism, deontology, virtue ethics. Professional Codes, Codes of professional ethics-Moral dilemmas, and moral autonomy- Internal ethics of business: whistle blowing, conflicts of interest, Job discrimination, and Exploitation of Employees; Social and ethical responsibilities of technologists: Responsibilities towards Customers, shareholders, employees – Social Audit.

Case Studies: Bhopal Gas Tragedy, Chernobyl (linking ethics to real-world failures).

Module 4: **3L**

Business ethics, ethical decision-making frameworks - Impact of ethics on business policies and strategies- Characteristics of ethical leaders; fostering integrity in teams; Addressing occupational crime, discrimination, and gender-based issues in workplaces-Intellectual property rights (IPR), Plagiarism and Academic Misconduct.

Text Books:

1. Durga Das Basu. *Introduction to the Constitution of India*. 27th ed. New Delhi: Lexis Nexis, 2024.
2. R.S Naagarazan. *A Textbook on Professional Ethics and Human Values*. New Age International (P) Limited, 2022.
3. N. Subramanian. *Professional Ethics.* New Delhi: Oxford University Press, 2017.
4. A N Tripathi, *Human Values*. New Delhi: New Age Publishers, 2019.
5. S. K. Chakraborty. *Values and Ethics for Organizations: Theory and Practices*. New Delhi: Oxford University Press, 1997.

Reference Books:

1. O. C. Ferrell, John Friaedrich and Linda Ferrell. *Business Ethics: Ethical Decision Making and Cases.* New Delhi: Cengage India, 2024.
2. Charles Fledderman. *Engineering Ethics*. 3rd ed. New Delhi: Pearson Education, 2007.
3. Dinesh G. Harkut and Gajendra R. Bamnote. *Professional Ethics for Engineers*. Chennai: Notion Press, 2023.
4. U.C.Mathur, *Corporate Governance and Business Ethics*: *Text and Cases*. Chennai: Macmillan, 2012.
5. Fernando. A. C., K. P. Muralidheeran and E. K. Satheesh. *Business Ethics – An Indian Perspective*. New Delhi: Pearson Education, 2019.

CO-PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**	**PSO3**
CO 1	-	-	-	-	-	-	-	2	-	-	2	2	3	3
CO 2	-	-	-	-	-	-	3	2	-	-	2	2	2	3
CO 3	-	-	-	-	-	2	3	2	-	-	2	3	3	2
CO 4	-	-	-	-	-	2	3	3	-	-	2	3	3	2

Course Title DESIGN THINKING AND INNOVATION
Course Code HU 103
(L-T-P) (2-0-0)
Class Hours / Week 02
Total class hours 30

Course Objective:
The objective of this Course is to provide new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products and services which are useful for a student in preparing for an engineering career.

Course Outcomes (COs):
Upon completion of the course, students shall be able to:

CO1. Analyze emotional experience and expressions to better understand stakeholders while designing innovative products through group brainstorming sessions.
CO2. Generate and develop design ideas through different technique
CO3. Develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing any innovative products using facility in AICTE IDEA LAB

Prerequisites:
For a course on the Basics of Design Thinking, students should ideally possess basic computer skills, communication abilities, problem-solving aptitude, critical thinking, introductory knowledge of Sustainable Development Goals, curiosity, and openness to new ideas, as well as basic understanding of mathematics, technology, and manufacturing processes.
However, even if these prerequisites are not satisfied, the faculty will cover them in the first few classes.
An awareness of 21st-century skills, including creativity and collaboration, is also beneficial.
These prerequisites aim to provide a foundation, and any gaps in knowledge will be addressed by the instructor early in the course.

COURSE CONTENT:

Module	Content	Hour
Module 1:	**Basics of Design Thinking:** Definition of Design Thinking, Need for Design Thinking, history of Design Thinking, Concepts & Brainstorming, 2X2 matrix, 6-3-5 method, NABC method;	3
Module 2:	**PROCESS OF DESIGN: Understanding Design thinking** Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping. Stages of Design Thinking Process (explain with examples) – Empathize (Methods of Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map, Empathy Map, Peer observation, Trend analysis). Define (Methods of Define Phase: Storytelling, Critical items diagram, Define success).	6
	Ideate (Brainstorming, 2X2 matrix, 6-3-5 method, NABC method). Prototype (Types of prototypes - Methods of prototyping - Focused experiments, Exploration map, Minimum Viable Product). Test (Methods of Testing: Feedback capture grid, A/B testing).	

Module 3:	**Tools for Design Thinking** Real-Time design interaction captures and analysis – Enabling efficient collaboration in digital space– Empathy for design – Collaboration in distributed Design	3
Module 4:	**Design Thinking in IT** Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping	2
Module 5:	**Design Thinking For strategic innovations** Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model	3
Module 6:	**Problem Solving & Critical thinking** Introduction to TRIZ, SCAMPER, UI and UX.	2
Module 7:	**Sustainable development goals (SDG)** Integrating and mapping 17 Sustainable development goals (SDG) during designing a product; goods or service. Introduction to 21st Century Skill Set	1
Module 8:	**Case Study & Project Report Submission**	10

Text Books:

1. Karmin Design Thinking by Dr. Bala Ramadurai, Mudranik Technology Private Ltd. ISBN 978-93-5419-0I0-0.
2. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
5. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

Reference Books:

1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
2. Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books, 2009.
4. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Toolbox, John Wiley & Sons, 2020.
5. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Playbook, John Wiley & Sons, 2018.
6. Kristin Fontichiaro, Design Thinking, Cherry Lake Publishing, USA, 2015.
7. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation - Research and Practice, Springer Series, 2016.

8. Gavin Ambrose, Paul Harris, Design Thinking, AVA Publishing, 2010.
9. Muhammad Mashhood Alam, Transforming an Idea into Business with Design Thinking, First Edition, Taylor and Francis Group, 2019.
10. S. Balaram, Thinking Design, Sage Publications, 2011.

WEB REFERENCES:

1. https://designthinking.ideo.com/
2. https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/
3. https://www.coursera.org/learn/design-thinking-innovation
4. https://swayam.gov.in/nd1_noc20_mg38/preview
5. www.tutor2u.net/business/presentations/. /productlifecycle/default.html
6. https://docs.oracle.com/cd/E11108_02/otn/pdf/. /E11087_01.pdf
7. www.bizfilings.com › Home › Marketing › Product Development
8. https://www.mindtools.com/brainstm.html
9. https://www.quicksprout.com/. /how-to-reverse-engineer-your-competit
10. www.vertabelo.com/blog/documentation/reverse-engineering https://support.microsoft.com/en-us/kb/273814
11. https://support.google.com/docs/answer/179740?hl=en

CO-PO MAPPING:

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

COURSE NAME: INTRODUCTION TO CIVIL ENGINEERING LAB-I
COURSE CODE-CE 191
CONTACT: 0:0:3
CREDITS: 1.5

Pre requisites: Basic awareness of science concepts at the higher secondary level and a general interest in civil engineering and construction practices will be helpful.

Course Objective: The objective of this course is to introduce students to the fundamental concepts of civil engineering through hands-on exposure to construction materials, simple laboratory tests, basic drawing practices, and elementary surveying techniques. The course aims to develop an understanding of material behavior, introduce essential lab equipment, and build foundational practical skills that are crucial for advanced civil engineering courses.

Course Outcome:

CO1	Identify and classify basic civil engineering materials such as cement, aggregates, bricks, and steel based on visual and field characteristics.
CO2	Perform simple field-level quality checks and basic laboratory tests on civil engineering materials such as flakiness index and elongation index of aggregates.
CO3	Observe and understand the working of a Universal Testing Machine (UTM) and recognize the stress-strain behaviour of mild steel.
CO4	Prepare scaled drawing (1:100) of a simple single-storey residential building (2BHK), indicating major architectural components.
CO5	Identify and demonstrate the use of basic surveying instruments and perform elementary chain surveying and offsetting techniques.

COURSE CONTENTS:

Module-1: [12L]: Construction Materials Identification & Testing:

Identification of Construction Materials: Introduction to common civil engineering materials (cement, bricks, sand, aggregates, steel), Classification based on natural/artificial and coarse/fine, Source-wise classification (e.g., river sand, manufactured sand). **Cement Identification and Visual Quality Test:** Recognizing different types of cement (Ordinary Portland, PPC), Field tests: color, texture, feel test, setting test, soundness test (visual/hand-based**). Coarse and Fine Aggregate Identification:** Visual differences and size classification, Identification of types: crushed stone, natural gravel, river sand, M-sand. **Brick Testing (Field Level):** Visual quality check: uniform shape, color, smoothness, Simple field tests: hardness (scratch), soundness (ring), water absorption (observation only), Identification of first class vs. second class bricks

Module-2: [9L]: Demonstration of Material Testing

Flakiness and Elongation Index of Aggregates: Use of standard gauge, Recording and comparison of flaky/elongated particles, Understanding aggregate shape influence on workability and strength.

Universal Testing Machine (UTM) – Study and Demonstration**:** Components of UTM: grips, load cell, dial gauge, understanding stress-strain behaviour (no calculation required)

Module-3:[9L]: Basic Drawing Skills

Drawing Practice – Simple Residential Building: Preparation of a scaled drawing (1:100), Plan layout of a single-storey load-bearing structure, Indicate walls, doors, windows, kitchen, bedrooms, toilet, stairs, Title block, legends, and dimensions

Module-4: [6L]: Surveying Instruments and Practice

Survey Instruments – Identification and Demonstration: Chain, tape, compass, Dumpy level, theodolite (intro only), Total station (demonstration only – no operation), Purpose and usage in real-life construction. Linear Measurement – Chain Survey: Ranging: direct and indirect, laying a straight line on ground, taking measurement using chain and tape, Recording in field book

Text / Reference Books:

Sl No	Name	Author	Publisher
1	Building Materials	S.K. Duggal	New Age International Publishers
2	Surveying (Vol. 1)	B.C. Punmia, Ashok Kumar Jain, Arun Jain	Laxmi Publications Pvt. Ltd.
3	Laboratory Manual on Testing of Engineering Materials	B. Bhattacharjee	New Age International Publishers
4	Basic Civil Engineering	Satheesh Gopi	Pearson Education
5	A Textbook of Engineering Drawing	R.K. Dhawan	S. Chand Publishing
6	Strength of Materials (For Simple Lab Understanding)	R.K. Rajput	S. Chand Publishing
7	Surveying and Levelling	R. Subramanian	Oxford University Press

CO-PO mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	1	1	1	1	1	2	1	2	2	3
CO2	3	3	1	2	2	1	1	1	1	2	1	2	2	2
CO3	3	2	1	2	2	1	1	1	1	2	1	3	2	2
CO4	2	1	3	1	3	1	1	1	1	3	1	2	3	2
CO5	2	2	2	2	2	1	1	1	2	3	1	2	2	3

Course Name: ARTIFICIAL INTELLIGENCE LAB
Course Code: CS192
Contact: 0:0:3
Credit: 1.5

Course Objectives:

The objectives of this course are to enable students to

1. Gain foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing
2. Formulate a problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.
3. Apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
4. Build expert systems offering solutions to the challenging problems of Artificial Intelligence.
5. Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies

Course Outcomes (COs):

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

CO1	**Acquire** foundational knowledge of PROLOG to **implement** an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing and **understand** the working principle of the agent and **assess** its utilitarian importance in current technological context leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem by analyzing its characteristics to fit a State-Space Exploration Framework or an Inferencing Agent Formulation Framework of Artificial Intelligence.
CO3	**Explore** relevant literature and **apply** the concepts of Artificial Intelligence to **solve** a problem by **implementing** well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
CO4	**Develop** ideas and **propose an** expert system offering solutions to the challenging problems of Artificial Intelligence.
CO5	**Plan and Implement** Artificial Intelligence based ideas as executable PROLOG programs through **developing** intelligent heuristic strategies or expert systems with adequate documentation in a collaborative environment for successfully carrying out projects on Artificial Intelligence Problems and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools.

Course Contents:

Module 1: Introduction to PROLOG Programming along with the IDE and its Basic Components

Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy. Understanding facts, rules, queries, and syntax.

Module 2: Recursive definitions in Prolog

Fibonacci Series, Calculator, Factorial, summation, list length, etc. Using recursive rules.

Module 3: Defining facts and simple queries

Writing a knowledge base for family relationships, basic objects.

Module 4: **Rules and inference in Prolog**

Creating logical rules and testing inferences.

Module 5: List operations in Prolog

Checking membership, concatenation, reverse, max/min of list.

Module 6: Pattern matching and symbolic reasoning

Simple examples involving pattern recognition (e.g., shape or name matching, Family Tree design)

Module 7: Expert system simulation (Mini project)

Building a mini knowledge-based system (e.g., Animal Classification, Medical diagnosis, etc).

Textbook:

Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition, Addison-Wesley.

CO–PO Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	3	2	3
CO3	2	2	3	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	3	2
CO5	2	2	3	3	2	2	2	2	2	2	2	2	2	3

Course Name: ENGINEERING CHEMISTRY LAB
Paper Code: CH 191
Total Contact: 0:0:2
Credit: 1

Prerequisites: 10+2

Course Objective

- Study the basic principles of pH meter and conductivity meter for different
- applications
- Analysis of water for its various parameters & its significance in industries
- Learn to synthesis Polymeric materials and drugs
- Study the various reactions in homogeneous and heterogeneous medium

Course Outcome

CO1: Able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2: Able to analyse and determine the composition and physical property of liquid and solid samples when working as an individual and also as a team member
CO3: Able to analyse different parameters of water considering environmental issues
CO4: Able to synthesize drug and sustainable polymer materials.
CO5: Capable to design innovative experiments applying the fundamentals of modern chemistry

COURSE CONTENT

Any 10 experiments to be conducted preferably a combination of estimation, water quality analysis, instrumental analysis and synthesis

1. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution.
2. Estimation of amount of Fe^{2+} in Mohr's salt using permanganometry.
3. To determine the surface tension of a given liquid at room temperature using stalagmometer by drop number method.
4. To determine the viscosity of a given unknown liquid with respect to water at room temperature, by Ostwald's Viscometer.
5. Water quality analysis :
   i. Determination of total, permanent and temporary hardness of sample water by complexometric titration.
   ii. Determination of Cl^- ion of the sample water by Argentometric method
   iii. Determination of alkalinity of the sample water.
   iv. Determination of dissolved oxygen present in a given water sample.
6. Determination of the concentration of the electrolyte through pH measurement.
7. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
8. Determination of cell constant and conductance of solutions.

9. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
10. Determination of Partition Coefficient of acetic acid between two immiscible liquids.
11. Drug design and synthesis
12. Synthesis of polymers (Bakelite) for electrical devices and PCBs.
13. Synthesis of Silver Nanoparticles doped organic thin film for organic transistors.
14. Determination of R_F of any amino acid by thin layer chromatography.
15. Saponification /acid value of any oil.
16. Isolation of graphene from dead dry batteries

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	3	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	2	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	3	2	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	3	2
CO5	3	2	3	3	2	2	2	2	2	2	2	2	2	3

Course Title: IDEA Lab Workshop
Course Code: ME193
Number of Credits: (L: 0, T: 0, P: 3)
Credit: 1.5

Course Objectives:

CO1- To learn all the skills associated with the tools and inventory associated with the IDEA Lab.
CO-2 Learn useful mechanical and electronic fabrication processes.
CO-3 Learn necessary skills to build useful and standalone system/ project with enclosures.
CO-4 Learn necessary skills to create print and electronic documentation for the system/project

Course Contents*:*

Module	Topics	
1	Electronic component familiarisation, Understanding electronic system design flow. Schematic design and PCB layout and Gerber creation using EagleCAD. Documentation using Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools such as FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT.	Introduction to basic hand tools - Tape measure, combination square, Vernier calliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits,

2	Familiarisation and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output) Circuit prototyping using (a) breadboard, (b) Zero PCB (c) 'Manhattan' style and (d) custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines.	Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboard a Box.
3	Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input. Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging	3D printing and prototyping technology – 3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering. Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers. Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab
4	Discussion and implementation of a mini project.	
5	Documentation of the mini project (Report and video).	

Laboratory Activities:

S. No.	List of Lab activities and experiments
1.	Schematic and PCB layout design of a suitable circuit, fabrication and testi of the circuit.
2.	Machining of 3D geometry on soft material such as soft wood or modelling w
3.	3D scanning of computer mouse geometry surface. 3D printing of scann geometry using FDM or SLA printer.

4.	2D profile cutting of press fit box/casing in acrylic (3 or 6 m thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5.	2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6.	Familiarity and use of welding equipment.
7.	Familiarity and use of normal and wood lathe.
8.	Embedded programming using Arduino and/or Raspberry Pi.
9.	Design and implementation of a capstone project involving embedded Hardware software and machined or 3D printed enclosure.

Reference Books:

S. No.	Title
1.	AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing, New Delhi.
2.	All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
3.	Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
4.	3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
5.	The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
6.	The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.
7.	Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374
8.	The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269
9.	Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542
10.	Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945,978- 9352131952, 978-9352133703
11.	Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586
12.	Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633
13.	Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13 : 978-1260019193.

14.	Pro GIT. 2nd edition. Scott Chacon and Ben Straub. A press. ISBN-13 : 978- 1484200773
15.	Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer, 2004.
16.	Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
17.	Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition,2002.

CO-PO mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	3	2	2
CO2	2	3	-	-	-	-	-	-	-	-	-	2	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	3	2	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	3	2
CO5	3	2	3	3	2	2	2	2	2	2	2	2	2	3

1st Year 2nd Semester (Gr-B)									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CE201	Introduction to Civil Engineering - II	3	0	0	3	3
2	ENGN	Major	CE 202	Engineering Mechanics in Civil Engineering	3	0	0	3	3
2	SCI	Multidisciplinary	PH201	Engineering Physics	3	0	0	3	3
3	SCI	Multidisciplinary	M201	Engineering Mathematics – II	3	0	0	3	3
5	HUM	Value Added Course	HU201	Environmental Science	2	0	0	2	2
6	HUM	Value Added Course	HU202	Indian Knowledge System	1	0	0	1	1
B. PRACTICAL									
1	ENGG	Major	CE291	Introduction to Civil Engineering Lab - II	0	0	3	3	1.5
2	ENGG	Major	CE292	Engineering Mechanics in Civil Engineering Lab	0	0	3	3	1.5

3	SCI	Skill Enhancement Course	PH291	Engineering Physics Lab	0	0	3	3	1.5
4	ENGG	Skill Enhancement Course	ME294	Engineering Graphics and Computer Aided Design Lab	0	0	3	3	1.5
5	HUM	Ability Enhancement Course	HU291	Communication and Presentation Skill	0	0	3	3	1.5
C. MANDATORY ACTIVITIES / COURSES									
	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club		0	0	0	0	0
Total of Theory, Practical								**29**	**22.5**
TOTAL FIRST YEAR CREDIT									**40**

COURSE NAME: INTRODUCTION TO CIVIL ENGINEERING - II
COURSE CODE: CE 201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisites: A basic knowledge in 10+2 Science subjects.

Course Objective: The concepts developed in this course will aid in quantification of several concepts in Civil Engineering based on previous knowledge science at the 10+2 levels in schools. Technology is being increasingly based on the basics of Civil Engineering, broad area of Civil Engineering and their application.

Course Outcomes (COs):

After completion of this course students will be able to:

CO1: Describe the fundamentals of Civil Engineering and their broad areas.
CO2: Evaluate theoretical and practical aspects related to the various aspects of Civil Engineering in Surveying, Transportation Engineering, Water Resource Engineering, Environmental Engineering, etc. to the industrial scale, in accordance with current needs.
CO3: Students will have knowledge about Engineering properties of Rocks and their Minerals.
CO4: Student will able to understand various geological parameters

COURSE CONTENT –

Module 1: Fundamentals of Surveying: 7L

Introduction, Basic Definitions (Surveying, levelling, Plans, Maps, Scales), Introduction to divisions of surveying, Classification of surveying, Fundamental principles of surveying, Measurement in Surveying, Phases of Surveying.

Module 2: Introduction to Transportation Engineering: 6L

Role of Transportation in National development, Transportation Ways and mode of transport, Surface Transportation and Aviation, Introduction to Railway Engineering, Elements of Traffic Engineering and Traffic Control.

Module 3: Environmental Engineering & Sustainability: 7L

Sustainability Concepts – Innovations and Challenges; Environmental Measurements from Different Disciplines; Water – Quantity and Quality; Water Treatment Basics; Basics of

Wastewater Collection, Treatment & Resource Recovery; Basics of Solid Waste, Soil and Noise Pollution; Basics of Air Pollution Issues – Global and Local

Module 4: Fundamentals of Water Resources Development: 6L

Elementary Hydrology, Sources of water, Watershed Development, Water requirements and its conservation, Basic Introduction of Hydraulic Structures of Storage. Basics of Hydrograph, hyetograph and unit Hydrograph.

Module 5: Engineering Geology: 10L

Geology and its importance in Civil Engineering
Mineralogy: Definition, internal and external structure of minerals, Classification and physical properties of minerals.
Classification of rocks: a) Igneous rocks: Origin, mode of occurrence, forms & texture, classification and engineering importance. b) Sedimentary rocks: Process of sedimentation, classification and engineering importance. c) Metamorphic rocks: Agents and types of metamorphism, classification and engineering importance.
Weathering of rocks: Agents and kinds of weathering, soil formation & classification based on origin.
Geological work of rivers: Origin and stages in the system, erosion, transportation and deposition.

Module 5: Rock Engineering 10L

Structural geology: Introduction to structural elements of rocks, dip & strike, definition, description, classification of folds, faults and joints, importance of geological structures in Civil Engineering.
Engineering properties of rocks: Porosity, permeability, compressive strength, tensile strength and abrasive resistance
Rocks as construction materials: Qualities required for building and ornamental stones, foundations, concrete aggregate, railway ballast, road metal, pavement, flooring and roofing
Landslides: Types of landslides, causes, effects and prevention of landslides

Reference Books

1) Chen, W. F. and Liew, J. Y. R., (Eds.), The Civil Engineering Handbook, Second Edition, CRC Press (Taylor and Francis)
2) Dalal, K. R., Essentials of Civil Engineering, Charotar Publishing House
3) Gopi, S., Basic Civil Engineering, Pearson Publishers
4) Engineering and General Geology Parvin Singh Katson house Delhi 1987
5) Engineering Geology for Civil Engineers D. Venkat Reddy Oxford, IBH, 1995.
6) Mondal, A. and Dey, S., Fundamentals of Civil Engineering: Principles, Practices, and Applications, Chyren Publication

7) McKay, W. B. and McKay, J. K., Building Construction Volumes | to 4, Pearson India Education Services 8) Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house
9) Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	2	2	1	1	2	3	2	2	2
CO2	3	2	1	2	1	2	2	2	1	2	3	3	2	2
CO3	3	2	1	2	1	2	3	1	2	2	3	2	3	3
CO4	3	2	1	2	1	3	3	2	2	2	3	2	2	2

COURSE NAME: ENGINEERING MECHANICS IN CIVIL ENGINEERING
COURSE CODE: CE202
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS: 3

Pre-requisites:

Basic concepts of Physics and foundational Engineering Mechanics.

Course Objectives:

To understand the core principles of engineering mechanics and apply them to solve practical problems in Civil Engineering involving forces, equilibrium, structural analysis, friction, and dynamic behaviour.

Course Outcomes:

CO1: Understand fundamental principles of engineering mechanics applicable to civil engineering systems.
CO2: Gain proficiency in vectorial representation and equilibrium of forces and moments.
CO3: Analyze and compute centroid, center of gravity, and moment of inertia for different structural elements.
CO4: Construct free-body diagrams and solve problems involving static equilibrium in trusses and frames.
CO5: Evaluate systems using work-energy principles and understand mechanical work and efficiency.
CO6: Understand the influence of friction and its role in real-world static and dynamic systems.

Module No.	Course Contents	Contact Hours
Module1	Introduction to Engineering Mechanics: Force systems, particle & rigid body equilibrium (2D & 3D), system of forces, coplanar forces, moments, couples, resultants, free-body diagrams, vector mechanics (dot & cross product).	8L
Module 2	Friction: Laws of friction, static & dynamic friction, wedge friction, screw jack, and differential screw jack.	4L
Module 3	Basic Structural Analysis: Trusses (zero force members, method of joints/sections), beams, frames, types of supports & loads.	4L
Module 4	Centroid and Centre of Gravity: Calculation using first principles and composite sections.	4L
Module 5	Moment of Inertia: Area and mass moment of inertia, standard and composite sections, parallel & perpendicular axis theorems.	4L
Module 6	Virtual Work & Energy Methods: Virtual displacement, active force diagrams, conservative forces, energy equation for equilibrium, stability.	3L

Module No.	Course Contents	Contact Hours
Module 7	Particle Dynamics: Rectilinear and curvilinear motion, relative motion, Newton's laws, impulse-momentum, impact (direct & oblique).	5L
Module 8	Kinetics of Rigid Bodies: Plane motion, instantaneous center, D'Alembert's principle, work-energy principle, connected bodies.	4L

Textbooks:

1. Irving H. Shames – *Engineering Mechanics*, 4th Ed., Prentice Hall
2. F.P. Beer and E.R. Johnston – *Vector Mechanics for Engineers*, Vol I & II, McGraw Hill
3. R.C. Hibbler – *Engineering Mechanics: Statics & Dynamics*, Pearson
4. Andy Ruina & Rudra Pratap – *Introduction to Statics and Dynamics*, Oxford University Press
5. Shanes & Rao – *Engineering Mechanics*, Pearson
6. Hibbler & Gupta – *Engineering Mechanics*, Pearson

Reference Books:

1. Vijaykumar K. Reddy & K. Suresh Kumar – *Singer's Engineering Mechanics*
2. R.K. Bansal – *A Textbook of Engineering Mechanics*, Laxmi Publications
3. R.S. Khurmi – *Engineering Mechanics*, S. Chand & Co.
4. A.K. Tayal – *Engineering Mechanics*, Umesh Publications

CO-PO mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	3
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2	2
CO3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	3	-	-	-	-	-	-	-	2	2	2
CO6	3	2	3	2	-	-	-	-	-	-	-	3	3	2

Course Name: ENGINEERING PHYSICS
Course Code: PH201
Contact: (3:0:0)
Total Contact Hours: 36
Credits: 3

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:

The aim of courses in Physics-I is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

COURSE OUTCOME

CO1: Explain the principles of lasers, fibre optics, and holography and apply them in modern optical and communication systems.
CO2: Identify different crystal structures and compute structural parameters such as Miller indices and packing factors; distinguish between metals, semiconductors, and insulators using band theory.
CO3: Utilize the principles of quantum theory—including quantization, wave-particle duality, and Schrödinger equation—to interpret fundamental quantum phenomena.
CO4: Illustrate the basic concepts of statistical mechanics and examine their implications on microscopic particle behaviour.
CO5: Describe the properties of nanomaterials and display/storage devices and analyze their applications in modern technology.

Course Content:

Module 1 (11L)
Modern Optics
1.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. 6L
1.02-Fibre Optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems. 3L
1.03-Holography-Theory of holography (qualitative analysis), viewing of holography, applications. 2L

Module 2 (5L)
Solid State Physics
2.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. 3L
2.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction. 2L

Module 3 (14L)
Quantum and Statistical Mechanics
3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: Black body radiation, Photoelectric and Compton Effect: no derivation required), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment, related numerical problems. 5L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions-Qualitative discussion; uncertainty principle, relevant numerical problems, Introduction of Schrödinger wave equation (only statement). 4L

3.03 Statistical Mechanics
Concept of energy levels and energy states, phase space, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)-physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level-Qualitative discussion. 5L

Module 4 (4L)
Physics of Nanomaterials
Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical).

Module 5 (2L)
Storage and display devices
Different storage and display devices-Magnetic storage materials, Operation and application of CRT, CRO, LED and OLED.

Text books
1. Concepts of Modern Engineering Physics- A. S. Vasudeva. (S. Chand Publishers)
2. Engineering Physics - Rakesh Dogra
3. Introduction to Nanoscience and Nanotechnology, An Indian Adaptation-Charles P. Poole, Jr., Frank J. Owens.

Reference books.
1. Optics - Ajay Ghatak (TMH)
2. Solid state Physics - S. O. Pillai
3. Quantum mechanics -A.K. Ghatak and S Lokenathan
4. Fundamental of Statistical Mechanics: B. B. Laud
6. Perspective & Concept of Modern Physics—Arthur Beiser

CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	2	-	2	2	3	3
CO2	3	3	-	-	-	-	-	-	2	-	2	3	2	2
CO3	3	3	-	-	-	-	-	-	2	-	2	2	2	2
CO4	3	3	-	-	-	-	-	-	2	-	2	2	3	2
CO5	3	3	-	-	-	-	-	-	2	-	2	2	2	2

Course Name: ENGINEERING MATHEMATICS - II
Paper Code: M 201
Contact (L: T: P): 3 : 0 : 0
Total Contact Hours: 36
Credit: 3

Prerequisites:

The students to whom this course will be offered must have the understanding of (10+2) standard algebraic operations, and elementary calculus concepts including limits, continuity, differentiation, and integration.

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations, Laplace transform and numerical methods. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1. Apply analytical methods to solve ordinary differential equations in engineering contexts.

CO2. Apply the properties and inverse of Laplace Transforms to compute improper integrals and determine solutions of linear ordinary differential equations with constant coefficients
in engineering scenarios.

CO3. Apply numerical methods to interpolate data, perform numerical integration, and solve ordinary differential equations in engineering applications.

CO4. Analyze the behavior of solutions using analytical and numerical approaches, including Laplace transforms, to assess stability, convergence, and accuracy in engineering contexts.

Course Content:

Module I: First Order Ordinary Differential Equations (ODE) (9L)
Solution of first order and first-degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation.
Solution of first order and higher degree ODE: solvable for$p$, solvable for y and solvable for $x$and Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE) (8L)
Solution of second order ODE with constant coefficients: Complementary Function and Particular Integral, Method of variation of parameters, Cauchy-Euler equations.

Module III: Laplace Transform (LT) (12L)
Concept of improper integrals; Definition and existence of LT, LT of elementary functions, First

and second shifting properties, Change of scale property, LT of $tf(t)$, LT of $\frac{f(t)}{t}$, LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods (7L)

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation. **Numerical integration:** Trapezoidal rule, Simpson's 1/3 Rule. **Numerical solution of ordinary differential equation:** Euler method, Fourth order Runge-Kutta method.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

1. Guruprasad, S. A text book of Engineering Mathematics-I, New age International Publishers.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
6. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
7. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
8. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
9. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
10. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.

CO-PO/PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	1	2	2	2
CO2	3	2	-	-	-	-	-	-	-	-	1	3	2	2
CO3	3	2	-	-	-	-	-	-	-	-	1	2	3	2
CO4	3	3	1	1	-	-	-	-	-	-	2	3	2	2

Subject Name: ENVIRONMENTAL SCIENCE
Paper Code: HU 201
Credits: 2
Contact Hours: 24

Prerequisites: 10+2

Course Objective (s)

This course will enable the students to,

- Realize the importance of environment and its resources.
- Apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Know about environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Solve scientific problem-solving related to air, water, land and noise pollution.

Course Outcome

CO	Statement
C01	Able to understand the natural environment and its relationships with human activities
C02	The ability to apply the fundamental knowledge of science and engineering to assess environmental and health risk
C03	Ability to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
CO4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Module 1 - Resources and Ecosystem (6L)

1. Resources (4L)

Types of resources, Human resource, Population Growth models: Exponential Growth, Logistic growth curve with explanation. Maximum Sustainable Yield [Derivation]

Alternative sources of Energy [Solar energy, tidal energy, geothermal energy, biomass energy]

2. Ecosystem (2L)

Components of ecosystem, types of ecosystems, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Pond eco system, Food chain, Food web.

Module 2 – Environmental Degradation (10L)

1. Air Pollution and its impact on Environment (3L)

Air Pollutants, primary & secondary pollutants, Criteria pollutants, Smog, Photochemical smog and London smog, Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.

2. Water Pollution and its impact on Environment (4L)

Water Pollutants, Oxygen demanding wastes, heavy metals, BOD [Rate equation], COD, Eutrophication, Hardness, Alkalinity, TDS and Chloride, Heavy metal (As, Hg, Pb) poisoning and toxicity. Numerical on BOD, Hardness.

3. Land Pollution and its impact on Environment (1L)

Solid wastes, types of Solid Waste, Municipal Solid wastes, hazardous wastes, bio-medical wastes, E-wastes,

4. Noise Pollution and its impact on Environment (2L)

Types of noise, Noise frequency, Noise pressure, Measurement of noise level and decibel (dB) Noise intensity, Noise Threshold limit, Effect of noise pollution on human health. Numerical on Measurement of noise level and decibel (dB) and Noise Threshold limit.

Module 3 – Environmental Management (6L)

1. Environmental Impact Assessment (1L)

Environmental Auditing, Environmental laws and Protection Acts of India, carbon footprint, green building practices. *(GRIHA norms)*

2. Pollution Control and Treatment (2L)

Air Pollution controlling devices, Catalytic Converter, Electrostatic Precipitator.

Wastewater Treatment (Surface water treatment &Activated sludge process), Removal of hardness of water (Temporary &Permanent -Permutitprocess).

3. Waste Management (3L)

Solid waste management, Open dumping, Land filling, incineration, composting & Vermicomposting, E-waste management, and Biomedical Waste management.

Module 4 – Disaster Management (2L)

1. Study of some important disasters (1L)

Natural and Man-made disasters, earthquakes, floods drought, landslide, cyclones, volcanic eruptions, tsunami, oil spills, forest fires.

2. Disaster Management Techniques (1L)

Basic principles of disaster management, Disaster Management cycle, Disaster management policy, Awareness generation program

Text Books:

1. Basic Environmental Engineering and Elementary Biology (For MAKAUT), Gourkrishna Dasmohapatra, Vikas Publishing.
2. Basic Environmental Engineering and Elementary Biology, Dr. Monindra Nath Patra & Rahul Kumar Singha, Aryan Publishing House.
3. Textbook of Environmental Studies for Undergraduate Courses, Erach Barucha for UGC, Universities Press

Reference Books:

1. A Text Book of Environmental Studies, Dr. D.K. Asthana & Dr. Meera Asthana, S.Chand Publications.
2. Environmental Science (As per NEP 2020), Subrat Roy, Khanna Publisher

CO-PO mapping

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

Paper Name: INDIAN KNOWLEDGE SYSTEM
Paper Code: HU202
Contact: 1:0:0
Credit: 01

Course outcome: On completing this course the student will be able

CO1: To define, identify, describe and classify the philosophical, literary and socio-religious heritage of ancient India and the core concepts of the Vedic corpus and way of life.
CO 2: To discover, enumerate, compare, contrast and categorize the importance of pioneering developments in science and mathematics and evaluate their continuing relevance.
CO 3: To analyze, appraise, correlate and describe the ancient Indian heritage in science and technology and examine technological correlations with present-day technological applications.
C0 4: To discover, assess and describe traditional knowledge in health care, architecture, agriculture and other sectors and to explore the history of traditional Indian art forms .

Module-1 **3L**
An overview of Indian Knowledge System (IKS): Importance of Ancient Knowledge - Definition of IKS - Classification framework of IKS - Unique aspects of IKS.
The Vedic corpus: Vedas and Vedangas - Distinctive features of Vedic life.
Indian philosophical systems: Different schools of philosophy (Orthodox and Unorthodox).

Module-2 **3L**
Salient features of the Indian numeral system: Developments in Indian Mathematics in ancient India - Importance of decimal representation - The discovery of zero and its importance - Unique approaches to represent numbers- Contribution of ancient Indian mathematicians
Highlights of Indian Astronomy: Historical development of astronomy in India- key contributions of ancient Indian astronomers.

Module 3 **3L**
Indian science and technology heritage: Metals and metalworking - Mining and ore extraction – Structural engineering and architecture in ancient India: planning, materials, construction and approaches- Dyes and painting; Shipbuilding.

Module 4 **3L**
Traditional Knowledge in Different Sectors: Traditional knowledge and engineering. Traditional Agricultural practices (resources, methods, technical aids); Traditional Medicine and Surgery; History of traditional Art forms and Culture.

Text Books:
1. Amit Jha . *Traditional Knowledge System in India*. New Delhi: Atlantic Publishers, 2024.
2. B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana . *Introduction to Indian Knowledge System: Concepts and Applications*. New Delhi: PHI, 2022.
3. Angad Godbole. *Science and Technology in Ancient India*. New Delhi: Biblia Implex, 2023.
4. Pritilakshmi Swain. *Indian Knowledge System*. New Delhi: Redshine Publication, 2024.
5. Vishnudut Purohit. *Fundamentals of Indian Knowledge System*. New Delhi: ABD Publishers, 2024.

Reference Books:

1. A. L. Basham. *The Wonder that was India*. Vol. I. New Delhi: Picador, 2019.
2. Arun Kumar Jha and Seema Sahay ed. *Aspects of Science and Technology in Ancient India.* Oxford and New Delhi: Taylor and Francis, 2023.
3. Kapil Kapoor and Awadhesh Kumar Singh. *Indian Knowledge Systems*. Vols. 1 and 2. New Delhi: D. K. Printworld, 2005.
4. S. N. Sen and K. S. Shukla, *History of Astronomy in India*. New Delhi: Indian National Science Academy, 2nd edition, 2000.
5. Arpit Srivastava. *Indian Knowledge System*. Rewa: AKS University, 2024.

CO-PO Mapping:

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

COURSE NAME: INTRODUCTION TO CIVIL ENGINEERING LAB-II:
COURSE CODE- CE 291
CONTACT: 3:0:0
CREDITS: 1.5

Pre requisites: Basic understanding of civil engineering concepts as introduced in CE191 – Introduction to Civil Engineering Lab – I. Familiarity with general science at the +2 level (basic concepts of geology, physics, chemistry).

Course Objective: This course aims to introduce first-year civil engineering students to practical applications in engineering geology, environmental engineering, soil mechanics, and computer-aided drafting (CAD). Through hands-on experiments and exercises, students will gain foundational skills in identifying geological samples, performing water and soil tests, and creating basic 2D engineering drawings. The course bridges theoretical learning with real-world civil engineering practices to enhance their technical and observational skills.

Course Outcome:

CO1	Identify and classify common rocks and minerals from hand specimens and interpret basic geological features using maps and sections.
CO2	Analyze water quality parameters such as pH, turbidity, and total solids through basic environmental engineering laboratory tests.
CO3	Determine fundamental geotechnical properties of soils including grain size distribution, water content, and specific gravity.
CO4	Apply basic CAD software tools to create simple 2D civil engineering drawings, including building plans and sectional views
CO5	Correlate theoretical knowledge of geology, environmental, geotechnical, and drawing principles with practical laboratory observations.

COURSE CONTENTS:

Module-1: [9L]: Engineering Geology:

Identification of Rocks and Minerals (Hand Specimens): Igneous, sedimentary, and metamorphic rocks, Quartz, Feldspar, Mica, Calcite, etc. Study of Geological Maps and Interpretation of Geological Structures: Horizontal, inclined, and folded strata Faults and unconformities, Interpretation of outcrops, dips, and strikes. Geological Problems: Borehole interpretation and correlation, Determination of thickness of strata from outcrops and borehole data

Module-2: [9L]: Environmental Engineering

Demonstration on Water Quality Testing Experiments: pH of water sample, turbidity using visual method, Calculation of Total Solids (TS) in a water sample

Module-3:[9L]: Geotechnical Engineering

Soil Properties and Index Tests**:** Grain Size Distribution by Sieve Analysis**,** Determination of Water Content by Pycnometer Method**,** Procedure for finding Specific Gravity of soil solids using Pycnometer.

Module-4: [9L]: Introduction to CAD

Basic Drawing Commands in CAD Software (AutoCAD or equivalent): Line, circle, rectangle, trim, extend, offset, mirror, array, Layer management and dimensioning. Simple 2D Drafting Practice: Plan of a room/building, Sectional view of a footing or foundation, Drawing title block, annotation, hatching

Text / Reference Books:

Sl No	Name	Author(s)	Publisher
1	Textbook of Engineering Geology	N. Chenna Kesavulu	McGraw Hill Education
2	Engineering and General Geology	Parbin Singh	S.K. Kataria & Sons
3	Laboratory Manual of Geotechnical Engineering	Alam Singh & Shamsher Prakash	CBS Publishers
4	Water Supply Engineering: Environmental Engineering Vol. I	B.C. Punmia, Ashok Jain, Arun Jain	Laxmi Publications
5	Environmental Engineering Lab Manual	R.K. Garg	Khanna Publishers
6	AutoCAD for Engineers and Designers (Latest Edition)	Sham Tickoo	CADCIM Technologies
7	Soil Mechanics and Foundations	B.C. Punmia, Ashok Jain, Arun Jain	Laxmi Publications

CO-PO mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	1	1	2	1	1	2	1	2	2	3
CO2	3	2	1	3	1	1	3	1	1	2	1	3	2	2
CO3	3	3	1	3	2	1	2	1	1	2	1	2	2	2
CO4	2	1	3	2	3	1	1	1	2	3	2	3	2	2
CO5	3	3	2	3	2	1	2	1	2	3	2	2	2	2

COURSE NAME: ENGINEERING MECHANICS LAB IN CIVIL ENGINEERING
COURSE CODE: CE292
CREDITS: 1.5

Pre-requisites:

Basic concepts of forces, moments, stress-strain relationships, and knowledge of standard civil engineering materials.

Course Objective:

To enable students to understand the fundamental mechanical behavior of civil engineering materials through laboratory tests including tension, compression, torsion, bending, impact, and hardness. The course also develops the ability to analyze, interpret, and report experimental results relevant to real-world engineering applications.

Course Outcome:

CO1: Understand the mechanical behavior of common civil engineering materials under tensile, compressive, bending, torsional, and impact loads.
CO2: Identify and evaluate key material properties such as strength, stiffness, ductility, and hardness through lab-based testing.
CO3: Apply theoretical principles to interpret experimental data using universal testing machines.
CO4: Compare performance of different structural materials through standardized testing.
CO5: Acquire skills in mechanical testing apparatus, teamwork, and technical reporting.

Course Contents:

Module	Topic	Hours
Module 1	Tension Test on Structural Materials: Mild Steel and Tor steel (HYSD bars)	3P
Module 2	Compression Test on Structural Materials: Timber, bricks, and concrete cubes	3P
Module 3	Bending Test on Mild Steel – Flexural Strength Determination	3P
Module 4	Torsion Test on Mild Steel Circular Bar	3P
Module 5	Hardness Tests on Ferrous and Non-Ferrous Metals: Brinell and Rockwell Methods	3P
Module 6	Test on Closely Coiled Helical Spring – Load vs Deflection	3P

Module	Topic	Hours
Module 7	Impact Tests: Izod and Charpy	3P
Module 8	Demonstration of Fatigue Test	3P

Text / Reference Books:

Sl No	Name	Author
1	Strength of Materials	R.K. Bansal
2	Mechanics of Materials	S.S. Bhavikatti
3	Material Testing Laboratory Manual	S.K. Duggal
4	Engineering Mechanics	S. Ramamrutham

CO-PO Mapping -

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	-	-	-	-	1	-	3	2	2
CO2	3	3	1	2	2	-	-	-	-	1	-	2	2	3
CO3	2	3	2	3	3	-	-	-	1	1	1	2	2	2
CO4	2	2	-	2	2	-	-	-	-	2	-	2	3	2
CO5	3	2	-	3	3	-	-	-	2	2	1	3	2	3

Course Name: ENGINEERING PHYSICS LAB
Course Code: PH291
Contact: (0:0:3)
Credits: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objectives:

The aim of course is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies

Course Outcomes

After completion of this course the students will be able to
CO1: *Determine* mechanical properties such as Young's modulus and rigidity modulus through hands-on experiments and *analyze* material behaviour under applied forces.
CO2: *Perform* optical experiments including Newton's Rings, laser diffraction, and optical fiber characterization, and *interpret* the results based on wave optics principles.
CO3: *Investigate* quantum effects such as the photoelectric effect and atomic transitions, and *relate* experimental outcomes to basic quantum principles.
CO4: *Study* the performance of semiconductor and electronic devices like solar cells, LEDs, and LCR circuits, and *investigate* their operational characteristics.
CO5: *Conduct* experiments such as Hall Effect, e/m determination, prism dispersion, or optical rotation to *demonstrate* the application of advanced physical principles in practical scenarios.

Course Content:

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide callipers/ Screw-gauge/travelling microscope for one experiment.
Experiments on Classical Physics (Any 4 to be performed from the following experiments):
1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of Young's moduli of different materials.
3. Determination of Rigidity moduli of different materials.
4. Determination of wavelength of light by Newton's ring method.
5. Determination of wavelength of light by Laser diffraction method.
6. Optical Fibre-numerical aperture, power loss.
Experiments on Quantum Physics (Any 2 to be performed from the following experiments):
7. Determination of Planck's constant using photoelectric cell.
8. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
9. Determination of Stefan's Constant.
10a. Study of characteristics of solar cell (illumination, areal, spectral)
10b. Study of characteristics of solar cell (I-V characteristics, Power-load characteristics, Power-wavelength characteristics)
Perform at least one of the following experiments:
11. Determination of Q factor using LCR Circuit.

12. Study of I-V characteristics of a LED/LDR.
13. Determination of band gap of a semiconductor.
**In addition, it is recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as
Innovative experiment.
Probable experiments beyond the syllabus:

1. Determination of the specific charge of the electron (e/m) from the path of an electron beam by Thomson method.
2. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor3. Study of dispersive power of material of a prism.

3. Determination of thermal conductivity of a bad/good conductor using Lees-Charlton / Searle apparatus.
4. Determination of the angle of optical rotation of a polar solution using polarimeter.
5. Any other experiment related to the theory.

Recommended Text Books for Engineering Physics Lab:

Waves & Oscillations:
1. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit Classical & Modern Optics:
2. A text book of Light- K.G. Mazumder & B.Ghosh (Book & Allied Publisher)
Quantum Mechanics-I
1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House) Solid
State Physics:
1. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
Text Books:
1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing) 3. Practical Physics by R. K. Kar (Book & Allied Publisher)

CO-PO Mapping

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	3	2	-	2	2	3	2
CO2	3	3	-	-	3	-	-	3	2	-	2	2	2	2
CO3	3	-	-	-	3	-	-	3	2	-	2	3	2	3
CO4	3	3	-	-	3	-	-	3	2	-	2	3	3	2
CO5	3	3	-	-	3	-	-	3	2	-	2	3	2	3

COURSE NAME: ENGINEERING GRAPHICS & COMPUTER AIDED DESIGN LAB
COURSE CODE: ME294
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites: Basic knowledge of geometry

Course Outcomes: Upon successful completion of this course, the student will be able to:

CO1: Use common drafting tools with the knowledge of drafting standards
CO3: Understand the concepts of engineering scales, projections, sections.

CO4: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints

CO5: Produce part models; carry out assembly operation and represent a design project work.

Course Contents:

Basic Engineering Graphics: **3P**

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing **6P**

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections **6P**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice- versa.

Module 3: Sections and Sectional Views of Right Angular Solids **6P**

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape ofthe sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics: **3P**

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid

Modeling.

Module 4: Overview of Computer Graphics 3P

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering 6P

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerance; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project 3P

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House
2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PO/PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	2	-	-	-	-	-	-	-	3	2	2
CO2	2	-	-	2	-	-	-	-	-	-	-	2	3	2
CO3	3	-	-	2	-	-	-	-	-	-	-	2	3	3
CO4	3	-	-	3	-	-	-	-	-	-	-	3	3	2
CO5	3	2	-	3	2	-	-	-	-	-	-	3	3	2

Paper Name: COMMUNICATION AND PRESENTATION SKILL
Paper Code: HU291
Contact: (0:0:3)
Credit: 1.5

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error feedback.

Course Outcome:
By pursuing this course, the students will be able to:
CO1: Recognize, identify and express advanced skills of Technical Communication in English and Soft Skills through Language Laboratory.
CO2: Understand, categorize, differentiate and infer listening, speaking, reading and writing skills in societal and professional life.
CO3: Analyze, compare and adapt the skills necessary to be a competent interpersonal communicator in academic and global business environments.
CO4: Deconstruct, appraise and critique professional writing documents, models and templates.
CO5: Adapt, negotiate, facilitate and collaborate with communicative competence in presentations and work-specific conclaves and interactions in the professional context.

Course Contents:

Module 1: Introduction Theories of Communication and Soft Skills
a. Communication and the Cyclic Process of Communication (Theory, benefits and application)
b. Introduction to Workplace Communication (Principles and Practice)
c. Non-Verbal communication and its application
c. Soft Skills Introduction: Soft-Skills Introduction
What is Soft Skills? Significance of Soft-Skills
Soft-Skills Vs. Hard Skills
Components of Soft Skills
Identifying and Exhibiting Soft-Skills (Through classroom activity)

Module 2: Active Listening
a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Differences between Listening and Hearing, Critical Listening, Barriers to Active Listening, Improving Listening.
d. Listening in Business Telephony and Practice
Practical (Role plays, case studies)

Module 3: Speaking Skills
a. Effective Public Speaking: Public Speaking, Selecting the topic for public speaking, (Understanding the audience, Organizing the main ideas, Language and Style choice in the speech, delivering the speech, Voice Clarity). Practical (Extempore)

Self-Learning Topics: Preparation, Attire, Posture and Delivery techniques

b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focused activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Group Discussion: Principles, Do's and Don'ts and Practice;

Module 4: Writing and Reading Comprehension
a. Reading and Writing a Book Review (classroom activity)
b. Writing a Film Review after watching a short film (classroom activity)
c. Reading Strategies: active reading, note-taking, summarizing, and using visual aids like diagrams and graphs
d. Solving Company-Specific Verbal Aptitude papers. (Synonyms, Antonyms, Error Correction and RC Passages)

Module 5: Presentation Skills
Kinds of Presentation. Presentation techniques, planning the presentation,
Structure of presentation: Preparation, Evidence and Research, Delivering the presentation, handling questions, Time management, Visual aids.

- Self-Introduction, Creation of Video Resume`
- Need for expertise in oral presentation, Assignment on Oral presentation.
- Rules of making micro presentation (power point). Assignment on micro presentation

Text Books:
1. Pushp Lata and Sanjay Kumar. *A Handbook of Group Discussions and Job Interviews*. New Delhi: PHI, 2009.
2. Jo Billingham. *Giving Presentations*. New Delhi: Oxford University Press, 2003.
3. B. Jean Naterop and Rod Revell. *Telephoning in English*. 3rd ed. Cambridge: Cambridge University Press, 2004.
4. Jeyaraj John Sekar. *English Pronunciation Skills: Theory and Praxis*. New Delhi: Authorspress, 2025.
5. Career Launcher. *IELTS Reading: A Step-by-Step Guide*. G. K. Publications. 2028

Reference Books:

1. Ann Baker. *Ship or Sheep? An Intermediate Pronunciation Course*. Cambridge: Cambridge University Press, 2006.
2. Barry Cusack and Sam McCarter. *Improve Your IELTS: Listening and Speaking Skills.* London: Macmillan, 2007.
3. Eric H. Glendinning and Beverly Holmström. *Study Reading.* Cambridge: Cambridge University Press, 2004.
4. Malcolm Goodale. *Professional Presentations*. New Delhi: Cambridge University Press, 2005.
5. Mark Hancock. *English Pronunciation in Use*. Cambridge: Cambridge University Press, 2003.
6. Tony Lynch, *Study Listening*. Cambridge: Cambridge University Press, 2004.
7. J. D. O'Connor. *Better English Pronunciation*. Cambridge: Cambridge University Press, 2005.

8. Peter Roach. *English Phonetics and Phonology: A Practical Course*. Cambridge: Cambridge University Press, 2000.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	2	3	-	3	2	3
CO2	-	2	-	-	-	2	-	-	-	3	-	2	2	3
CO3	-	-	-	-	-	2	-	-	3	3	-	2	2	2
CO4	-	2	-	-	-	-	-	3	-	3	-	3	2	2
CO5	-	-	-	-	-	3	-	-	3	3	-	3	3	3

2nd Year- 3rd Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CE301	Surveying	3	0	0	3	3
2	ENGG	Major	CE302	Building Materials and Construction	2	0	0	2	2
3	ENGG	Major	CE303	Strength of Materials	3	0	0	3	3
4	ENGG	Major	CE304	Fluid Mechanics	3	0	0	3	3
5	ENGG	Minor	CS(CE)301	Advanced Computer Programming	3	0	0	3	3
6	ENGG	Minor	CE305	Composite Materials	3	0	0	3	3
B. PRACTICAL									
6	ENGG	Major	CE391	Surveying Lab	0	0	3	3	1.5
7	ENGG	Major	CE392	Fluid Mechanics Lab	0	0	3	3	1.5
8	ENGG	Skill enhancement Course	CS(CE)391	Advanced Computer Programming Lab	0	0	3	3	1.5
9	ENGG	Major	CE393	Building Planning and Drawing Lab	0	0	2	2	1.0
10	ENGG	Internship	CE394	Industrial Training (min 1 weeks)	0	0	2	2	0.5
Total of Theory, Practical and Mandatory Activities / Courses								29	23.0

COURSE NAME: SURVEYING
COURSE CODE: CE301
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS: 3

Pre requisites: Student should have knowledge about measurement and mathematical knowledge

Course Objective: The objective of this course is appreciated of the need for lifelong learning through the discussion of recent changes in survey procedures and equipment and also have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in surveying.

Course Outcome:

CO1	Students will understand the fundamental concepts, objectives, and classifications of surveying, along with its basic principles.
CO2	Students will apply chain and compass surveying techniques to measure distances and angles, record field data, compute areas, and analyze errors with suitable corrections.
CO3	Students will conduct field operations using plane table, leveling, and contouring instruments to prepare topographic maps, sections, and calculate volumes with accuracy.
CO4	Students will perform angular measurements using theodolite and determine horizontal/vertical distances using tacheometry, while preparing traverse and coordinate tables.
CO5	Students will interpret and execute advanced surveying techniques including curve setting and Total Station operations for complex engineering applications

COURSE CONTENTS:

Module-1: [1L]

Introduction: Definition, classification of surveying, objectives, principles of surveying.

Module-2: [9L]

Chain surveying: Chain and its types, Optical square, Cross staff, Reconnaissance and site Location, Locating ground features by offsets – Field book. Chaining for obtaining the outline of structures, Methods for overcoming obstacles, Conventional symbols, Plotting chain survey and Computation of areas, Errors in chain surveying and their elimination: Problems.

Compass Surveying: Details of prismatic compass, Use and adjustments, Bearings, Local attraction and its adjustments. Chain and compass surveying of an area, Booking and plotting, Adjustments of traverse, Errors in compass surveying and precautions: Problems.

EDM: Principle of Electronic Distance Measurement (EDM); Types of EDM instruments; Application of EDM

Module-3: [3L]

Plane Table Surveying: Equipment, Orientation, Methods of Plane Tabling, Three Point Problems.

Module-4: [9L]

Leveling: Introduction, Basic definitions, Detail of dumpy Level, Temporary adjustment of Levels, Sensitiveness of bubble tube; Methods of leveling – Differential, Profile & fly Leveling, Effect of curvature and refraction, Automatic levels, Plotting longitudinal sections and Cross sections; Measurement of area and volume.

Contouring: Topographic Map, Characteristics of Contour, Contour Interval. Methods of Locating Contours, Interpolation of Contours.

Module-5: [9L]

Theodolite Surveying: Components of a Transit Theodolite, Measurement of horizontal and vertical Angles, Co-ordinates and traverse Table.

Tacheometry: Definition, Details of stadia System, Determination of horizontal and vertical distance with Tacheometer- Staff held vertically and normal to the line of sight.

Module-6: [3L]

Simple & Transition Curves: Definition, Degree of Curve, Elements of Simple Curve, Setting out by Linear method and Rankine's tangential method, Transition Curves.

Module-7: [3L]

Introduction to Total Station with Field applications.

Text / Reference Books*:*

Sl No	Title	Author
1	Surveying: - Vol - I & II	B.C. Punmia
2	Surveying & leveling	R. Subramanian (OXFORD)
3	Surveying& Leveling Vol - I [Part I & II]	T.P.Kanetkar & Kulkarni
4	Surveying: - Vol - I & II	S.K. Duggal
5	Fundamental of Engineering Survey	J.K. Ghosh (Studium Press, Roorkee)
6	Higher Surveying	Dr. A. M. Chandra
7	Surveying	R.B. Gupta & B.K. Gupta
9	Plane and Geodetic Surveying (Vol - I & II)	David Clark
10	Fundamental of Surveying	S. K. Roy
11	Surveying	Saikia & Das (PHI)

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	2	3	2	3
CO2	3	2	2	2	3	-	-	-	-	-	2	2	2	2
CO3	3	2	2	2	3	-	-	-	-	-	2	2	2	2
CO4	3	2	3	3	3	-	-	-	-	-	2	3	2	2
CO5	3	3	3	3	3	-	-	-	-	-	2	2	3	3

COURSE NAME: BUILDING MATERIALS AND CONSTRUCTION

COURSE CODE: CE302
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24HRS
CREDITS: 2

Pre requisites: No Pre-Requisite required (NPR)

Course Objective: The objective of this course is to teach the student about the basic building materials, properties and their applications., to know the smart building materials, external paints and their uses to understand different types of masonries and their applications

Course Outcome:

CO1	Students will summaries basic knowledge about various kind of material used in construction work.
CO2	Students will differentiate about different types of building foundation i.e. Shallow and deep foundation, their mechanisms and uses.
CO3	summariesknowledgeaboutvariousstructuralmembersofabuildinglike-walls, door, window, stair, flooring, roof etc.
CO4	Extendtoapplytheirknowledgeatthetimeofdecisionmakingforapplicationof structural member including material used.

COURSECONTENTS:

Module-1:[9L]

Bricks: Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick Earth, Different forms of bricks, testing of bricks as per BIS. Defects of bricks. Fly ash bricks [2L+1T]

Aggregates: Classification, Characteristics, Deleterious substances, Soundness, Alkali–aggregates reaction, Fine aggregates, coarse aggregates, testing of aggregates [2L+1T]

Lime: Impurities in limestone, Classification, Slaking and hydration, Hardening, Testing, Storage, Handling, **Cement:** OPC: Composition, PPC, Slag cement, Hydration, setting time **Concrete**: Types, ingredients, W/C ratio, Workability, Different grades in cement concrete, Tests on cement concrete [2L+1T]

Module-2:[9L]

Mortars: Classification, Uses, Characteristics of good mortar, Ingredients. Cement mortar, Lime mortar, Lime cement mortar, special mortars [2L+1T]

Wood and Wood Products: Classification of Timber, Structure, Characteristics of good timber, seasoning of timber, Defects in Timber, Diseases of timber, Decay of Timber, Preservation of Timber, Testing of Timber, Veneers, Plywood, Fibre Boards, Particle Boards, Chip Boards, Black Boards, Button Board and Laminated Boards, Applications of wood and wood products [2L+1T]

Paints, Enamels and Varnishes: Composition of oil paint, characteristic of an ideal paint, preparation of paint, covering power of paints, Painting: Plastered surfaces, painting wood, surfaces, painting metal Surfaces. Defects, Effect of weather, enamels, distemper, water wash and colour wash, Varnish, French Polish, Wax Polish. **Miscellaneous Materials**: Gypsum: Classification, Plaster of Paris, Heat and sound insulating materials, Geo-synthetics [2L+1T]

Module-3:[9L]

Foundations: Function of Foundations, Essential requirement of good foundation, Different types of shallow and deep Foundations. Uses of Spread foundation, pile and well foundation [2L+1T]

Brick masonry: Definitions, Rules for bonding, Type of bonds–stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond (one and one and half brick thick wall). Cavity wall [2L+1T]

Wall, Doors and Windows: Load bearing wall, Partition wall, Reinforced brick wall, Common types of doors and windows of timber and metal [2L+1T]

Module-4[9L]

Stairs: Technical Terms, Requirements of good stair, Dimension of steps, Classification, Geometric design of a dog legged stair case, Elevation and cross section of different type of stair cases. [2L+1T]

Flooring: Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing [2L+1T]

Plastering and Pointing: Plastering with cement mortar, Defects in plastering, pointing, white washing, colour washing, Distempering, **Roofs:** Types, pitched roofs and their sketches, Lean – to roof, coupled and collared roofs, King Post – Truss, Queen post truss and Simple steel Truss, Roof Covering materials: AC sheets GI sheet [2L+1T]

Text/Reference Books:

Sl no	Name	Author	Publisher
1	Building Materials	S.K. Duggal	
2	Building Materials	P.C.Varghese	PHI
3	Engineering Materials	S.C.Rangwala	
4	Concrete Technology	M.S.Shetty	
5	Concrete Technology	A.M. Nevile&J.J.Brooks	Pearson Education
6	Building Construction	B.C. PUNMIA	

CO-PO mapping

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

COURSE NAME: STRNGTH OF MATERIALS
COURSE CODE: CE 303 CONTACT: 3:0:0
TOTAL CONTACT HOURS:
36 HRS CREDITS: 3

Pre requisites: Student should have the knowledge about Elements of Civil Engineering &Mechanics.

Course Objective: The objective of this course is elaborate on the knowledge of engineering mechanics (statics) and to teach the students the purpose of studying strength of materials with respect to civil engineering design and analysis. The course introduces the students to the concepts of engineering mechanics of materials and the behavior of the materials and structures under applied loads.

Course Outcome:

CO1	Recall and explain the fundamental concepts of stress, strain, stress-strain relationships, and beam statics including support reactions and internal force diagrams.
CO2	Apply the theory of symmetric bending and flexure formulas to compute bending and shear stresses in beams of various cross-sections.
CO3	Determine the deflection of statically determinate beams using direct integration method and understand the moment-curvature relationship.
CO4	Analyze determinate plane trusses and two-dimensional stress systems using methods such as joints, sections, and Mohr's Circle.
CO5	Evaluate stresses in thin cylindrical and spherical shells, torsional effects on shafts, and assess buckling of columns using Euler's theory and other relevant formulas

COURSE CONTENTS:

Module-1: [6L]

Review of Basic Concepts of Stress and Strain: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Bulk Modulus: Factor of safety. Beam Statics: Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever, and overhanging beams

Module-2: [9L]

Symmetric Beam Bending: Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear center, center of gravity [3L+2T]

Deflection of statically determinate beams: Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration solution [3L+1T]

Module-3: [10L]

Analysis of determinate plane trusses: Concepts of redundancy, Analysis by method of joints, Method of sections. [3L+1T]

Two-Dimensional Stress Problems: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle, applications. [4L+2T]

Module-4: [11L]

Introduction to thin cylindrical & spherical shells: Hoop stress and meridonial - stress and volumetric changes. [2L+2T]

Torsion: Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs [2L+1T]

Columns: Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load and secant formulae. [3L+1T]

Text / Reference Books:

Sl No	Name	Author	Publisher
1	Elements of Strength of Material	S. P. Timoshenko & D.H.	EWP Pvt. Ltd
2	Engineering Mechanics of Solids	E. P. Popov	Pearson Education
3	Strength of Materials	R. Subramanian	OXFORD University Press
4	Strength of Material	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
5	Engineering Mechanics I by	J. L. Mariam	John Willey
6	Engineering Mechanics	I. H. Shames	PHI
7	Fundamentals of Strength of Material	Nag & Chandra	WIE

CO-PO mapping

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	1	1	1	1	3	2	1
CO2	3	3	2	1	2	1	1	1	1	1	1	3	2	2
CO3	3	3	2	2	2	1	1	1	1	1	1	3	3	2
CO4	3	3	2	2	2	1	1	1	2	2	2	3	3	2
CO5	3	3	2	2	2	1	2	1	2	2	2	3	3	3

COURSE NAME: FLUID MECHANICS
ENGINEERING COURSE CODE: CE 304
CONTACT: 3:0:0
TOTAL CONTACT HOURS:36 HRS
CREDITS: 3

Pre requisites:

Physics and Mechanics (10+2 level)

Course Objective:

The objective of this course is to provide students with a fundamental understanding of the behavior of fluids at rest and in motion. It aims to develop the ability to analyze and solve fluid-related problems through theoretical and practical knowledge. The course emphasizes the application of core principles such as fluid statics, dynamics, continuity, momentum, and energy conservation to engineering systems.

Course Outcome:

CO1: Get knowledge about fluid flow properties and analyze hydrostatic forces on flat or curved surfaces.
CO2: Explore the detailed analysis of kinematics and dynamics of fluid for laminar and turbulent flow and exploit the conservation equations for the flow regimes of practical interest.
CO3: Learn about boundary layer theory for a variety of constraints and understand the basics of a turbulent flow.
CO4: Explain the basics of compressible flow and apply for dimensional analysis for practical prototyping.

Course contents:

Module-I: **Introduction** Introduction to Fluid Mechanics - Fluid, Fluid types, Newton ‘s law of viscosity, surface tension	**2L**
Module-II: **Analysis of Fluid Motion** Fluid statics: Forces on submerged surfaces; forces or vertical, horizontal, inclined and curved surfaces, Center of pressure. Stability of floating bodies. Fluid kinematics: fluid flow and classifications. Continuity equation in 1D and 3D. Potential flow and Stream function; types of flow lines. Dynamics of fluid: equations of motion; Euler‘s equation; Navier-Stokes equation; Bernoulli‘s equation; Applications of Bernoulli‘s equation..	**9L**
Module-III: **Viscous and Turbulent Flow** Flow through circular pipes, Flow between parallel plates, momentum and energy correction factors, Reynold‘s experiment, characteristics of turbulent flow, velocity distribution in turbulent flow through pipes.	**5L**
Module-IV: Flow through pipes Fluid friction in pipes, head loss due to friction. Darcy– Weisbach equation of friction loss; hydraulic grade line and total energy line. Variation of friction factor with wall roughness – Moody‘s chart. Minor losses in pipes.	**4L**

Module-V: Flow Measurement Orifices, notches and weirs: Basic principle for flow through orifices, rectangular and V-notches, rectangular and trapezoidal weir	**3L**
Module-VI: Boundary layer flow Definition; Boundary layer separation – basic concept. Drag force on a flat plate due to boundary layer, turbulent layer on a flat plate, displacement thickness, momentum thickness	**4L**
Module-VII: Submerged bodies Flow of fluid and forces around submerged bodies; basic concepts of drag and lift.	**3L**
Module-VIII: Dimensional Analysis Dimensions and dimensional homogeneity, Importance and use of dimensional analysis. Buckingham's π theorem with applications. Geometric, Kinematic and Dynamic similarity, Non-dimensional Numbers, Model studies	**3L**
Module-IX: Compressible Flow Thermodynamic relations, Basic equations of compressible flow, velocity of pressure wave in a fluid, Mach number, Stagnation properties, area velocity relationship, flow of compressible fluid through orifices and nozzles fitted to a large	**3L**

Text Books:

1. Introduction to Fluid Mechanics and Fluid Machines – Som and Biswas, TMH
2. Fluid Mechanics and Machinery – R.K.Bansal, Luxmi Publications.
3. A textbook on Fluid Mechanics and Hydraulic Machines – Sukumar Pati, TMH
4. Fluid Mechanics and Turbo Machines – M.M.Das, PHI, 2010.

Reference Books:

1. Introduction to Fluid Mechanics – Fox and Macdonald, Wiley.
2. Fluid Mechanics – Fundamentals and Applications – Cengel and Cimbala, TMH.
3. Mechanics of Fluid – Bernard Massey, Taylor and Francis

CO-PO/PSO Mapping:

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

COURSE NAME: ADVANCED COMPUTER PROGRAMMING
COURSE CODE: CS(CE)301
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Number system, Boolean Algebra

Course Outcomes (COs)

CO1. After completion of the course, students will be able to:
CO2. Understand and differentiate among various programming paradigms for problem solving.
CO3. Describe the way of execution, debugging, and performance profiling of programs in C.
CO4. Define, select, and compare data types, loops, and functions to solve computational and scientific problems.
CO5. Understand the dynamic behavior of memory and advanced usage of pointers.
CO6. Design and develop modular programs using control structures, file handling, and introductory data structures.

Course Contents

Module	Syllabus	Contact Hours
1. Advanced Programming Foundations	Algorithmic problem-solving techniques, structured vs modular programming, pseudo-code and flowcharts, compiler and interpreter basics. Advanced debugging tools, profiling techniques, and effective usage of IDEs for large-scale program management.	9
2. Advanced C Programming Concepts	Overview of structured programming. Variables, data types, identifiers, and keywords. Operators and expressions: arithmetic, relational, logical, bitwise, assignment, conditional, and advanced type casting. Input and output functions: scanf, printf. Emphasis on program efficiency and coding style.	5
3. Advanced Branching and Looping	Decision-making constructs: if, if-else, nested conditions, switch-case with error handling. Loops: while, for, do-while with focus on complexity and performance. Use of break, continue, and goto with best practices.	5

Module	Syllabus	Contact Hours
4. Program Structures and Recursion	Functions: prototypes, parameter passing, recursion, and inline functions. Storage classes – auto, static, register, extern. Preprocessor directives and macros with parameters.	4
5. Arrays, Pointers, and Memory Management	One- and two-dimensional arrays, passing arrays to functions. Pointers and pointer arithmetic, pointers with arrays and functions. Strings and string manipulation, pointer-to-string concepts. Dynamic memory allocation: malloc, calloc, realloc, free. Advanced concepts: memory leaks, dangling pointers, garbage collection introduction.	5
6. Structures, Unions, Enums, and Data Structures	Structures, arrays of structures, pointers to structures, bit fields. Unions and enums – definitions and use cases. Introduction to fundamental data structures: stack, queue, and linked list basics in C, including operations and simple applications.	5
7. Advanced File Handling in C	File operations: opening, closing, reading, writing in different modes. Formatted and unformatted files. Command line arguments. Functions: fopen, fclose, fgetc, fputc, fprintf, fscanf. Error handling and robust file processing.	3

Textbooks

- Byron Gottfried, *Schaum's Outline of Programming with C*, McGraw-Hill
- YashavantKanetkar, *Let Us C*, BPB Publication, 15th Edition

Reference Books

- Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language*, Prentice Hall of India
- **ReemaThareja, *Programming in C with Data Structures*, Oxford University Press**

CO–PO/PSO Mapping:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	-	3	3	3
CO2	3	2	2	2	2	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	2	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	2	-	-	-	-	-	-	3	3	3

COURSENAME: COMPOSITE MATERIALS
COURSE CODE: CE305
CONTACT: 3:0:0
CREDITS:3.0
TOTAL CONTACT HOURS: 36

Prerequisite: Knowledge on behavior of basic civil Engineering Materials.

Course Outcomes:
CO1: Know the structure and basic properties of composite and nano-composite materials.
CO2: Explore and understand the several methods of composite fabrication.
CO3: Predict the characteristics and performance of composite materials.
CO4: Apply varying composite materials in automotive, aerospace and other applications.

Course Contents

Module No.	Syllabus	Contact Hrs.
1	Introduction to composites: Definition and applications of composite materials, Fibers-glass, carbon, ceramic and aramid fibers; Matrices polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina-assumptions, macroscopic viewpoint, generalized Hookes law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.	10
2	Characterization of Composites: Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross-ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, von Mises Yield criterion for isotropic materials, generalized Hill‘s criterion for anisotropic materials, Tsai-Hill‘s criterion for composites, prediction of laminate failure, thermal analysis of composite laminates	10
3	Performance Analysis of Composites: Analysis of laminated plates equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies	8
4	Fabrication and application of Composites: Manufacturing of composite materials, bag molding, compression molding, pultrusion, filament welding, other manufacturing processes, Industrial Application of Composite Materials	8

Text Books:

1. Compositematerials,K.K.Chawala,2nded.,(1987)Springer-Verlag,New York.

2. NanocompositeScienceandTechnology,P.M.Ajayan,L.S.Schadler,P.V.Braun,(2003),Wiley- VCH Verlag GmbH Co. KgaA, Weinheim.

3. Mechanicsand Analysis ofComposite Materials, V.V. Vasilievand E.V. Morozov,(2001), Elsevier

ScienceLtd,TheBoulevard,Kidlington,OxfordOX5Lgb,UK.

4. Ceramicmatrixcomposites,K.K.Chawala,1sted.,(1993)Chapman&Hall, London

CO-PO/PSO Mapping:

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

COURSE NAME: SURVEYING AB

COURSE CODE: CE391
CONTACT: 0:0:3
CREDITS: 1.50

Pre requisites: Student should have knowledge about the basic Survey Theory

Course Objective: Student will be able to function as a member of a team and have the ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcome:

CO1	Student will be able to perform chain surveying to prepare maps, identify features, handle obstacles, and determine distances between inaccessible points using appropriate field techniques
CO2	Student will be able to conduct compass surveying to measure bearings, plot traverses, and compute distances between inaccessible points using chain and compass methods.
CO3	Student will be able to execute leveling operations including differential and profile leveling, and compute reduced levels accurately using dumpy level and auto level.
CO4	Student will be able to generate contour maps using direct and indirect methods, and interpret topographical features from the data collected in the field.
CO5	Student will be able to apply advanced instruments like theodolite and total station for traversing, angle measurements, leveling, and curve setting in real-world surveying tasks.

LISTOFEXPERIMENT:

Chain Surveying

Preparing index plans, Location sketches, Ranging, Preparation of map, getting outline of the structures by enclosing them in triangles/quadrilaterals, Distance between inaccessible points, Obstacles in chain survey.

Compass Surveying

Measurement of bearings, Preparation of map, Distance between two inaccessible points by chain and compass, Chain and compass traverse.

Leveling

Reduced Level calculation with Dumpy and Auto level for Differential leveling, Profile leveling and plotting the profile,

Contouring:
Direct contouring, Indirect contouring (Method of Interpolation).

Theodolite
Traversing by using Theodolite. Measurements of Horizontal &Vertical angles.

***Circular Curves*:**
Setting out of Simple Circular Curves.

Total Station
Traversing and Levelling with Total Station

Text/Reference Books:

Sl. No.	Title	Author
1	Surveying: -Vol-I &II	B.C.Punmia
2	Surveying&leveling	R.Subramanian(OXFORD)
3	Surveying&Leveling Vol-I[Part I &II]	T.P.Kanetkar&Kulkarni
4	Surveying: -Vol-I &II	S.K.Duggal
5	FundamentalofEngineeringSurvey	J.K.Ghosh(StudiumPress, Roorkee)
6	HigherSurveying	Dr.A.M.Chandra
7	Surveying	R.B.Gupta&B.K. Gupta
9	PlaneandGeodeticSurveying(Vol- I&II)	DavidClark
10	FundamentalofSurveying	S. K. Roy
11	Surveying	Saikia&Das (PHI)

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	**3**	-	**2**	**2**	**3**	-	-	-	-	-	**2**	**2**	**3**	**3**
CO2	**3**	-	**2**	**2**	**3**	-	-	-	-	-	**2**	**3**	**3**	**2**
CO3	**3**	-	**2**	**2**	**3**	-	-	-	-	-	**2**	**2**	**3**	**3**
CO4	**3**	-	**2**	**2**	**3**	-	-	-	-	-	**2**	**3**	**2**	**3**
CO5	**3**	**2**	**3**	**3**	**3**	-	-	**3**	-	-	**2**	**3**	**2**	**2**

COURSE NAME: FLUID MECHANICS LAB **ENGINEERING COURSE CODE: CE 392** **CONTACT: 0:0:3** **CREDITS: 1.50**
Pre requisites: Introduction to Fluid Mechanics
Course Objective: The objective of the Fluid Mechanics Laboratory course is to reinforce theoretical concepts through hands-on experimentation and observation. This course aims to develop practical skills in measuring, analyzing, and interpreting fluid behavior in various engineering applications. Students will gain experience in using fluid mechanics instruments and in validating theoretical models with experimental data.
Course Outcome: **CO1:** Develop a hands-on grasp of fluid behavior principles through experiments, covering pressure, velocity, and flow dynamics. **CO2:** Determine the various hydraulic coefficients **CO3:** Determine the minor losses through pipes. **CO4:** Gain expertise in using instruments like manometers, pitot tubes, and viscometers for accurate fluid parameter measurement and data interpretation.
LIST OF EXPERIMENT:
Experiment 1: Measurement of Coefficient of Discharge of an Orifice
Experiment 2: Measurement of Coefficient of Discharge of a Venturi meter
Experiment 3: To verify the Bernoulli‘s Theorem
Experiment 4: To find the critical Reynolds number for pipe flow
Experiment 5: To determine friction factor for a flow through pipe
Experiment 6: Measurement of water surface profile for flow over Broad crested weir
Experiment 7: Determination of Minor Losses in Pipes due to Sudden Enlargement and Sudden Contraction
Experiment 8: Determination of the density and viscosity of an oil and friction factor of oil flow in a pipe

Text Books:

1. Introduction to Fluid Mechanics and Fluid Machines – Som and Biswas, TMH
2. Fluid Mechanics and Machinery – R.K.Bansal, Luxmi Publications.
3. A textbook on Fluid Mechanics and Hydraulic Machines – Sukumar Pati, TMH
4. Fluid Mechanics and Turbo Machines – M.M.Das, PHI, 2010.

Reference Books:

1. Introduction to Fluid Mechanics – Fox and Macdonald, Wiley.
2. Fluid Mechanics – Fundamentals and Applications – Cengel and Cimbala, TMH.
3. Mechanics of Fluid – Bernard Massey, Taylor and Francis

CO-PO/PSO Mapping:

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

COURSE NAME: ADVANCED COMPUTER PROGRAMMING LAB

COURSE CODE: CS(CE) 391

CONTACT: 0:0:3

CREDITS: 1.5

Prerequisites: Number system, Boolean Algebra

Course Outcomes (COs):
After completion of the course students would be able to,

CO1: Apply basic Linux/Windows commands and effectively use IDEs for creating, compiling, debugging, and executing programs.

CO2: Implement programs using appropriate data types, operators, and conditional statements with focus on correctness and efficiency.

CO3: Design modular programs using functions, recursion, and iterative constructs, ensuring maintainability and clarity.

CO4: Apply arrays, strings, pointers, and dynamic memory allocation in solving computational problems and develop structured programs involving files.

CO5: Implement and test introductory data structures (stack, queue, and linked list) in C for problem-solving.

Course Content:

Module-1: Familiarization with basic commands of DOS/Linux. File handling and directory structures, file permissions. Creating and editing simple C programs in different editors and IDEs. Compilation, execution, and debugging in an IDE (e.g., Code::Blocks).

Module-2: Programs based on
- Basic data types
- Arithmetic and logical operators
- printf() and scanf() functions.

Module-3: Programs based on conditional statements:
- if-else statements
- Nested conditions
- Relational and logical operators.

Module-4: Programs based on loops:
- for loop
- while loop
- do-while loop.

Module-5: Programs based on
- Menu-driven program using switch-case statement
- Functions (with parameters and return values)
- Recursive functions.

Module-6: Programs based on
- Arrays (1-D and 2-D)
- Passing arrays to functions
- String manipulation.

Module-7: Programs based on pointers and dynamic memory allocation:
- Pointer operations and pointer-to-array
- malloc, calloc, realloc, and free
- Avoiding memory leaks.

Module-8: Programs based on file handling:
- File read/write in different modes
- Formatted and unformatted I/O
- File error handling.

Module-9: Programs based on Introductory Data Structures:
- Implementation of stack (push, pop, display)
- Implementation of queue (enqueue, dequeue, circular queue)
- Simple linked list creation, traversal, insertion, and deletion.

CO-PO/PSO Mapping:

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3

Textbooks:

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

Yashavant Kanetkar, Let Us C, BPB Publication, 15th Edition

Reference Books:

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

K. R. Venugopal& S. R. Prasad, MASTERING C, TMH, 2nd Edition

Reema Thareja, Programming in C with Data Structures, Oxford University Press

COURSE NAME: BUILDING PLANNING AND DRAWING LAB COURSE
CODE: CE 393
CONTACT: 0:0:2
CREDITS:1.0
TOTAL CONTACT HOURS: 36

Pre requisites: Student should have knowledge about building materials and construction and also mathematics

Course Objective: The objective of this course is to make student able to Learn to sketch and take field dimensions and to take data and transform it into graphic drawings and Auto Cad skills.

Course Outcome:

CO1. Prepare simple layout of buildings.
CO2. Produce working drawings for individual components like doors and windows etc.
CO3. Develop line diagram, building section, elevation, key plan and sectional elevation.
CO4. Illustrate hand drafting any parts of a building and implement the regulations for layout of plan.

LISTOFEXPERIMENT:

Foundations- Spread foundation for walls and columns; Footing for a RCC column, raft and pile foundations (4L)
Doors and Windows-Glazed and paneled doors of standard sizes; Glazed and paneled windows of standard sizes; special windows and ventilators(4L)
Stairs-Proportioning and design of a dog-legged, open well RCC stair case for an office / Residential building; Details of reinforcements for RCC staircases; Plan and elevation of straight turn, quarter turn, dog- legged and open well staircases. (4L)
Roofs- Types of sloping roof, lean-to roofs, RCC roof with details of reinforcements(2L)
Trusses- King post and Queen post trusses. (2L)
Functional Design of Buildings-To draw the line diagram, plan, elevation and section of the following: Residential Buildings (flat & pitched roofs), Office Buildings (flat roof), School. The designs must show positions of various components including lift well and their sizes. Introduction to drawing by using software package.(8L)

Text/ReferenceBooks:

SlNo	Title	Author
1	PrinciplesofBuildingDrawing	Shah&Kale
2	TextBookofBuildingConstruction	Sharma&Kaul
3	BuildingConstruction	BCPunmia
4	Civilengineeringdrawing	M.Chakrabory

CO-PO mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	2	-	1	2	1		1			1	2	2	1
CO 2	3	2	-	1	2	1		1			1	2	2	1
CO 3	3	2	-	1	2	1		1			1	2	2	1
CO 4	3	2	-	1	2	1		1			1	2	2	1

COURSE NAME: INDUSTRIAL TRAINING COURSE
CODE: CE394
CREDIT: 1

Course contents: Collective Data from 3rd to 4th Semester (Summer/Winter Training during Semester Break & Internship should be done after 3rd Semester or 4th Semester). All related certificates to be collected by the training/internship coordinator(s).

2nd Year 4th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CE401	Concrete Technology	3	0	0	3	3
2	ENGG	Major	CE402	Structural Analysis	4	0	0	4	4
3	ENGG	Major	CE403	Soil Mechanics	4	0	0	4	4
4	ENGG	Minor	M(CE)401	Numerical Methods	3	0	0	3	3
B. PRACTICAL									
5	ENGG	Major	CE491	Concrete Technology Lab	0	0	3	3	1.5
6	ENGG	Major	CE492	Soil Mechanics Lab-I	0	0	3	3	1.5
7	ENGG	Major	CE493	Quantity Surveying, Specifications and Valuation	0	0	2	2	1.0
8	ENGG	Minor	CS(CE)491	Numerical Methods Lab	0	0	3	3	1.5
9	PROJECT	Minor	PR491	Minor Project - I	0	0	2	2	1.0
10	HUM	Ability Enhancement Course	HU(CE)491	Quantitative Aptitude: Numerical and Logical reasoning	1	0	0	1	0.5
Total of Theory, Practical and Mandatory Activities / Courses								26	21

COURSE NAME: CONCRETE TECHNOLOGY
COURSE CODE: CE 401
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36HRS
CREDITS: 3

Pre requisites: Student should have knowledge about the building materials and construction.

Course Objective: The objective of this course is to provide students with fundamental knowledge of concrete as a construction material, including its ingredients, properties, and behavior in both fresh and hardened states.

Course Outcome:

CO1: Students will be able to understand the properties, composition, and hydration process of cement, including different types of cement, testing methods, and specifications as per IS 456:2000

CO2: Students will be able to analyze the physical and mechanical properties of aggregates and water used in concrete and evaluate their suitability through various standard tests and IS specifications.

CO3: Students will be able to assess the workability, strength, durability, and deformation characteristics of fresh and hardened concrete through laboratory and non-destructive testing methods.

CO4: Students will be able to explain the factors affecting durability of concrete, demonstrate the use of admixtures, and understand the behavior and applications of special concrete types like SCC, lightweight, polymer, and fiber-reinforced concrete.

CO5: Students will be able to design concrete mix proportions using the guidelines of IS 10262:2019 and IS 456:2000 to achieve desired workability, strength, and durability.

Course contents:

Module-1:[7L] ***Introduction: -***Concrete as a Structural Material, Good Concrete Manufacture of Portland Cement, Chemical Composition of Cement, Hydration of Cement, Heat of Hydration [4L] ***Types of Cement***: –Ordinary, Rapid hardening, low-heat, sulphate resisting, Portland slag, Portland pozzolana, super sulphated cement, white cement. Tests on cement and cement paste – fineness, consistency, setting time, soundness, strength. [3L] Specification as per IS 456 (2000)	**7L**
Module-2:[7L] ***Aggregates***– Classification, Mechanical and Physical Properties, Deleterious Substances, Alkali-Aggregate Reaction, Sieve Analysis, Grading Curves, Fineness modules, Fine Aggregate Zone, Grading Requirements. Testing of Aggregates – Flakiness, Elongation Tests, Aggregate Crushing Value, Ten Percent Fines Value, Impact Value, Abrasion Value, Bulking of Sand. [5L] Specification as per IS 456 (2000) ***Water-*** Quality of Water – Mixing Water, Curing Water, Harmful Contents. [2L]	**7L**

Module-3: [10L] **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. [3L] **Strength & durability of Concrete–**Water/Cement ratio, Gel/Space ratio, Concept of maturity in concrete, Strength in Tension, Compression, Effect of Age on Strength, Relation between Compressive and Tensile Strength, Fatigue Strength, Stress Strain Relation and Modules of Elasticity, Poisson's Ratio, Shrinkage and Creep, Compression Test on Cubes, Cylinders, [5L] **Non-Destructive Tests**. [2L]	**10L**
Module-4: [7L] **Durability:** Permeability of concrete, Chloride & Sulphate attack on concrete, carbonation of concrete [2L] **Admixtures**–different types (chemical and mineral), effects, uses, Retarder sand Super plasticizers. [2L] **Special concrete:** Self Compacting Concrete, Light-weight, Polymer and Fiber-reinforced concrete. [3L]	**7L**
Module-5: [5L] Mix Design by I.S. 10262(2019) and IS 456 (2000) Code method. [5L]	**5L**

Text/Reference Books:

SLNO	NAME	Author	publisher
1	Concrete Technology	Neville	PearsonEducation
2	Concrete Technology	M.S.Shetty	S.Chand
3	Concrete Technology	A.R.Santakumar	OXFORDUniversityPress
4	Concrete Technology	M.L.Gambhir	TataMcGraw Hill
5	Relevant IS Codes: I.S. 10262(2019) and IS 456 (2000)	BIS	

CO-POmapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	2	2	2	3
CO2	3	2	-	-	-	-	-	-	-	-	2	2	3	3
CO3	3	2	2	2	2	-	-	-	-	-	2	3	3	2
CO4	3	2	2		2	-	-	-	-	-	2	3	2	2
CO5	3	2	3	3	3	-	-	-	-	-	2	3	3	3

COURSE NAME: STRUCTURAL ANALYSIS
COURSE CODE: CE 402
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Pre requisites: Students must have knowledge in engineering mechanics, solving of free body diagrams and application of different structural aspects of materials in any type of structures like support reactions, bending moments, stresses, torsion etc.

Course Objective: To provide knowledge about determinate and indeterminate structures and how to calculate degree of indeterminacy of a structure, applications and analysis of determinate and indeterminate structures in various aspects.

Course Outcome:

CO1	Identify and classify structures as determinate or indeterminate and compute the degree of static and kinematic indeterminacy for beams, frames, and trusses.
CO2	Analyze determinate structures (beams, trusses, frames, and arches) using classical methods such as moment-area, conjugate beam, unit load, and influence lines.
CO3	Apply strain energy concepts and energy-based methods (Castigliano's theorems, virtual work, Betti's and Maxwell's theorems) to evaluate deflections in structures.
CO4	Evaluate the internal forces and deflections of statically indeterminate beams and arches using the theorem of three moments, force method, and energy methods.
CO5	Analyze statically indeterminate frames using slope-deflection, moment distribution, and approximate methods (portal and cantilever methods) for practical structural applications.

Course contents:

Module-1: [3L]

Determination of stability of any type of structure, Determinate and Indeterminate structures, Degree of indeterminacy for different types of structures: Beams, Frames, Trusses**.**

Module-2: [6L]

Analysis of determinate structures: Portal frames, arches.

Module-3: [6L]

Strain energy: Due to axial load, bending and shear, Torsion; Castigliano's theorems, theorem of minimum potential energy, Muller Breslau Principle, principle of virtual work, Maxwell's theorem of reciprocal deflection, Betti's law

Module-4: [6L]

Deflection of determinate structures: Moment area and Conjugate beam method, Energy methods, Unit load method for beams, Deflection of trusses and simple portal frames

Module-5: [6L]

Influence line diagrams: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shears**.**

Module-6: [3L]

Analysis of statically Indeterminate beams: Theorem of three moments. Energy Method, Force Method, Analysis of two hinged arch.

MODULE –7: [6L]

Analysis of statically indeterminate structures: Moment distribution method, Slope Deflection Method, Approximate method of analysis of structures-portal and cantilever method.

Text / Reference Books:

Sl No	Name	Author	Publisher
1	Engineering Mechanics of Solids	ByE. P.Popov	PearsonEducation
2	BasicstructuralAnalysis	C.S.Reddy	TMH
3	Staticallyindeterminate structures	C.K.Wang	McGraw-Hill
4	StructuralAnalysis(VolI&Vol II)	SSBhavikatti	VikasPublishing House Pvt. Ltd
5	StructuralAnalysis	Ramammurtham	Dhanpat Rai Publishing House
6	Structures	Schodek&M.Bechhold	PearsonEducation

CO-PO mapping

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1	1	1	2	2	1	3	2	2
CO2	3	3	2	2	2	1	1	1	2	2	1	3	2	2
CO3	3	3	2	3	2	1	1	1	2	2	1	3	3	2
CO4	3	3	2	3	2	1	1	1	2	2	1	3	3	2
CO5	3	3	3	2	3	1	1	1	2	3	2	3	2	3

COURSE NAME: SOIL MECHANICS
COURSECODE: CE 403 CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48HRS
CREDITS:4

Pre requisites: Student should have knowledge about the basic of strength of materials, physics and chemistry

Course Objective: To provide students with basic understanding of physical and mechanical properties of soil, together with knowledge of basic engineering procedures to identify factors controlling soil behavior and methods to determine soil properties. Students will acquire basic knowledge in engineering design of geotechnical systems

Course Outcome:

CO1: Identify the fundamental differences in engineering behavior between cohesive and cohesion less soils

CO2 : Compute the ground water seepage and distribution of ground water pressure.

CO3 : Calculate the applied stress beneath the ground surface.

CO4: Demonstrate that you know the fundamental difference in the strength and deformation characteristics of cohesive and cohesionless soils.

CO5: Analyze field and laboratory data to determine the strength and deformation properties of cohesive and cohesionless soils.

CO6: Determine settlements due to consolidation of soil

Course contents:

Module-I: ***Origin & formation of Soil: -***Types, Typical Indian Soil, Fundamental of Soil-Structure, Clay Mineralogy. [3L] ***Soil as a Three Phase System: -***Weight- Volume Relationship, Measurement of Physical Properties of Soil: In- situ Density, Moisture Content, Specific-Gravity, Relative Density. [5L]	**8L**
Module-II: ***Particle Size Distribution: -***By Sieving, Sedimentation Analysis. [2L] ***Index Properties of Soil***: -Atterberg's Limits- Determination of Index Properties of Soil by Casagrande's Apparatus, Cone Penetrometer, Soil Indices. [4L] ***Soil Classification: -*** As per Unified Classification System, As per IS Code Recommendation, AASHTO Classification, Field Identification of Soil, Consistency of Soil. [4L]	**10L**
Module-III: ***Soil Moisture: -***Darcy's Law, Capillarity in Soil, Permeability, Determination of Coefficient of Permeability of Soil in Laboratory, Permeability for Stratified Deposits. [3L] ***Effective Stress Principles***: - Definition of Effective Stress, Estimation of Effective Pressure Due to different conditions[3L]	**10L**

Two-Dimensional Flow Through Soil: -Laplace's Equations, Flow nets, Flow Through Earthen Dam, estimation of Seepage, Uplift due to Seepage, Design of Fillers, Critical Hydraulic Gradient, Quick Sand condition[4L]	
Module-IV: **Stress Distribution in Soil: -** Boussinesq's &Westergaard's Assumption & Formula for Determination of stress due to Point Loads, Stress Beneath Line, Strip & Uniformly Loaded Circular - Pressure Bulbs, Newmark's charts- Use for Determination of Stress due to Arbitrarily Loaded Areas, Contact Stress distribution for various types of Loading & on Different Types of Soils. [4L] Compaction of Soil: - Principles of Compaction, IS Light & Heavy Compaction Test, Field Compaction Equipment's, Various methods of field Compaction Control. [4L]	**8L**
Module-V: **Compressibility & Consolidation of Soil: -** Terzaghi's Theory of One-Dimensional Consolidation, Compressibility Characteristics of Soils, Compression Index, Coefficient of Compressibility & Volume change, Coefficient of Consolidation, Degree & rate of Consolidation, Consolidometer & Laboratory One Dimensional Consolidation Test as per latest IS Code, Determination of Consolidation Parameters, Secondary Consolidation. [6L] **Shear Strength of Soil: -**Basic Concept of Shear Resistance & Shear Strength of Soil, Mohr- Columb's Theory, Laboratory Determination of Soil Shear Parameter- Direct Shear, Tri-axial Test, Unconfined Compression, Vane Shear Test, Sensitivity & thixotropy of clay. [6L]	**12L**

Text/Reference Books:

Sl no	Name	Author	Publishers
1	Text book of Soil Mechanics & Foundation Engineering	V.N.S. Murthy	CBS Publisher's & Distributors
2	Principles of Foundation Engineering	B.M. Das	Thomson Book
3	Principles of Geotechnical Engineering	B. M. Das	Thomson Book Store
4	Basic & Applied Soil Mechanics	Gopal Ranjan &A.S.R.Rao	Willes EasternLtd
5	Soil Mechanics	Lambe& Whitman	WIE
6	Hand Book of Bureau of Indian Standard IS –1904, 6403, 8009, 2950, 2911 etc		

CO-PO mapping

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	3
CO2	2	2	3	3	2	3	1	1	2	2	2	3	3	3
CO3	2	2	3	2	2	1	1	3	2	1	1	3	3	3
CO4	3	3	3	3	3	2	1	3	2	1	3	2	3	3
CO5	2	3	1	2	1	3	1	2	2	2	2	3	2	3
CO6	3	3	3	3	2	2	2	2	3	2	2	2	2	3

Course Name: NUMERICAL METHODS
Course Code: M(CE) 401
Total Contact Hours: 36
Credit: 3

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard number system, algebra and calculus and basic knowledge of numerical analysis.

Course Objectives:

The purpose of this course is to provide better understanding of the derivation and the use of the numerical methods along with the knowledge of finite precision arithmetic.

Course Outcomes (COs):
On successful completion of the learning sessions of the course, the learner will be able to:

CO	DESCRIPTIONS
CO1	Recall the distinctive principles of numerical analysis and the associated error measures.
CO2	Understand the theoretical workings of numerical techniques.
CO3	Apply numerical methods used to obtain approximate solutions to intractable mathematical problems such as interpolation, the solution of linear and nonlinear equations, and the solution of ordinary and partial differential equations.
CO4	Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.

Course Content

MODULE I: ***Error Analysis and Interpolation*** ***(10 Lectures)***

Approximation in Numerical Computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic.
Interpolation: Central Difference Operator: Stirling's interpolation formula, Bessel's interpolation formula, Cubic Spline interpolation.

MODULE II: Matrix and ***Numerical Solution of Linear and Non-linear Equations (16 Lectures)***

Matrix: Eigen values and eigen vectors of matrix: Power method.

Numerical Solution of a System of Linear Equations: Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Jacobi iterative method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method.
Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Secant Method, Newton-Raphson method, fixed point iteration.

MODULE III: ***Numerical Solution of Differential Equation*** ***(10 Lectures)***

Numerical Solution of Ordinary Differential Equation: Taylor series method, Adams- Bashforth-Moulton method and Milne's Predictor-Corrector methods, finite difference method.
Numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

Project Domains:

1. Application of PDE and ODE in Engineering Field.
2. Application of numerical methods for the relevant field.
3. Mathematical modelling.

Text Books:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. *Numerical Methods (Problems and Solution)*. New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books

Reference Books:

1. Balagurusamy, E. *Numerical Methods*, Scitech. TMH.
2. Dutta, N. *Computer Programming & Numerical Analysis*, Universities Press.
3. Guha, S. and Srivastava, R. *Numerical Methods*, Oxford Universities Press.
4. Shastri, S. S. *Numerical Analysis*, PHI.
5. Mollah, S. A. *Numerical Analysis*, New Central Book Agency.
6. Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI.
7. Rao, G. S. *Numerical Analysis*, New Age International.

CO-PO Mapping:

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

COURSE NAME: CONCRETE TECHNOLOGY LAB COURSE
CODE: CE491
CONTACT: 0:0:3
CREDITS: 1.50

Pre requisites: Student should have the basic knowledge about concrete technology theory

Course Objective: The objective of this course is to understand the characteristics and behavior of civil engineering materials used in buildings and infrastructure. Students will learn standard principles and procedure to design prepare and/or test materials such as concrete mix design including field test methods for fresh concrete. Know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.

Course Outcome:

CO1 Student will be able to identify the functional role of ingredients of concrete
CO2 Student will be able to test of different concrete property to specify quality of concrete
CO3 Student will be able to apply this knowledge to mix design philosophy to get different grade of concrete
CO4 Student will be able to learn to work in a team to achieve the objective

LISTOFEXPERIMENT:

Tests on cement– specific gravity, fineness, soundness, normal consistency, setting time, compressive strength on cement mortar Cubes.
Tests on fine aggregate–specific gravity, bulking, sieve analysis, fineness modulus, moisture content, bulk density, water absorption and Deleterious materials.
Tests on coarse aggregate-specific gravity, sieve analysis, fineness modulus, bulk density and water absorption.
Tests on Fresh Concrete: Workability: Slump, Vee-Bee, Compaction factor tests
Hardened Concrete: Compressive strength on Cubes, Split tensile strength, Static modulus of elasticity, Flexure tests,
Nondestructive testing (Rebound hammer & Ultrasonic pulse velocity)
Mix Design- As per IS 10262(2019) and IS 456 (2000) methods

Text/Reference Books:

SLNO	NAME	Author	publisher
1	ConcreteTechnology	Neville	PearsonEducation
2	ConcreteTechnology	M.S.Shetty	S.Chand
3	ConcreteTechnology	. R.Santakumar	OXFORDUniversityPress
4	ConcreteTechnology	M.L.Gambhir	TataMcGrawHill
5	Text book of Concrete Technology	P.D. Kulkarni	TataMcGrawHill

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	2	2	2	2
CO2	3	2	2	2	3	-	-	-	-	-	2	3	2	2
CO3	3	2	3	3	3	-	-	-	-	-	2	3	2	3
CO4	-	-	-	-	-	-	-	3	-	-	2	3	2	3
CO5	3	-	-	-	-	-	-	-	-	-	2	3	2	2

COURSE NAME: SOIL MECHANICS LAB – I
COURSE CODE: CE 492
CONTACT: 0:0:3
CREDITS :1.50

Pre requisites: Student should have the basic knowledge about Basic Soil Mechanics theory

Course Objective: Provide civil engineering students with the basic knowledge to carry out field investigations and to identify soils in geotechnical engineering practice and educate civil Engineering students in performing and interpretation laboratory tests for evaluating soil property.

Course Outcome:

CO1. Identify soils with reference to their characteristics
CO2. Describe the behavior and effect of water in soils
CO3. Examine modes of soil behavior Calculate and plot soil strength parameters
CO4. Interpret different methods of improving soil stability

LISTOFEXPERIMENT:

1. Field identification of different types of soil as per Indian standards [collection of field samples and identifications without laboratory testing], determination of natural moisture content.
2. Determination of specific gravity of i) Cohesionless ii) Cohesive soil
3. Determination of In-situ density by core cutter method & sander placement method.
4. Grain size distribution of cohesionless Soil by sieving & fine-grained soil by hydro-meter analysis.
5. Determination of Atterberg's limits (liquid limit, plastic limit & shrinkage limit).
6. Determination of co-efficient of permeability by constant head permeameter (coarse grained soil) & variable head-permeameter. (fine-grained soil).
7. Determination of compaction characteristics of soil.

Reference

1. Soil Testing by T.W. Lamb (John Wiley)
2. SP-36(Part-I&Part-II)
3. Measurement of Engineering properties of soil by E. Saibaba Reddy & K. Ramasastri (New-age international publication).

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	3	3	2	1	-	1	3	2	2	3	2
CO2	3	3	2	2	3	2	1	1	-	2	3	3	3	3
CO3	3	2	1	2	1	3	1	2	-	2	1	3	3	3
CO4	2	3	2	3	1	1	2	1	2	1	2	2	3	3
CO5	2	3	3	2	2	1	1	1	2	1	2	3	3	2

COURSE NAME: QUANTITY SURVEYING, SPECIFICATIONS AND VALUATION
COURSE CODE: CE493
CONTACT: 0:0:2
CREDITS: 1.0

Pre requisites: Student should have knowledge about building construction and material details.

Course Objective: The objective of this course is to give the students basics knowledge of estimating and valuation of civil engineering works. After completing this course, the students will also be able to analyze the rates and estimate the various construction works

Course Outcome:

CO1: Student will be able to prepare specification for using materials of construction and its items of works.
CO2: Student will be able to illustrate a detailed estimation of material consumption and abstracts for entire construction projects
CO3: Student will learn how to analyze the rates for different items of work including labor and material.
CO4: Interpret fundamental concepts of valuation
CO5: Students will be able to identify various legal issues related to construction.

LISTOFEXPERIMENT:

Unit: Different types of estimates, Concept of items of work, unit of measurement, unit rate of payment. Quantity estimate of a single storied building. Bar bending schedule. Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities. Quantity estimate of Road, Underground reservoir, Surface drain, Septic tank
Unit II: Analysis and schedule of rates for Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring and Finishing.
Unit III: Specification of materials: Brick, cement, fine and coarse aggregates; Specification of works: PCC, RCC, first class brickwork, cement plastering and pointing, white washing, colour washing, distempering, lime punning, painting and varnishing
Unit IV: Basic concept of Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalized value, Year of purchase, depreciation, obsolescence, deferred income, freehold and leasehold property, Mortgage, rent fixation, valuation table.

Text/ReferenceBooks:

B.N.Datta,Costing,EstimationandValuation,UBSPublication S.C.Rangwala,
Estimating&Costing(CivilEngg.), Charotar Publication
G.S. Birdie, AtextbookofEstimating&Costing, DhanpatRai&Sons
S.C.Rangwala, ValuationofRealproperties, CharotarPublication
Estimating, Costing,Specification&ValuationinCivilEngineeringbyM. Chakraborty

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	-	-	-	2	2	2	2	-
CO2	3	3	3	2	-	-	-	-	-	1	2	2	2	-
CO3	3	3	3	1	-	-	-	-	-	2	2	2	2	-
CO4	3	3	3	2	-	-	-	-	-	2	2	2	2	-
CO5	3	3	3	2	1	2	-	2	2	2	2	2	2	-

COURSE NAME: NUMERICAL METHODS LAB

COURSE CODE: CS(CE)491
CONTACT: 0:0:3
CREDITS: 1.50

Prerequisite: Any introductory course on programming language (example. C/ MATLAB).

Course Objective: The purpose of this course is to provide basic programming skills for solving the problems in numerical methods.

Course Outcome (CO):
On successful completion of the learning sessions of the course, the learner will be able to:

CODES	DESCRIPTIONS
CO1	Understand the theoretical workings of numerical techniques with the help of C/ MATLAB
CO2	Execute basic command and scripts in a mathematical programming language
CO3	Apply the programming skills to solve the problems using multiple numerical approaches.
CO4	Analyze if the results are reasonable, and then interpret and clearly communicate the results.

LIST OF EXPERIMENT:

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.
6. Assignments on numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab/Scilab/Labview/Mathematica/NAG(Numerical Algorithms Group)/Python.

CO-PO Mapping:

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

3rd Year 5th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CE501	Structural Design-I	4	0	0	4	4
2	ENGG	Major	CE502	Foundation Engineering	4	0	0	4	4
3	ENGG	Major	CE503	Transportation Engineering - I	4	0	0	4	4
4	ENGG	Major	CE504	Environmental Engineering	3	0	0	3	3
5	ENGG	Minor	CE505	A. Energy Science and Engineering B. Geoinformatics C. Application of IOT in Civil Engineering	4	0	0	4	4
B. PRACTICAL									
6	ENGG	Major	CE591	Soil Mechanics Lab-II	0	0	3	3	1.5
7	ENGG	Major	CE592	Highway and Transportation Engineering Lab	0	0	3	3	1.5
8	ENGG	Major	CE593	Environmental Engineering Lab	0	0	3	3	1.5
9	PROJECT	Minor	PR591	Minor Project-II	0	0	2	2	1
Total of Theory, Practical and Mandatory Activities / Courses								27	24.5

COURSE NAME: STRUCTURAL DESIGN–I
COURSE CODE: CE 501
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Pre-requisites: Student should have knowledge about how to solve analysis of structural problem.

Course Objective:

1. Student will be able to perform analysis and design of reinforced concrete members and connections and be able to identify and interpret the appropriate relevant industry design codes.
2. To become familiar with professional and contemporary issues in the design and construction of reinforced concrete members.

Course Outcome:

CO1: Exhibit the knowledge of concrete design philosophies, by working and limit state methodology
CO2: Design the structural details of beam and slab
CO3 : Design the structural details of column.
CO4 : Design the structural details of foundation
CO5: Interpret and use the I.S Code specifications

Course contents:

Module-I: [1L+1T] Introduction: Principles of design of reinforced concrete members –Working stress and Limit State method of design.	**2L**
Module-II: [2L+2T] Working stress method of design: Basic concepts and IS code provisions (IS:4562000) for design against bending moment and shear forces - Balanced, under reinforced and over reinforced beam/ slab sections; design of singly and doubly reinforced sections.	**4L**
Module-III: [2L+2T] Limit state method of design: Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces; concepts of bond stress and development length; Use of 'design aids for reinforced concrete' (SP:16).	**6L**
Module-IV: [2L+2T] Analysis, design and detailing of singly reinforced rectangular, "T"," L" and doubly reinforced beam sections by limit state method.	**6L**
Module-V: [2L+2T] Design and detailing of one-way and two-way slab panels as per IS code provisions	**6L**
Module-VI: [2L+2T] Design and detailing of continuous beams and slabs as per IS code provisions	**6L**
Module-VII: [2L+2T] Stair cases: Types; Design and detailing of reinforced concrete dog legged stair case	**6L**
Module-VIII: [2L+2T] 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.	**6L**

Module-IX: [3L+3T] Shallow foundations: Types; Design and detailing of reinforced concrete isolated square and rectangular footing for columns as per IS code provisions by limit state method.	**6L**
Limit state method should be followed for serial number 4 to 9 as above as per IS 456 - 2000	

Text/Reference Books:

Name	Author	Publishers
IS: 456- 2000 "Indian Standard for Plain and reinforced concrete–code of practice	Bureau of Indian Standard	
SP:16 Design Aid to IS 456		
Reinforced Concrete Design by	Pillai and Menon	TMH
Reinforced concrete Limit state design	Ashok K. Jain,Arun kv jain,B.C. Punmia	Laxmi publication
Reinforced concrete	S.N.Sinha	TMH
Fundamentals of reinforced concrete	N.C.Sinha and S.K.Roy	S.Chand & Co
Limit State Design of Reinforced Concrete	P.C. Varghese	PHI
Reinforced Concrete	S.K.Mallick and A.P.Gupta	Oxford IBH
Reinforced cement Concrete Design	Neelam Sharma	S.Khataria & sons

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	3	2	1	1	1	3	3	3	3
CO2	3	3	3	3	1	3	2	2	1	1	3	3	3	3
CO3	3	3	3	3	1	3	3	1	1	1	3	3	3	3
CO4	3	3	3	3	1	3	3	2	1	1	3	3	3	3
CO5	3	3	3	3	1	3	2	1	1	1	3	3	3	3

COURSE NAME: FOUNDATION ENGINEERING COURSE CODE: CE 502
CONTACT: 3:0:0
TOTALCONTACTHOURS:36HRS
CREDITS: 3

Prerequisites: Student should have knowledge about basic of Soil Mechanics

Course Objective:

Application of soil mechanics and other related techniques to design of foundation. Methods and site and soil exploration; bearing capacity and settlements; shallow and deep foundation; bracing and retaining structures. Case studies.

Course Outcome:

CO1: Describe bearing capacity of soil and settlement analysis of soil.
CO2: Define earth pressure theories
CO3: Analysis of slope stability
CO4: Classify piles & their loading capacity for deep foundation.
CO5: Demonstrate the fundamental Knowledge of Site investigation and soil exploration

Course contents:

Module-1: **Earth Pressure Theories: -**Plastic equilibrium of soil, Earth pressure at rest, Active & passive Earth pressure, Rankin's & Coulombs earth pressure theories, wedge method of analysis, estimation of earth pressure by graphical construction (Culmann method).	**4L**
Module-2: **Retaining Wall & sheet pile structures:** Proportion soft retaining walls, stability checks, cantilever and anchored sheet piles, free earth and fixed earth method. Analysis of anchored bulk heads, coffer dam structures types.	**8L**
Module-3: **Stability of slopes:** Analysis of finite and infinite slopes, Swedish and friction circle method, Taylor's stability number, Bishop's method of stability analysis.	**4L**
Module-4: **Site Investigation & Soil Exploration:** Planning of sub-surface explanation, methods, sampling, samples, In-situ tests: SPT, SCPT, DCPT, field vane-shear, Plate load test.	**4L**
Module-5: **Shallow foundations:** Safe bearing capacity, Terzaghi's bearing capacity theory, effect of depth of embedment, water table, eccentricity of load, foundation shape on Bearing capacity, Bearing capacity as per 1S6403	**4L**
Module-6: **Settlement analysis of shallow foundation:** Immediate and consolidation settlement, correction for rigidity and dimensional effects, settlement in various	**4L**

Types of soil, IS-1904 and 8009 recommendations, Allowable bearing capacity.	
Module-7: **Deep foundations:** Pile: Types, load transfer mechanism Determination of load carrying capacities of piles by static and dynamic formulae, Recommendations of IS2911, Pile group: Group efficiency, Negative skin friction, pile load test.	**8 L**

Text/Reference Books:

1. Principles of Geotechnical Engineering B. M. Das Thomson Book Store Text book of Soil Mechanics & Foundation Engineering
2. V.N.S. Murthy CBS Publisher's & Distributors
3. Geotechnical Engineering – Principles and Practice Coduto Pearson Education
4. Soil Mechanics Lambe & Whitman WIE
5. Basic & Applied Soil Mechanics Gopal Ranjan & A.S.R.Rao Willes EasternLtd
6. SP 36 (Part I) Numerical Problems – Geotechnical Engineering Rao & Venkatramaiah University Pres

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	1	1	1	2	3	1	1	2	3
CO2	2	2	3	3	2	2	2	1	2	3	1	3	2	3
CO3	2	2	2	2	1	1	1	1	1	2	1	3	2	3
CO4	2	1	2	2	2	2	2	1	1	2	1	2	2	2
CO5	3	2	2	2	2	2	2	2	2	3	2	3	3	3

COURSE NAME: TRANSPORTATION ENGINEERING –I
COURSE CODE: CE 503
CONTACT: 3:1:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Pre requisites: Knowledge on IRC codes, Loading pattern base on IRC, Pavement failure and stress criteria.

Course Objective:

Priority of road networking
Highway geometric design
Calculation of wheel load stresses.
Pavement design and construction technique.

Course Outcome:

CO1 : Ability to describe about the highway engineering
CO2 : Ability to describe the highway alignment
CO3 : An ability to demonstrate the highway geometric design
CO4: An ability to demonstrate about the pavement design and construction technique.

Course contents:

Module-I: Introduction to highway engineering Scope of highway engineering and road networking; Jayakar Committee Report; Motor vehicle act, Central Road Research Institute, saturation system; highway financing ('pay as you go method and credit financing method) and highway economics (quantifiable and non-quantifiable benefits to highway users, cost of vehicle operation, annual cost method, and benefit-cost ratio method).	**8L**
Module- II: Highway Alignment Requirements; factors controlling alignment; engineering surveys for highway alignment and location.	**4L**
Module–III: Highway geometric design Cross-sectional elements (friction, unevenness, light reflecting characteristics, camber, kerbs, shoulders, footpaths, width of Carriageway, formation, and right of way); PIEV theory, geometric design elements like design speed, passing and non-passing Sight distances; requirements and design principles of horizontal alignment including radius of curvature, super elevation, extra widening, Design of transition curves, curve resistance and grade compensation and vertical alignment.	**14 L**
Module- IV: Pavement design Evaluation of soil sub-grade, sub-base, base and wearing courses; design factors for pavement thickness (including design wheel load and ESWL, strength of pavement materials and plate load tests, and effect of climatic variations) Group Index and CBR methods of flexible pavement design; Westergaard's analysis of wheel load stresses in rigid pavements; frictional stresses and warping stresses; IRC Recommendations for design of rigid pavements; design of expansion and contraction joints. Benkelman Beam Test.	**14 L**

Module V: Pavement construction Technique: Types of pavements; construction of earth roads, gravel roads, WBM, bitumen and cement concrete roads; joints in cement concrete pavements. Road Materials and Testing: Soil, Stone Aggregate, Bitumen, Marshal Stability Test. Failure in flexible and rigid pavements; Maintenance of earth roads, WBM and bitumen roads; remedial measures for waves and corrugations and mud-pumping; strengthening of pavements; geometric standards for Hill roads; requirements of highway drainage systems; and types of surface and subsoil drainage methods.	**8L**

Text Books:

High Way Engineering Khanna & Justo Nemchand & Brothers, Roorkee

Reference Books:

Principles of Transportation Engineering P. Chakraborty & A. Das PHI

Transportation Engineering- C.J Khisty& B.K Lall.

I.S Specifications on Concrete , Aggregate & Bitumen Bureau of Indian Standard

Relevant latest IRC Codes (IRC-37 – 2001, IRC 58 – 2002, IRC 73 - 1980, IRC 86 - 1983, IRC 106 – 1990, IRC 64 – 1990, IRC 15- 2002 Indian Road Congress

CO-PO Mapping:

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

COURSE NAME: ENVIRONMENTAL ENGINEERING
COURSE CODE: CE504
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS: 3

Pre requisites:

The basic concept of hydraulics with knowledge of pressure, loss etc calculation. Fundamentals of chemistry and preliminary knowledge of Quantity estimation.

Course Objective:

Students will gain knowledge on water demand and source of water they will acquire knowledge on water quality and its parameters. To be familiar with water distribution Network and water treatment procedures and methodology. Students will be familiar with sewage and Drainage and will be able to design sewer. Students will be acquainted with wastewater characteristics, pollution and wastewater treatment.

Course Outcome:

CO1 : Students will be able to understand key current environmental problems like level of pollution
CO2 : Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
CO3 : Be able to analyze an industrial activity and identify the environmental problems.
CO4 : Be able to plan strategies to control, reduce and monitor pollution.
CO5 : Be able to select the most appropriate technique to purify and/or control the emission of pollutants.
CO6 : Be able to apply the basis of an Environmental Management System (EMS) to an industrial activity

Course contents:

Module - 1. Water demands: -Water demands; Per capita demand; Variations in demand; Factors affecting demand; Design period; Population forecasting	**3L**
Module - 2. Sources of water: Surface water sources; ground water sources.	**3L**
Module - 3. Water Quality: Impurities in water; Water quality parameters; Standards for potable water.	**3L**
Module-4. Conveyance of water: Hydraulic design of pressure pipes	**3L**
Module -5. Water Treatment: Typical flow chart for surface and ground water treatments; Aeration, Plain sedimentation, Sedimentation with coagulation, Water Softening, Filtration, Disinfection.	**6l**
Module -6. Water Distribution: Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs.	**6L**
Module – 7. Sewage and Drainage: Definition of Common Terms, Quantity estimation for sanitary sewage and storm sewage.	**3L**
Module – 8. Sewer Design: Hydraulic design of sewers, Partial flow diagrams and Nomograms	**3L**
Module – 9. Wastewater Characteristics & Water pollution: Physical, chemical and biological characteristics, DO, BOD and COD, pollution characteristics of typical industries, suggested treatment	**3L**
Module–10. Wastewater Treatment: Typical flow chart for waste water treatment; Primary Treatments; Secondary Treatments: Activated Sludge Process, Trickling Filter Process, Septic tank.	**3L**

Tank.

Text / Reference Books:

Slno	Name	Author	Publishers
1	Environmental Engineering	S.K .Garg,	Khanna Publishers
2	Water Supply, Waste Disposal and Environmental Pollution Engineering	A.K. Chatterjee	Khanna Publishers.
3	Environmental Engineering, Vol.II	P. N. Modi	-
4	Environmental Modelling	Rajagopalan	Oxford University Press.
5	Environmental Engineering	P. V. Rowe	TMH

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	1	2	3	1	1	3	3	3	1	1	1	1	2	3
CO2	2	2	3	2	1	3	3	2	1	1	1	1	2	3
CO3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	2	3	2	3	2	3	3	3	2
CO5	3	3	3	3	3	1	3	2	2	3	3	3	3	3
CO6	3	3	3	2	3	3	2	1	2	3	3	3	3	2

COURSE NAME: ENERGY SCIENCE & ENGINEERING

COURSE CODE: CE505 A
CONTACT: 3:1:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Pre requisites: Students should have a basic understanding of Physics, Chemistry and Environmental Science

Course Objective: To introduce the fundamental concepts of energy science and its application in engineering. The course aims to build awareness about energy resources, energy conversion technologies, sustainability, and their impact on society and the environment.

Course Outcome:

CO1	Students will be able to understand the fundamentals of energy science and global energy resources.
CO2	Students will be able to identify and analyze renewable and non-renewable energy sources.
CO3	Students will be able to understand to evaluate energy conversion technologies and their efficiencies.
CO4	Students will be able to able to apply the principles of energy storage and energy conservation.
CO5	Students will be able to able to analyze the environmental and economic impacts of various energy systems

COURSE CONTENTS:

Module-1: [4L]

Introduction to Energy Science: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment.

Module-2: [8L]

Overview of energy systems: sources, transformations, efficiency, and storage.

Conventional Energy Resources: Coal, petroleum and natural gas – origin, composition, reserves, extraction and usage; nuclear energy – principles of nuclear reactions, nuclear reactors, nuclear waste, and safety issues. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future.

Module-3: [10L]

Renewable Energy Sources: Solar energy – photovoltaic and thermal systems; wind energy, wind turbines, characteristics, and applications; hydro power – principles and classifications; biomass and biogas; geothermal and ocean energy; tidal and hydrogen; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor- based energy storages, high efficiency batteries); Energy conversion processes – thermoelectric, piezoelectric and fuel cells; energy storage – mechanical, chemical, electrical and thermal storage systems; Sustainability and environmental trade-offs of different energy systems.

Module-4: [10L]

Energy & Environment: Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade; global and Indian energy scenarios and policies.

Energy Conservation and Management: Energy efficiency in buildings, industries, and transport systems; energy auditing and management; demand side management**.**

Module-5: [8L]

Civil Engineering Projects connected with the Energy Sources: Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydropower stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems.

Module-6: [8L]

Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.

Text / Reference Books*:*

Sl. No	Title	Author
1	Non-Conventional Energy Sources	G.D. Rai, Khanna Publishers
2	Non-Conventional Energy Resources	B.H. Khan, McGraw Hill
3	Solar Engineering of Thermal Processes	Duffie & Beckman, Wiley
4	Energy Technology	S. Rao & B.B. Parulekar, Khanna Publishers
5	Renewable Energy Resources	Twidell & Weir, CRC Press
6	Energy Technology	O.P, Gupta, Khanna Book Publishing, (2019)
7	Renewable Energy (2nd edition)	Boyle, Godfrey (2004), Oxford University Press
9	Energy Engineering & Management	Chakrabarti, PHI

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	2	1	-	-	-	2	3	2	3
CO2	3	3	2	-	2	2	1	-	-	-	2	2	2	3
CO3	3	3	3	2	2	2	2	-	-	-	2	2	2	2
CO4	3	2	2	2	2	3	2	-	-	-	3	3	2	2
CO5	2	3	2	2	3	3	3	-	-	-	3	3	2	2

COURSE NAME: GEOINFORMATICS

COURSE CODE: CE505 B
CONTACT: 3:1:0
TOTAL CONTACT HOURS:48HRS
CREDITS: 4

Prerequisites: Basic knowledge of surveying and environmental studies is required. Familiarity with coordinate systems, maps, and spatial thinking will be helpful

Course Objective: To introduce the principles and applications of remote sensing, GIS, GNSS, and photogrammetry, enabling students to analyze spatial data and apply geoinformatics tools effectively in civil engineering, environmental planning, and disaster management contexts.

Course Outcome:

CO1	Students will be able to understand the principles of remote sensing and photogrammetry
CO2	Students will be able to explain spatial data models and GIS operations.
CO3	Students will be able to demonstrate understanding of GNSS and digital mapping techniques
CO4	Students will be able to able to apply geoinformatics tools in real-world Civil Engineering scenarios

COURSECONTENTS:

Module-1:[10L]

- Basics: Definition, types, advantages & limitations
- Electromagnetic radiation (EMR) and its interaction with atmosphere and earth surface
- Spectral signatures of vegetation, soil, and water
- Types of resolutions: spatial, spectral, radiometric, temporal
- Satellite sensors: IRS, LANDSAT, SPOT, IKONOS, MODIS

Module-2:[6L]

- Basics of aerial photography: vertical and oblique images
- Scale, relief displacement, and interpretation keys
- Introduction to photogrammetry and stereo viewing
- Applications in topographic and land use mapping

Module-3:[12L]

- GIS fundamentals: definition, components, and architecture
- Spatial and attribute data models: raster vs vector
- Data acquisition: scanning, digitization, GPS integration
- Spatial analysis: overlay, buffering, query, and interpolation
- Errors, accuracy, precision, and metadata in GIS.

Module-4:[10L]

- GNSS overview: GPS, GLONASS, NAVSTAR
- Segments: space, control, and user
- Positioning techniques: absolute and differential GPS
- Coordinate systems, map projections, and transformations
- Applications in navigation, surveying, and asset mapping

Module-5:[10L]

- Urban planning: land use/land cover mapping, utility mapping
- Disaster management: flood, landslide, earthquake hazard zonation
- Water resources: watershed mapping and management
- Infrastructure: road alignment, site selection for dams and buildings
- Environmental impact assessment using remote sensing & GIS

Text / Reference Books*:*

Sl.No	Title	Author
1	Introduction to Geographic Information Systems	Kang-tsung Chang
2	Remote Sensing of the Environment	Jensen, J.R.
3	Concepts and Techniques of GIS	Lo, C.P., and Yeung, A.K.W.
4	GPS Surveying	Satheesh Gopi
5	Remote Sensing and Image Interpretation	Lillesand & Kiefer
6	Principles of Geographic Information Systems	Burrough, P.A.

CO-POmapping:

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

COURSE NAME: Applications of IoT in Civil Engineering
COURSE CODE: CE505C
CONTACT: 3:1:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Prerequisites:
Basic knowledge of sensors, microcontrollers, and civil engineering systems such as structures, water supply, and transportation. Familiarity with programming fundamentals and data communication is recommended but not mandatory.

Course Objectives:
- To introduce the fundamentals of IoT and its relevance in civil engineering.
- To provide practical insights into the integration of IoT in domains like SHM, smart construction, water systems, and transportation.
- To explore data communication protocols, system architectures, and security.
- To enable students to design, simulate, and evaluate IoT-enabled civil engineering systems.

Course Outcomes (COs):

CO	Course Outcome Statement
CO1	Students will be able to explain the core principles of IoT, including architecture, protocols, and components relevant to civil infrastructure.
CO2	Students will be able to identify appropriate sensors, microcontrollers, and communication technologies for civil engineering problems.
CO3	Students will be able to develop and implement basic IoT prototypes for real-time monitoring of civil infrastructure systems.
CO4	Students will be able to analyse the effectiveness of IoT-based solutions in domains such as SHM, water systems, and smart construction.
CO5	Students will be able to evaluate cloud platforms and data analytics tools for secure and effective processing of civil engineering data.
CO6	Students will be able to design and present a functional IoT-based civil engineering solution through teamwork and practical demonstration.

Course contents:
Module 1: Fundamentals of IoT and Smart Civil Infrastructure (8L)
- Introduction to IoT: Definition, evolution, and key concepts
- Importance of IoT in civil engineering practice
- Smart cities and infrastructure
- Real-world examples and trends

Module 2: IoT Architecture and Communication Technologies (4L)
- IoT layers and architecture
- Wired vs wireless systems
- Communication protocols: MQTT, CoAP, HTTP, Zigbee, LoRa, NB-IoT
- IoT ecosystems: Sensors, controllers, gateways

Module 3: Sensing Technologies for Civil Engineering (8L)
- Types of sensors for structural, environmental, and geotechnical applications
- Sensor calibration, interfacing, and placement
- Microcontrollers and boards: Arduino, Raspberry Pi, ESP series
- Real-time data acquisition principles

Module 4: IoT in Structural Health Monitoring (SHM) (4L)
- Sensor-based vibration and displacement monitoring
- Bridge and building SHM systems

- Long-term performance data logging
- SHM case studies using IoT

Module 5: Smart Construction Practices (8L)
- IoT in project tracking, workforce monitoring, and equipment tracking
- Integration with BIM and digital twins
- IoT for accident prevention and quality control
- Energy efficiency monitoring at construction sites

Module 6: Water and Waste Management using IoT (4L)
- Water quality, level, and leakage detection
- Drainage, sewage, and pipeline monitoring
- Flood forecasting and control
- Smart irrigation systems

Module 7: Smart Transportation and Infrastructure Systems (4L)
- Real-time traffic management
- Pavement monitoring and maintenance
- ITS: Intelligent Transport Systems
- Parking and lighting management systems

Module 8: Data Analytics, Cloud Integration & Security (4L)
- Cloud platforms: Thingspeak, AWS IoT, Firebase
- Data filtering, preprocessing, visualization
- Security, privacy, and ethical issues

Module 9: Capstone Project and Case Studies (4L)
- Design of a small-scale IoT-enabled civil system (e.g., water monitoring or traffic control)
- Group-based mini-project with presentation
- Case study analysis from the book

Text / Reference Books:

Sl. No.	Name of the Book	Authors	Publisher
1	Introduction to Internet of Things in Civil Engineering: Theory and Practice	Ankur Bhogayata, Amit Sata	CRC Press
2	Internet of Things: A Hands-On Approach	Vijay Madisetti, Arshdeep Bahga	VPT (Vikas Publishing Technologies)
3	6LoWPAN: The Wireless Embedded Internet	Zach Shelby, Carsten Bormann	Wiley

CO-PO mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	1	-	-	-	-	2	3	2	2
CO2	3	2	2	-	3	1	-	-	-	-	2	2	2	2
CO3	3	2	3	2	3	1	-	-	-	-	3	2	2	3
CO4	2	3	2	3	2	2	-	-	-	-	3	2	2	3
CO5	2	2	2	2	3	1	2	-	-	-	3	2	2	2
CO6	2	2	3	2	2	1	-	3	3	3	3	2	2	3

COURSE NAME: SOIL MECHANICS LAB-IICOURSECODE: CE591
CONTACT: 0:0:3
CREDITS:1.50

Prerequisites: Basic course on soil mechanics with understanding of soil parameters, behavior and response against loading.

Course Objective: Students will be able to access unconfined compressive strength of soil, shear parameter of soil by direct shear test and un-drained shear strength by vane-shear test.
Students will be familiar with fractional test standard penetration test.

Course Outcome:

CO1. Ability to calculate the compressive strength of soil
CO2. Ability to determine shear strength of soil
CO3. Ability to understand standard penetration test
CO4. Ability to understand consolidation parameters of soil
CO5. Ability to perform all the test for determine shear strength of soil

LISTOFEXPERIMENT:

1. Determination of compressibility characteristics of soil by Oedometer test (co- efficient of consolidation & compression Index)
2. Determination of unconfined compressive strength of soil
3. Determination of Shear parameter of soil by Direct shear test
4. Determination of undrained shear strength of soil by Vane shear test.
5. Determination of shear parameter of soil by Triaxial test (UU)
6. Standard Penetration Test
7. Expt No. 6 by large groups in the field.

Text/Reference Books:

Soil testing by T.W. Lamb(John Willey) SP-36 (Part-I & Part– II)
Soil Mechanics Laboratory Manual by B. M. Das, OXFORD UNIVERSITY PRESSMeasurementofengineeringpropertiesofsoilbyE.JaibabaReddy&K. Ramasastri.

CO-PO mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	1	2	2	2	1	2	2	3	2
CO2	3	3	2	2	2	1	2	2	2	2	2	3	3	2
CO3	2	2	1	1	2	2	2	3	2	2	2	2	2	2
CO4	3	3	3	2	3	2	3	2	2	2	3	2	2	2
CO5	3	3	2	2	2	2	3	2	2	2	3	2	2	2

COURSE NAME: TRANSPORTATION & HIGHWAY ENGINEERING LAB
COURSE CODE: CE 592
CONTACT: 0:0:3
CREDITS: 1.50

Pre requisites: Student should have the basic knowledge about highway and transportation engineering.

Course Objective: The objective of this course is to understand the characteristics and behavior of highway materials used in highway engineering. Students will learn standard principles and procedure to design prepare and/or test materials such as B.M. & S.D.B.C. mix design including Marshal Stability Test. Know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.

Course Outcome:

CO1: Identify the functional role of different materials of highway engineering.
CO2: Apply this knowledge to mix design philosophy to get different suitable B.M. & S.D.B.C. Mix.
CO3: Student should be able to test of existing highway and examine the quality of that highway by Benkelman Beam Test.
CO4: Student shall learn to work in a team to achieve the objective.

LIST OF EXPERIMENT:

1. **Tests on highway materials –** Aggregates- Impact value, los-Angeles Abrasion value water absorption, Elongation & Flakiness Index.
2. **Bitumen & bituminous materials –** Specific Gravity, Penetration Value, Ductility, Softening Point, Loss on Heating, Flash & Fire Point Test.
3. **Stripping value test**
4. **Design of mix gradation** for mix seal surfacing Design of B.M. &S.D.B.C. Mix
5. **Marshal Stability Test.**
6. **Benkelman Beam Test.**

Text / Reference Books:

Highway material testing(Laboratory Manual)by S.K. Khanna and CE.G. Justo
Relevant IS & I.R.C. codes.
BIS codes on Aggregates & Bituminous materials

CO-PO Mapping:

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

COURSE NAME: Environmental Engineering Lab
COURSE CODE: CE593
CONTACT: 0:0:3
CREDITS: 1.50

Pre requisites: Basic course of Environmental Engineering with preliminary knowledge of chemistry. Provides understanding of different impurities and various dissolved solids, along with the chemical behaviour of those elements.

Course Objective: Students will gain hands-on knowledge of various water quality tests, including total solids, turbidity, chloride, carbonate, hardness, fluoride, iron, residual chlorine demand, BOD, COD, DO, organic matter, nitrate, phosphate, and bacteriological quantity of water.

Course Outcome:

CO1: To enumerate various economic, financial, social, and sustainable tools in infrastructure management.
CO2: Identify appropriate test for environmental Problems
CO3: Statistically analyze and interpret laboratorial results
CO4: Apply the laboratorial results to problem identification, quantification, basic environmental design, and technical solutions.
CO5: Understand and use water and wastewater sampling procedures and sample preservation methods.

LISTOFEXPERIMENT:

EXPERIMENT NO.	EXPERIMENTNAME	TYPEOFTEST
1.	Determination of turbidity for a given sample of water.	PHYSICAL
2.	Determination of solids in a given sample of water: Total solids, Suspended Solids, and Dissolved Solids.	
3.	Determination of pH for a given sample of water.	CHEMICAL
4.	Determination of concentration of chlorides in a given sample of water.	
5.	Determination of carbonate, bicarbonate, and hydroxide alkalinity for a given sample of water.	
6.	Determination of hardness for a given sample of water	
7.	Determination of concentration of fluorides in a given sample of water.	
8.	Determination of concentration of Iron in a given sample of water	
9.	Determination of the Optimum Alum Dose for a given sample of water Through JarTest	

10.	Determination of residual chlorine in a given sample of water.	
11.	Determination of the chlorine demand for a given sample of water.	
12.	Determination of the available chlorine percentage in a given sample of bleaching powder.	
13.	Determination of the amount of Dissolved Oxygen (DO) in a given sample of water.	
14.	Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater.	
15.	Determination of the Chemical Oxygen Demand (D) for a given sample of wastewater.	
16.	Determination of organic matter/organic carbon for a given sample of water.	
17.	Determination of phosphate for a given sample of water.	
18.	Determination of nitrate for a given sample of water.	
19.	Determination of sulphate for a given sample of water.	
20.	Determination of bacteriological quality of water: presumptive test, confirmative test, and determination of MPN (Most Probable Number).	BACTERIOLOGICAL

Text/Reference Books:

Name	Author	Publishers
1.Environmental Engineering. Volume-1 andVolume-2.2.	Garg,S.K.	Khanna Publishers
Environmental Engineering.	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	McGraw Hill International Edition/Tata McGraw Hill Indian Edition

CO-PO Mapping:

CO	PO1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	3	2	3	3	3	2	1	2	2	2	2	2
CO2	3	3	3	3	2	1	3	3	3	2	1	2	2	2
CO3	3	3	3	3	2	2	3	3	2	3	2	3	3	3
CO4	3	3	3	3	3	3	3	1	3	2	3	3	3	3
CO5	2	2	3	3	1	2	3	1	3	1	3	3	2	1

3rd Year 6th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CE601	Irrigation and Water Resource Engineering	4	0	0	4	4
2	ENGG	Major	CE602	Construction Planning and Management	3	0	0	3	3
3	ENGG	Major	CE603	Structural Design-II	4	0	0	4	4
4	SCI	Minor	CE604	A. Operations Research B. Human Resource Management C. Values and Ethics	4	0	0	4	4
B. PRACTICAL									
5	ENGG	Major	CE691	Structural Design and Detailing Lab	0	0	3	3	1.5
6	ENGG	Major	CE692	Computer Aided Analysis and Design Lab	0	0	2	2	1.0
7	ENGG	Internship	CE693	Industrial Training (Min 2 weeks)	0	0	2	2	1.0
8	PROJECT	Minor	PR691	Minor Project-III	0	0	2	2	1.0
Total of Theory, Practical and Mandatory Activities / Courses								23	19.5

COURSE NAME: IRRIGATION AND WATER RESOURCE ENGINEERING
COURSE CODE: CE601
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Prerequisite: Introduction to Fluid Mechanics in Civil Engineering.

Course Objective: Students will gain knowledge on the hydrologic cycle, rainfall Calculation and measurement and frequency analysis of rainfall intensity curve. students will also be familiar with direct and indirect method of stream flow measurement to acquire the basic engineering technique of calculating hydrograph S curve flood routing. students will gain knowledge on irrigation methods duty, delta and crop seasons. To acquire knowledge on Canal irrigation and design of Alluvial channel by silt theories kennedy's method, lacey's theory. Familiarity with water logging and Drainage with basic knowledge on groundwater flow, Darcy's law, well tube well.

Course Outcome:
CO1 : The student will be able to acquire knowledge of Hydrological Cycle and its component
CO2: The student will be able to understand irrigation water, use of irrigation water in farm land, different irrigation methods; effective usage of water resources
CO3 : The student will be able to analyse Ground water and Surface water conveyance system.
CO4: The student will learn Canal Irrigation, canal Lining and effect and prevention of water logging.

Course contents:	
Module 1: History of hydrology, 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, depth area-duration relationship, maximum intensity/ depth-duration-frequency relationship, Probable maximum precipitation, Rainfall mass curve, Hyetograph, Examples.	**6L**
Module 2: Evaporation, evapotranspiration and infiltration: Process, evaporimeters, evaporation equations, methods for reduce evaporation losses, measurement of evapotranspiration, evapotranspiration equation, Potential Evapotranspiration (PET), Actual evapotranspiration (AET), Forms of subsurface water, aquifer properties, geological formation of aquifers, Well hydraulics: steady state flow in wells, equilibrium equation for confined and unconfined aquifers, aquifer tests, measurement of drawdown. Examples.	**8L**

Module 3: Stream-Flow measurement: Direct and indirect methods, Examples, Stage discharge relationship, SCS-CN method of estimating run-off volume, run-off hydrograph, Factors affecting runoff hydrograph, components of hydrograph, Factors affecting run-off, estimation of run-off, rainfall - runoff relationship, Examples. Base-Flow Separation, Methods of base flow separation, Effective rainfall, Unit Hydrograph, use and Limitations of unit hydrograph, Derivation of Unit Hydrograph, S-Curve, Flood routing, Basic equations, Flood Control, Global warming and its impact on water resources.	**12L**
Module 4: Types of Irrigation system and their detail description, Crops and crop seasons in India, cropping pattern, duty and delta, relationship in duty & delta, Duty at various places, measures for improving Duty of water, Water requirements for crops, Base period, quality of Irrigation water, frequency of irrigation, Methods of applying water to the field: surface, sub-surface, sprinkler and Drip irrigation. Examples.	**8L**
Module 5: Irrigation canals: design principles of irrigation canals, navigation canals and drainage canals. Design of unlined alluvial channels by silt theories: Introduction, Sediment Load, Suspended load and its measurement, Bed load and its measurement, Kennedy's theory, procedure for design of channel by Kennedy's method, Lacey's theory, design procedure by Lacey's theory, Cross section of an irrigation canal, balancing depth. Example.	**8L**
Module 6: Lining of Irrigation canals: Objectives, advantages and disadvantages of canal lining, economics and requirement of canal lining. Water logging and drainage: causes, Effects and prevention of water logging. Types of open drains and closed drains, canal outlets, land reclamation. Example.	**6L**

Text / Reference Books:		
Name	**Author**	**Publishers**
Irrigation Engineering & Hydraulic Structures	**S. K. Garg**	**Khanna Publisher**
Fluid Mechanics	**A.K. Jain**	**Khanna Publisher**

CO-PO mapping

CO VS PO	PO1	PO2	PO3	PO4	P5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	1	1	2	1	2	3	3	1
CO2	3	3	2	3	3	3	1	2	2	1	3	3	3	2
CO3	3	3	3	3	3	3	1	1	2	2	3	3	3	3
CO4	3	3	3	3	3	3	1	2	2	3	3	3	3	3

COURSE NAME: CONSTRUCTION PLANNING AND MANAGEMENT
COURSE CODE: CE602
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36HRS
CREDITS: 3

Prerequisites: Basic course in construction material and methodology with understanding of structural elements and their uses and sequence of construction, erection. Basic knowledge of quantity Estimation and valuation.

Course Objective: Students will gain knowledge on planning, Regulation and by laws for construction. Students will be familiar with fire protection, construction plant and equipment. students will be able to plan and schedule construction project by CPM and CEAT. some knowledge on management and departmental procedures of PWD, EMD and SD and familiarity Cost-Analysis, project cost, cost slopes and time optimization.

Course Outcome:

- **CO1.** Students will be able to successfully apply business and Management skill sin positions within the construction industry.
- **CO2.** Students will be able to use industry resources including associations and organizations.
- **CO3.** Students will be able to practice in-formed decision-making in personal and professional endeavors.
- **CO4.** Students will be able to manage a quality construction project from start to completion while maintaining budget, schedule, and safety requirements.

Course contents:

Module-I: **Planning**: General consideration, Definition of aspect, prospect, roominess, grouping, circulation Privacy, acclusion	**4L**
Module-II: **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	**4L**
Module-III: **Fire Protection**: Firefighting arrangements in public assembly buildings, planning, offices, auditorium	**4L**
Module-IV: **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	**6L**
Module-V: **Planning & scheduling of constructions Projects:** Planning by CPM & PERT, Preparation of network, Determination of slacks or floats. Critical activities. Critical path, project duration. expected meantime, probability of completion of project, Estimation of critical path, problems	**6L**
Module-VI: **Management**: Professional practice, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contracts	**6L**
Module-VII: **Departmental Procedures:** Administration, Technical and financial sanction, operation of PWD, EMD and SD, Acceptance of tenders, Arbitration, cost Analysis, Direct and Indirect project costs, Total costs- cost slopes. Crushing cost and time optimization	**6L**

Text/ReferenceBooks:

Name	Author	Publishers
Construction Planning, Equipment and Methods	Puerifoy	R.L.McGrawHill
Management in construction industry	P.P.Dharwadkar	OxfordandIBH Publishingcompany New Delhi
Construction Management, Critical path Methods in Construction	J.O.Brien	WileyInterscience
PERT and CPM	L.S. Srinath	-
Project planning and control with PERT And CPM' Construction equipment and its management	B.C.Punmiaand K.K.Kandelwal	S.C.Sharma
Estimating, Costing, Specification & Valuation in Civil Engineering	M Chakraborti	Chakraborti
National Building code BIS	-	-

CO-POmapping:

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

COURSE NAME: STRUCTURAL DESIGN–II
COURSE CODE: CE 603
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Pre-requisites: A basic concept to material properties and behavior with basic knowledge of Structural analysis and structural elements behavior under different loading pattern. Knowledge of stress and strain with fundamental concept of Engineering mechanics.

Course Objective: Students will be able to analyse the behavior of steel structure under different type of loading. To design a connection using IS:800-2007 and satisfy the serviceability and strength parameters. To acquire the knowledge to design tension, compression members, columns, beams, Girders. Using the codal guideline and basic knowledge of structural analysis students will also be able to design plate girders and gantry girders considering lateral buckling.

Course Outcome:

CO1: Understand various types of design methodology as per limit and working stress method
CO2: Interpret different type of connections
CO3: Design compression, tension and beam members
CO4: Analyze column bases
CO5: Design plate girder, gantry girder and uses of stiffeners

Course contents:

Module-I: **Materials and Specification: -** Rolled steel section, types of structural steel, specifications, Residual stress	**2L**
Module-II: **Structure connections:** Riveted, welded and bolted including High strength friction grip bolted joints– types of riveted & bolted joints, assumptions, failure of joints, efficiency of joints, and design of bolted riveted, fillet and butt-welded joints for axial load, IS code provisions. **Eccentric connection: -** Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.	**7L**
Module-III: **Tension members:** Design of tension members, I.S code provisions. Permissible stresses, Design rules, Examples	**8L**
Module-IV: **Compression members:** Effective lengths about major & minor principal axes, I.S code provisions. Permissible stresses, Design rules, Design of one component, two components and built-up compression members under axial load, Examples. **Built up columns under eccentric loading**: Design of lacing and batten plates, Different types of Column Bases- Slab Base, Gusseted Base, and Connection details.	**8L**
Module-V: **Beams:** Permissible stresses in bending, compression and tension, lateral buckling. Design of laterally supported and Unsupported beams, rolled section and built-up section Beams. Simple Beam end connections, beam - Column connections. I.S code provisions	**9L**

Module-VI: **Plate girders:** Design of webs & flanges, Concepts of curtailment of flanges –Riveted & welded web stiffeners, web flange splices -Riveted, welded& bolted. I.S code provisions	**7L**
Module-VII: **Gantry Girder:** Design gantry girder considering lateral buckling – I.S code provisions.	**7L**
IS800–2007to be followed for all IS code provisions.	

Text/Reference Books:

Name Author Publishers

- Design Of Steel Structures S.K.Duggal Tata Mc-Graw Hill , New Delhi
- Design of Steel structures N. Subramanian Oxford University Press
- Design of steel structures A.S.Arya and J.L.AjmaniNemchand& Bros.
- Design of steel structures Vol. I & II Ramachandra
- Design of steel structures PasalaDayaratnam A.H.Wheeler& Co Ltd. 1990
- Design of steel structures B.S.Krishnamachar and D.AjithaSinha Tata McGraw – Hill publishing Co. Delhi. Design of steel structures Ramamurtham
- IS 800 – 2007(Latest Revised code) Bureau of Indian Standard
- S.P.: 6(1) – 1964 Structural Steel Sections Bureau of Indian Standard

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	1	1	1	1	3	**3**	**3**	**2**
CO2	3	3	3	3	3	3	2	2	1	1	3	**3**	**3**	**3**
CO3	3	3	3	3	3	3	1	2	2	2	3	**3**	**3**	**3**
CO4	3	3	3	3	3	3	2	2	2	2	3	**3**	**3**	**3**
CO5	3	3	3	3	3	3	2	1	1	2	3	**3**	**3**	**3**

COURSE NAME: OPERATIONS RESEARCH
COURSE CODE: CE604A
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Pre requisites: Basic concepts of Probability distribution, statistical estimation, regression analysis and ANOVA, Basic Mathematics

Course Objective:

1) To study various optimization techniques in real world problems related to civil engineering
2) To study the inventory models
3) To study about assigning jobs to people in an efficient way
4) To study about sequencing techniques
5) To understand transportation model utility in construction industry

Course Outcome:

CO1 : At the end of the course, the students will be able to identify and develop operational research models from the verbal description of the real System.
CO2: Apply the mathematical tools that are needed to solve optimization problems.
CO3 : Use mathematical software to solve the proposed models.
CO4 : Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Course contents:

Module 1: Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.	**10L**
Module 2 : Transportation Problems: Types of transportation problems, mathematical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines.	**8L**
Module 3: Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT.	**10L**
Module 4: Theory of Games: Rectangular games, Minimax theorem, graphical solution of 2 x n or m x 2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queing model, single server models.	**10L**
Module 5: Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipment's that deteriorate with time, equipment's that fail with time.	**10L**

Text / Reference Books:

Name	Author	Publishers
Operations Research	Wayne L	Thomson Learning,2003.
Operations Research-An Introduction	Hamdy H. Taha	Pearson Education,2003
Operations Research	R. Panneer Seevam	PHI Learning, 2008
Total Quality Management	V.K.Khanna	New Age International, 2008
Linear Programming and Theory of Games	P. M. Karak	ABS Publishing House
Linear Programming and Theory of Games	Ghosh and Chakraborty	Central Book Agency
Operations Research	M. V. Durga Prasad	CENGAGE Learning

CO-PO mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	-	3	-	-	3	2	2	-
CO2	-	-	-	-	-	1	-	1	-	3	-	1	2	2	-
CO3	-	-	-	-	-	2	-	-	-	-	-	1	2	2	-
CO4	-	-	-	-	-	3	2	-	3	3	-	2	2	2	-

COURSE NAME: HUMAN RESOURCE MANAGEMENT
COURSE CODE: CE604B
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS: 4

Pre requisites: Basic concepts of Management and Planning

Course Objective:

1) Explain the importance of human resources and their effective management in organizations
2) Demonstrate a basic understanding of different tools used in forecasting and planning human resource needs
3) Outline the current theory and practice of recruitment and selection and demonstrate the ability to prepare a selection strategy for a specific job.
4) Evaluate a benefits package that supports the organization's strategy in line with HRM cost-containment policies and practices and Recommend actions based on results of the compensation analysis and design compensation schemes that are cost effective, that increase productivity of the work force, and comply with the legal framework
5) Explain their understanding of the administrative complexities of providing a full array of benefits to employees and the ways and means of delivering these benefits

Course Outcome:

CO1 : To understand principles, processes and practices of human resource management.
CO2: To identify problems or barriers which complicate and distort the effectiveness of human resource planning.
CO3 : To understand various provisions contained in labour legislation relating to Industrial relations.
CO4 : Apply HR concepts and techniques in strategic planning to improve organizational performance.

Course contents:

Module- 1: Introduction Human Resource Management- Objectives, Scope and Significance of HRM, Functions of HRM, Problems and Prospects in HRM, Environmental scanning.	**8L**
Module-2: Planning, training and development Human Resource Planning, Demand Forecasting Techniques, Supply Forecasting Techniques, Analysing work and designing jobs, Recruitment and Selection, Interviewing Candidates. Human Resource Development, Orientation, Training and Development, Management Development, Performance Appraisal and Employee Compensation, Factors Influencing Employee Remuneration and Challenges, Incentives and benefits	**10L**
Module-3: Labour Laws Contract Labout Act, Equal Remuneration Act, Minimum Wage, Payment of wage, Gratuity, Bonus payment, Industrial Disputes and Discipline.	**10L**
Module-4: Managing Ethical Issues in Human Resource Management Workers Participation in Management, Employee safety and health, Managing Global Human Resources and Trade Unions ,International HRM, Future of HRM and Human Resource Information Systems.	**8L**

Text / Reference Books:

1. Aswathappa, Human Resource Management — TMH., 2010.
2. Garry Dessler and Biju Varkkey ,Human Resource Management, PEA., 2011.
3. Noe & Raymond ,HRM: Gaining a Competitive Advantage, TMH, 2008.
4. Bohlander George W, Snell Scott A, Human Resource Management, Cengage Learning, 2009.
5. William J Bruns Jr. "Performance Measurement, Evaluation and Incentives", Tata McGraw
6. Monappa A, "Personnel Management", Tata McGraw Hill, New Delhi, 1997
7. Rao T, "HRD in the New Economic Environment", Tata McGraw Hill

CO-PO mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	2	-	-	-	-	3	2	-	3	2	2	-
CO 2	-	2	-	3	-	2	-	2	-	3	-	2	2	2	-
CO 3	-	2	-	3	-	-	-	-	-	3	2	2	2	2	-
CO 4	2	-	-	-	-	3	2	-	-	2	3	-	2	2	-

COURSE NAME: STUDIES ON SIX SIGMA
COURSE CODE: CE604C
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS : 4

Pre requisites: Basic concepts of Management and Planning

Course Objective:

1. To translate the selection, application and implementation of a Six Sigma project including roles and responsibility of team members
2. Collect appropriate data from process to support problem solving.
3. Create details flowchart and process maps.
4. Demonstrate ability to control and monitor process.

Course Outcome:

CO1 : Understand requirement of implementation of Six Sigma.
CO2: Relate Six Sigma concept to the overall business mission and objective.
CO3 : Understand Six Sigma methodology including DMAIC.
CO4 : Employ Six Sigma skills to lead a successful process improvement project for a meaningful result

Course contents:

Module 1: Introduction – General History of Six Sigma, Evolution and Value of Six Sigma, The Basics and meaning of Six Sigma, Basic Concepts of variation.	**4L**
Module 2 : Six sigma Roles and responsibilities, Implementing Six Sigma, Six Sigma Roadmap, Process Mapping, Lean Principles and Value Stream Mapping, Selection and defining Six Sigma Projects.	**4L**
Module 3: Becoming a Customer and Market-Driven Enterprise, Voice of the customer, Customer Expectations and Needs, Linking Six Sigma Projects to Strategies	**3L**
Module 4: Attributes of Good Metrics, Using Resources Wisely, Project Management Using the DMAIC and DMADV Models	**3L**
Module 5: The Lean enterprise, The History of Lean, Understanding lean, Lean & Six Sigma, The seven elements of waste	**3L**
Module 6: The Define Phase – Defining a process, Critical to Quality Characteristics, Cost of Poor Quality, Basic Six Sigma Metrics, Pareto Analysis	**3L**
Module 7: The Measure Phase – Process Definition, Cause and effect / Fishbone Diagram, Basic Probability and Statistics, X-Y Diagram, Normal Distribution and Normality, Precision & Accuracy, Process Capability	**4L**
Module 8: The Analyze Phase- Pattern of Variation, Multi-Vari Analysis, Inferential Statistics, Sampling	**4L**

Techniques & Uses, Central Limit Theorem, Hypothesis Testing, Confidence Intervals, Analysis of Variance (ANOVA)	
Module 9: Improve Phase: Simple linear Regression, Correlation, Regression Equations, Residual analysis, Multiple and Non- linear regression, Data transformation, Box Cox.	**4L**
Module 10: The Control Phase: Lean Controls, Control Methods for 5S, Kanban, Poka – Yoka (Mistake Proofing), Statistical process Control (SPC), Data collection of SPC, Six Sigma Control Plans, Cost benefit analysis, Elements of control Plan, Elements of Response Plan.	**4L**

Text / Reference Books:

Name	Author	Publishers
Simplified six sigma methodology tools and implementation	N. Gopala Krishnan	PHI
Eight steps to problem solving- six sigma	Mohit Sharma	Zorba Books
Six Sigma Handbook	PYZBEK	-
ASQ Certified Six Sigma Handbook	American Society of Quality	-

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	1	-	-	-	-	-	-	-	1	2	2	-
CO 2	2	1	1	1	1	-	-	-	-	-	-	1	2	2	-
CO 3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	-
CO 4	3	3	3	3	3	-	-	-	2	2	2	1	2	2	-

COURSE NAME: STRUCTURAL DESIGN AND DETAILING LAB
COURSE CODE: CE 691
CONTACT:0:0:3
CREDITS:1.50

Prerequisites:

Student should have knowledge about RCC and steel structure design of various structural components and building structure.

Course Objective:

Student should be able to design structural components and RCC and steel structure. Students will be able to understand about the members of structure, different loading condition how it behaves and where to use such member

Course Outcome:

- **CO1.** Design principle of R.C.C. sections. Limit state method of design Loads and stresses to be considered in the design as per I.S. code provision.
- **CO2.** Design & detailing of a i) simply supported R.C.C. Beam ii) Continuous T-Beam
- **CO3.** Student should be able to Design & Detailing of columns, isolated and combined footing.
- **CO4.** Design of different units: Slab, beam column, roofing and staircase from floor plan of a multistoried frame building, typical detailing of a two-way floor slab.
- **CO5.** Problems on general consideration and basic concepts

LISTOFTOPICS:

1. General considerations: Design principle of R.C.C. sections. Limit state method of design. Loads and stresses to be considered in the design as per I.S. code provision.
2. Design & detailing of a i) simply supported R.C.C. Beam ii) ContinuousT-Beam.
3. Design & Detailing of columns, isolated and combined footing
4. Design & detailing of a i) simply supported one way slab ii) One-way Continuous slab.
5. Design of different units: Slab, beam column, roof in grand stair-case from floor plan of a multistoried frame building, typical detailing of a two-way floor slab.
6. Problems on general consideration and basic concepts
7. Discussion on different loads (i.e. wind load, Deadload, live load and others) as per IS875
8. Design & drawing of the following components of a roof truss:

Members of the roof truss. Joints of the roof truss members, Purlins, Gable bracings, Column with bracings, Column base plate, Column foundation

Text Books / Reference Books:

R.C.C design: Punmia, Jain, Jain
Design of Steel Structures -S.K. Duggal Tata Mc-Graw Hill, NewDelhiNewDelhi Reinforced cement concrete design- Nilam Sharma
Design of Steel structures N. Subramanian Oxford University Press
Design of steel structures A.S. Aryaand J.L. Ajmani Nemchand & Bros.

CO	PO 1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	2	1	1	1	2	2	2	2
CO2	3	2	2	2	2	2	2	2	2	2	1	2	3	3
CO3	3	2	2	2	2	1	1	2	1	2	2	3	2	3
CO4	3	1	1	1	1	2	1	3	2	2	2	3	2	3
CO5	3	3	3	1	1	2	2	2	2	2	2	3	2	2

Computer Aided Design & Drafting Lab (CE692)

Semester: 6th
Regulation: R25

Course Objective:

Students will be familiar with features of detailing and design of structures by using software for detailing different structural elements and their analysis and design.

Course Outcomes (COs):

CO Code	Course Outcome Description
CO1	Students will be able to integrate the role of graphic communication in the engineering design process.
CO2	Students will be able to use design and drafting software to generate a computer model and technical drawing for a simple, well-defined part or assembly.
CO3	Students will be able to apply basic concepts to develop construction (drawing) techniques and produce 2D Orthographic Projections.
CO4	Generate structural drawings incorporating ductile detailing in compliance with IS Codes.
CO5	Become familiar with the use of Blocks, Design Center, and Tool Palettes, Solid Modeling concepts and techniques.

List of Lessons:

1. Introduction to computer-aided design and drafting tools: Overview of features for modelling, analysis, and design.
2. Modelling and analysis of a simple multistoried RCC building frame using structural design software.
3. RCC slab design: Data input, analysis, and interpretation using design software.
4. RCC beam and column design, including ductile detailing concepts.
5. RCC isolated and combined footing design using analysis tools.
6. Design and detailing of basic steel structural elements (e.g., trusses or beams) using structural tools.
7. Drafting structural detailing drawings of RC elements in 2D (beam, column, slab).
8. Project-based structural design exercise integrating analysis, design, and drawing preparation.

CO-PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	2	-	-	-	-	-	1	3	2	2
CO2	2	3	3	2	3	1	-	-	-	-	2	2	2	2
CO3	2	2	2	-	3	-	-	-	-	-	1	2	3	2
CO4	2	2	3	-	3	2	1	-	1	-	1	2	2	3
CO5	2	3	2	2	3	-	-	-	-	-	2	2	3	3

COURSE NAME: INDUSTRIAL TRAINING
COURSE CODE: CE693
CREDIT: 1.0
Course contents:
Collective Data from 3rd to 6th Semester (Summer/Winter Training during Semester Break & Internship should be done after 5th Semester or 6th Semester). All related certificates to be collected by the training/internship coordinator(s).

COURSE NAME: MINOR PROJECT III
COURSE CODE: PR691
CONTACT:0:0:2
CREDIT: 1
Course contents:
It is intended to start the project work in the semester. The students in a group of 4 to 6 works on a topic are to be approved by the head of the department under the guidance of a faculty member. The students prepare a comprehensive project report after completing the work to the satisfaction of the supervisor to be submitted at the end of the semester. The project work is evaluated based on oral presentation and the project report may jointly by examiners constituted by the Head of the Department.

4th Year 7th Semester									
Sl. No.	Broad Category	Category	Course Code	Course Title	Hours per week				Credits
					L	T	P	Total	
A. THEORY									
1	ENGG	Major	CE701	Transportation Engineering - II	3	1	0	4	4
2	ENGG	Major	CE702	A. Advanced Structural Analysis B. Advanced Foundation Engineering C. Structural Dynamics and Earthquake Engineering D. Pre-stressed Concrete	3	0	0	3	3
3	ENGG	Major	CE703	A. Solid Waste and Waste Water Management B. Hydraulic Structure C. Air and Noise Pollution and Control D. Pavement Design	3	0	0	3	3
4	SCI	Minor	CE704	A. Project Management B.Cyber Law and Ethics C.Studies on Six Sigma	3	0	0	3	3
5	HUM	Minor	HU(CE)705	Economics for Engineers Human Resource Development and Organizational Behavior History of Science and Engineering	3	0	0	3	3
B. PRACTICAL									
6	PROJECT	Major	PR781	Major Project-I	0	0	8	8	4
7	ENGG	Major	CE782	Internship (Min 1 month)	0	0	2	2	1.0
8	HUM	Ability Enhancement Course	HU(CE)791	Technical Seminar Presentation	0	0	1	1	0.5
9	ENGG	Skill enhancement Course	HU(CE)792	Skill Development: Technical article writing	0	0	1	1	0.5
Total of Theory, Practical and Mandatory Activities / Courses								26	22

COURSE NAME: TRANSPORTATION ENGINEERING - II
COURSE CODE: CE 701
CONTACT: 3:1:0
CREDITS : 4

Pre requisites: Student should have the basic knowledge about highway and transportation engineering, traffic studies, railway survey and planning, airport engineering to some extent.

Course Objective:

1. Introduction to traffic studies and traffic planning.
2. Traffic engineering.
3. Analyze and design the railway and airport facilities and components.

Course Outcome:

CO1: Understanding of traffic engineering and traffic management.
CO2: Understanding the traffic planning principles
CO3: Ability to analyze and design the railway components.
CO4: Ability to analyze and design the airport facilities and components.

Course Contents

Module 1: Traffic Engineering Traffic Engineering : Road user and vehicle characteristics; Traffic flow characteristics – Traffic Volume, Speed, Headway, Concentration and Delay; Traffic surveys & studies; Traffic estimation; Statistical applications in traffic engineering analysis; Parking; Road intersections – Basic traffic conflicts, classification of at-grade intersections, channelization, rotaries, traffic signals, signs and marking; Road Safety; Traffic System Management.	**12L**
Module 2: Traffic Management Transportation planning at different levels; Transport Project planning– Planning studies and investigation; Elements of Urban Transportation Planning; Transport Demand Analysis; Preparation of Project Report.	**6L**
Module 3: Railway Engineering Railway terminology, survey for track alignment, railway track component parts, gauges, wheel and axle arrangements, Resistance to traction, various resistances and their evaluation, hauling capacity and tractive effort, : Permanent way component parts, rails, railway sleepers, types, railway creep, anti creep devices check and guard rails, ballast requirements, types specification, formation, cross section and drainage, Alignment, horizontal curves, super elevation, equilibrium cant and cant deficiency, Gradients and grade compensation, Site, requirements, classification of railway stations, Objectives, principles of signaling, classification and types of signals in stations and yards & methods of interlocking.	**16L**
Module 4: Airport Engineering General philosophy of airport planning and development, ICAO classification of airports, site selection factors characteristics and jet aircraft, Orientation of runways, length of runways and corrections, width of runways, sight distances, gradients and clearance, taxiways and Aprons.	**14L**

Text Books:

High Way Engineering Khanna & Justo Nemchand & Brothers, Roorkee
A Text Book of Railway Engineering – S.P. Arora & S.C. Saxena Docks, Harbours and Tunnels by Srinivasan Transportation Engineering by Vazirani & Chandola Airport planning and Desigri. S.K.Khanna & M.G.Arora

CO-PO Mapping:

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

COURSE NAME: ADVANCED STRUCTURAL ANALYSIS
COURSE CODE: CE702A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36HRS
CREDITS: 3

Prerequisites: Students should have knowledge about the subjects Strength of Materials and Structural Analysis.

Course Objective:

1. Learning the concept of Matrix method of analysis
2. Learning dynamic analysis of structural frames for wind loads.
3. Learning the theories of special structures like Plates & Shells.
4. Introduction to the advanced theories of elasticity.

Course Outcome:

CO1: Students will understand matrix method of analysis.
CO2: Students will learn to evaluate wind loads on structures.
CO3: Students will learn to analyze plates and shell structures.
CO4: Students will be able to apply knowledge of elasticity in different coordinate systems.

Course contents:

Module-I: **Matrix methods of analysis**: Matrix formulation of redundant beam analysis (Clapeyrons three moment theorem. Stiffness and flexibility approaches for beams, simple portal frame, trusses by matrix formulation.	**10L**
Module-II: **Dynamic analysis of structural frames:** Wind analysis of structures by using IS.Code provisions. IS 875-III to be followed for the Wind Load calculations.	**6L**
Module-III: **Theory of plates and shells:** Thin plate analysis. Differential equation of bending under point and uniformly distributed load, various support systems. Rectangular and circular plates. Membrane analysis of thin shell, meridional & hoop-stress, shell of revolution, cylindrical shell, applications.	**10L**
Module-IV: **Theory of Elasticity:** Three-dimensional stress and strain analysis, stress-strain transformation, stress in variants; equilibrium and compatibility equations, boundary conditions; Two dimensional problems in Cartesian and Polar coordinates. Beam bending problems; Energy principles, variational methods and numerical methods.	**10L**

CO-PO Mapping-

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

Reference Books –

Sl. No	Name of the Book	Authors	Publisher
1.	Structural Analysis (A Matrix Approach)	Pandit & Gupta	Mc Grawhill Publisher
2.	Structural Analysis	Devdas Menon	Narosa Publisher
3.	IS 875 Part-III	IS Bureau of India	
4.	Theory of Elasticity	Timoshenko & Goodier	Mc Grawhill Publisher

COURSE NAME:ADVANCED FOUNDATION ENGINEERING
COURSE CODE: CE702B
CONTACT:3:0:0
TOTAL CONTACT HOURS:36HRS
CREDITS: 3

Prerequisites:

Basic knowledge of soil mechanics with emphasis on soil behavior, parameters, test procedure.
Knowledge on foundation and bearing capacity and settlement analysis.
Preliminary knowledge on vibration and dynamics of structures.

Course Objective:

Students will gain knowledge on soil exploration and site investigation, with bearing capacity from SPT and SCPT and plate load test data. Students will be able to design beams on elastic foundation and raft Foundation as perIS:2950.
Familiarity with deep Foundation- pile, laterally loaded piles by as per codal provisions and load carrying capacity and settlement analysis.
Students will acquire knowledge on retaining wall and sheet pile structures.
Familiarity with design of foundation for vibration control and foundation on expansive soils.

Course Outcome:

CO1: Determine suitable oil parameters
CO2: Design and analyze foundation systems using conventional methods
CO3: Design a budget and proposal for a Geotechnical investigation
CO4: Design appropriate foundation systems based on ground-investigation data and be able to select correct soil parameters for the designs
CO5: Understand limitations and uncertainties in geotechnical design

Course contents:

Module-I: **Soil Exploration and Site Investigation:** Planning of soil exploration programme, Field testing, Preparation of bore- log and soil investigation report, Geo-physical exploration: Seismic refraction survey electrical resistively method	**4L**
Module-II: **Shallow Foundations** Bearing Capacity from SPT and SCPT and Plate-load Test data, proportioning of footing based on settlement criteria. Beams on elastic foundation: Infinite beam, Finite beam, Modulus of sub- grade reaction and effecting parameters. Raft-Foundation: Settlement and Bearing Capacity analysis, Analysis of flexible and rigid raft as per IS2950.	**10L**
Module-III: **Deep Foundations** Pile: Tension piles, laterally loaded piles: Elastic continuum approach, Ultimate load Analysis, Deflection and maximum moment as per IS 2911, Pile-load test Drilled Shaft: Construction procedures, Design Considerations, Load Carrying Capacity and settlement analysis, Caissons: Types, Sinking and control.	**6L**

Module-IV: **Retaining walls and sheet pile structures** Gravity, cantilever and counterfort retaining walls: Stability checks and design Sheet Pile Structures: Cantilever sheet piling, Anchored sheet piling: Free and fixed earth support methods of Analysis, Braced Excavation	**8L**
Module-V: **Design of foundation for vibration control** Elements of vibration theory, Soil-springs and damping constants, dynamic soil parameters, Types of Machine foundations, General consideration in designing dynamic bases.	**4L**
Module-VI: **Foundations on expansive soils**: Problems and Remedies	**4L**

Text/Reference Books:

Name	Author	Publishers
Foundation Analysis &Design	J.E.Bowels	McGrawHill
PrinciplesofFoundationEngineering	B.M.Das	ThomsonBook
FoundationDesignManual	N. V.Nayak	DhanpatRaiPublicationPvt.Ltd
FoundationsforMachines:Analysisanddesign	Shamsher Prakash,VijayKPuri	Wiley Series in GeotechnicalEngineering
AdvanceFoundation Engineering	N.Som&S.C.Das	
HandBookofMachineFoundation	P. Sirinivashalu&C.V. Vaiddyanathan	TataMcGrawHill

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	3	2	1	2	1	2	2	3	2	2	3
CO2	3	3	3	2	2	1	2	2	2	1	3	2	2	2
CO3	3	1	1	2	2	2	3	3	3	2	3	2	2	3
CO4	3	3	3	3	3	2	3	2	2	2	2	3	2	3
CO5	3	3	3	3	3	1	2	2	2	2	2	3	2	2

COURSENAME:STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING
COURSE CODE: CE702C
CONTACT:3:0:0
TOTAL CONTACT HOURS:36HRS
CREDITS: 3

Prerequisites: Student should have knowledge about Structural Mechanics.

CourseObjective: Studentshouldbeabletodealdynamicbehavioranddynamicsofstructureas well as earthquake resistant design properly.

Course Outcome:

CO1. Student will be able know Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system

CO2. Student will be able to know about Response of single degree freedom system due to harmonic loading

CO3. Student will be able to know about Duhamel's Integral, Response due to constant force, Rectangular load, Introduction to numerical evaluation of Duhamel's integral of undamped system.

CO4. Student will able to know about Fundamentals: Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems Student will able to know about Principles of earthquake resistant design

Course contents:

Module-I: **Theory of vibrations:** Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system	**7L**
Module-II: **Response of single degree freedom system due to harmonic loading:** Undamped harmonic excitation, Damped Harmonic excitation	**7L**
Module-III: **Response due to Transient loading:** Duhamel's Integral, Response due to constant force, Rectangular load, Introduction to numerical evaluation of Duhamel's integral of undamped system.	**7L**
Module-IV: **Elements of seismology:** Fundamentals: Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems	**7L**
Module-V: **Principles of earthquake resistant design:** Terminology, General principles and Design criteria, Methods of Analysis, Equivalent lateral force method of Analysis for multistoried building as per Indian Standard Code of Practice, Introduction to Response Spectrum Method, Fundamental concepts of Ductile detailing	**8L**

Text/Reference Books:

Name	Author	Publishers
Structural Dynamics (Theory and Computation)	Mario Paz	CBSPublishersand Distributor
Dynamics of Structure (Theory and Application to Earthquake Engineering)	A.K. Chopra	PearsonEducation
Elements of Eathquake Engineering	Jai Krishna, A. R. Chandrashekhar and Brijesh Chandra N.C. Sinhaand S.K.Roy	SouthAsianPublishers
Earthquake Resistant Design	D.J. Dowrick	JohnWilley& Sons
IS1893(Part1):2002,IS3920,IS4326-Bureau of Indian Standard	-	-

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	3	-	-	-	2	-	2	2	3
CO2	2	2	2	-	2	3	3	2	-	2	-	3	2	3
CO3	3	2	-	2	1	2	-	2	2	-	2	2	2	2
CO4	3	1	2	2	2	1	1	2	2	1	2	2	2	2
CO5	1	2	2	1	2	1	1	-	2	1	3	2	2	2

COURSE NAME:PRESTRESSED CONCRETE
COURSE CODE: CE702D
CREDITS:3
CONTACT:3:0:0
TOTAL CONTAC THOURS:36HRS

Pre requisites:

Basic understanding of R.C.C. design and analysis with fundamental knowledge of limit state behavior of R.C.C. with basic knowledge of structural analysis.

Course Objective: Students will gain knowledge on pre-stressed concrete behavior analysis methods,stresscalculation,losses,limitstatedesigncriteriaandmethods. Student will be familiar with anchorage zone stress in post tension member. Basic knowledge on composite construction of pre-stressed and in situ concrete. Preliminary idea on partial pre-stressing and non stressed reinforcement.

Course Outcome:

CO1:Thestudentwillgetbasicconcept ofpre-stressingmaterialsandprocedures.
CO2:Detailunderstandingonlossesinprestressed
CO3:BecomefamiliarwithISCodesonPrestressing.
CO4:Understanddesignofvariouspartsofaprestressedstructureformanykindofloading.
CO5: DetailIdea onanchoragezoneand compositemembers

Coursecontents:

Module-I: [6L] **Introduction of Pre-stressed concrete**: Materials, pre-stressing system, analysis of prestress andBendingstress,lossesShearandtorsionalresistance:designofshearreinforcement,design of reinforcementfor torsion ShearandbendingDeflectionsof pre-stressedconcrete members: Importance, factors, short term and long term Deflection	**6L**
Module-II:[6L] **Limitstatedesigncriteria:**Inadequacyofelasticandultimateloadmethod,criteriaforlimit states,strengthandserviceability. Designofsections for flexure: methodsbyLinandMagnel	**6L**
Module-III:[6L] **AnchorageZonestressesinposttensionedmembers:**Stressdistributioninendblock, anchorage zone reinforcement	**6L**
Module-IV: [6L] **Compositeconstructionofpre-stressedandin-situconcrete:**Types,analysisofstresses StaticallyIndeterminate structures: advantages of continuous member, effect of pre stressing, methods of achieving continuity and method of analysis of secondary moments	**6L**
Module-V: [6L] **Pre-stressedconcretepolesandsleepers:**Designofsections forcompressionandbending	**6L**
Module-VI: [6L] **Partialpre-stressingandnonpre-stressedreinforcement**	**6L**

Text/ReferenceBooks:

Name	Author	Publishers
PrestressedConcrete	NKrishnaRaju	McGrawHill
DesignofPrestressedStructures	T.Y.LinandN.H.Burns	WileyEasternLtd
FundamentalsofPrestressedConcrete	N.C.SinhaandS.K.Roy	-
PrestressedConcrete	S.Ramamurthan	-

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-		-	-	-	1	2	2	-
CO 2	3	2	1	2	-	-		-	-	-	1	2	2	-
CO 3	-	2	1	-	1	3		-	-	-	1	2	2	-
CO 4	2	2	3	2	2	-		-	-	-	1	2	2	-
CO 5	2	2	1	2	2	-		-	-	-	1	2	2	-

COURSENAME: SOLID WASTE AND WASTE WATER MANAGEMENT
COURSE CODE: CE 703A
CONTACT:3:0:0
TOTALCONTACTHOURS:36HRS
CREDITS : 3

Prerequisites: Studentshould haveknowledgeaboutbasicofsolid waste and sewage.

CourseObjective:

Solid Waste Management (SWM) will cover the basics of waste generation, characterization, collection, storage, processing, and disposal. Various topics on different waste types, such as municipal, industrial, hazardous, and biomedical waste, as well as the principles of integrated waste management and waste minimization will be covered. Waste water management will include various topics on

CourseOutcome:

CO1:Student will be able to describethe fundamental s of solid waste management

CO2: Student will be able to define theStorage, Collection and Transportation of Municipal Solid Waste along with Disposal of Municipal Solid Waste

CO3: Student will be able to apply appropriate treatment to raw water i.e. surface water/ground water useful for domestic as well as drinking purpose, industries liquid waste and reuse of water.

CO4:Student may clarify and identify the impurities present in water used for domestic, different types of industrial as well as construction works.

CO5: Student will able to produce and select water distribution and sewer-network system.

Coursecontents:

Module-1:Fundamentals of solid waste management Definition of solid waste, terms of different solid waste — domestic waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, sources of solid waste, classification of solid waste— hazardous and non-hazardous waste.Physical and chemical characteristicsofmunicipal solid waste.Impactofsolidwasteon environment.Solid waste management techniques —solid waste managementhierarchy,waste preventionandwastereduction techniques.Factorsaffectingthesolid waste generation.	**4L**
Module-2:Storage, Collection and Transportation of Municipal Solid Waste Storage of solid waste, Collection methods of solid waste, Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin-like movable and stationary bin Transportation of municipal waste. Transportation vehicles with their capacity, Organization pattern of solid waste management system, practices according to Population of the town or city.	**4L**
Module-3:Disposal of Municipal Solid Waste Concept of composting of waste, Principles of composting process. Factors affecting the composting process. Methods of composting—a) Manual Composting — Bangalore method, Indore Method, b) Mechanical Composting —Dano Process, c) Vermi-composting. Land filling technique, Factors to be considered for site selection Land filling methods-Area method, Trench method and Ramp method. Leachate and its control, Biogas from landfill Advantages and disadvantages of landfill method, Recycling of municipal solid waste. Incineration of	**4L**

waste:Introduction of incineration process. Types of incinerators - Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste— Definition, Methods Products of incineration process. Advantages and disadvantages of incineration process.	
Module-4:Biomedical Waste management and Health aspects and public Involvement in Solid Waste Management:Biomedical Waste Management Definition of Biomedical Waste. Sources and generationof Biomedical WasteClassificationofBiomedical Waste. ManagementHealth aspects during handling and processingHealth problems during time of segregation, recovery, recycling and reuse of solid waste. Public involvement and participation in solid waste management practices.	**4L**
Module-5: Industrial waste and E-waste management Industrial waste Management: Variety of industrial waste Collectionanddisposalof industrial waste. Control measures for industrial waste, Recycling of industrial waste. E-waste ManagementDefinition of E-waste Varieties of E-wastes, Dangers of E- waste, Recycling of E-waste. Disposal of E-waste.	**4L**
Module-6: Estimating the Design Sewage Discharge -Estimating Sewage Discharge, Design Periods for Different Components of a Sewerage Scheme, Future Forecasts and Estimating Design Sewage Discharge, Variations in Sewage Flow and their Effects.	**4L**
Module-7: Hydraulic Design of Sewers and S.W Drain Sections-Difference in the Design of Water Supply Pipes and Sewer Pipes and Sewer Pipes, Hydraulic Formulas for Determining Flow Velocities in Sewers, Effect of flow variations on Velocity in a Sewer, Hydraulic Characteristics of Circular Sewer, Various Forms of Underground Sources, Use of Tables and Nomograms for Hydraulic Computations for the Design of Sewers, Limitation on Depth of Flow, Egg Shaped Sewer .	**4L**
Module-8: Quality and Characteristics of Sewage-Decomposition of Sewage, Characteristics of Sewage	**2L**
Module-9: Disposing of the Sewage Effluents-Disposal by Dilution, Disposal of Wastewaters in Rivers and Self, Disposal on Land for Irrigation, Dilution Method Vs Land Disposal Method .	**2L**
Module-10: Treatment of Sewage-Classification of Treatment Processes, Screening, Types of Screens, Their Designs and Cleaning, Grit Removal basins, Grit Chambers, Sedimentation, Principle of Sedimentation, Sedimentation Tank, Sedimentation Aided with Coagulation, Contact Beds for Biological Filtration of Sewage, Trickling Filters for Biological Filtration of Sewage	**4L**

Text/Reference Books:

1. **Solid waste: BhideA.D Indian National Scientific DocumentationCentre,NewDelhi Edition 1983 ASIN: B0018MZ0C2**
2. **Solid waste: Techobanoglous George;Kreith, Frank McGraw Hill Publication,NewDelhi 2002, ISBN 9780071356237**
3. **Environmental studies Manjunath D. L**
4. **Waste Water Treatment and Water Management : Anamika Srivastava**
5. **Water Treatment and Management INDUSTRIAL WASTE WATER TREATMENT A. D. Patwardhan**

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	1	-	-	-	-	-	2	2	-
CO2	2	3	2	-	1	1	-	-	-	-	-	2	2	-
CO3	3	2	2	-	1	-	-	-	-	-	-	2	2	-
CO4	3	2	2	-	1	-	-	-	-	-	-	2	2	-
CO5	3	2	2	-	1	-	-	-	-	-	-	2	2	-

COURSE NAME: HYDRAULIC STRUCTURE
COURSE CODE: CE703B
CONTACT: 3:0:0
TOTALCONTACTHOURS:36HRS
CREDITS: 3

Prerequisites:

Basic course on hydraulics with emphasis on fluid behavior pressure losses and application of theories in real scenario knowledge of seepage and groundwater calculation.

Course Objective:

Students will acquire knowledge on different elements of Hydraulic structure, diversion headwork, weirs, barrages.
Familiarity with hydraulic design of canals, Ogee fall and cross-drainage works.
Acquire knowledge on dams, earthen dams, method of construction, type, failure causes, seepage control in earthen Dam, gravity dam.
Familiarity with spillways and its requirement capacity.

Course Outcome:

CO1: Students will able to analyze and design hydraulic structures using of practice.
CO2: Students will able to Apply the basic design principles to engineering design practice
CO3: To define basic theories of hydraulic structure design concepts- cross drainage works, canal falls etc.
CO4: To define basic theories of hydraulic structure design concepts- dams, culverts, siphons etc.
CO5: To identify seepage under hydraulic structures and protection methods.

Course contents:

Module-1: Diversion Headworks: Necessity, Difference between weir and Barrage, Type of Weirs, Selection of site, layout and description of each part, Effects of construction of a weir on the river regime, causes of failure of weirs on permeable foundation and their remedies.	**4L**
Module-2: Theories of seepage and Design of weirs and Barrages: Failure of Hydraulic Structures Founded on Pervious foundations: i) By piping ii) By Direct uplift, Bligh's creep theory of seepage flow, Khosla's theory & concept of flow-nets, concept of exit gradient and critical Exit gradient, Khosla'smethodofindependentvariablefordeterminationofpressuresandexit gradient for seepage below a weir or a barrage, necessary corrections, examples.	**8L**
Module-3: Hydraulic structures for canals: Canal falls, Description of Ogee fall, Trapezoidal- notch fall, Syphon; well drop. Examples.	**2L**
Module-4: Cross-Drainage Works: Necessity, types, selection of a suitable type (Introduction only).	**2L**
Module-5: Dam (General): Definition, classification of Dams, factors governing selection of type of dam, selection of suitable site for a dam. Earthen Dams: Introduction, Types of Earthen Dams, Methods of Construction, Causes of failure, Design Criteria, Determination of line of seepage or phreatic line in Earthen Dam, seepage control in Earthen Dam, Examples.	**8L**

Module6: Gravity Dam: Definition, Typical cross-section, Forcesacting on Gravity Dam, Combination of forces for design, Mode of failure and criteria for structural stability of Gravity Dams, Principal and shear stresses. Elementary profile of a Gravity Dam, Concept of High and low Gravity Dam, Examples.	**6L**
Module7: Spillways: Types, Location, Essential requirements, spillway capacity. Components of spillway, Energy Dissipators, Stilling basins (Indian standard)	**6L**

Text/Reference Books:

Name	Author	Publishers
Irrigation Engineering and Hydraulic Structures	S.KGarg	KhannaPublishers
Irrigation Water Resources and Water Power Engineering	Dr. P.N. MODI	Standard Book House, Delhi-6
Water Resources Systems Planning	Mahesh C. Chaturvedi	Indian Academy of Sciences

CO-POmapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	3	-	-	-	-	-	-	-	-	2	2	-
CO3	2	1	2	1	-	-	-	-	-	-	1	2	2	-
CO4	2	2	3	1	-	-	-	-	-	-	2	2	2	-
CO5	1	2	3	-	-	-	-	-	-	-	-	2	2	-

COURSE NAME: AIR AND NOISE POLLUTION AND CONTROL
ENGINEERING COURSE CODE: CE703C
CONTACT: 3:0:0
TOTAL CONTACTHOURS:36 HRS
CREDITS: 3

Pre requisites:

Basic knowledge of environment pollution and its causes with preliminary knowledge of chemistry knowledge on different impurities are pollutants of air.

Course Objective:

Students will acquire knowledge on air pollution, sources and control of particulates, gaseous pollutant and self-cleansing properties of the environment. Familiarity with noise pollution, measurement, sources and control. Acquire knowledge on global environmental issues like ozone depletion, acid rain, greenhouse effect. Familiarity with administrative control on environment with function of State and Central Pollution Control Boards and clearance process for industries and infrastructural projects. Some knowledge on Environmental laws and Environmental Impact Assessment.

Course Outcome:

CO1: To learn about the air pollutants, sources and its effects.
CO2: To have a clear understanding on the air quality standards and its techniques.
CO3: To determine the fluid resistance for organic materials.
CO4: To find the Properties of air pollution and its control measures.
CO5: To learn about the effects and the sources of noise pollution.

Course contents:

Module-I: **Air Pollutants** Sources; Classification; Effects on Human, Vegetation, Material Effects of Air pollution on Atmosphere: Photochemical Smog, Ozone Layer Depletion, Acid Rain, Greenhouse Effect and Global Warming	**4L**
Module-II: **Air Pollution Meteorology** Lapse Rate; Atmospheric Stability; Inversion; Plume Pattern	**3L**
Module-III: **Dispersion of Air Pollutants** Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height	**3L**
Module-IV: **Air Quality** Methods of Measurement: Gaseous pollutants, Particulate pollutants Air Quality Standards and Indices: Ambient Air Quality Standard, NAAQS, Emission Standard, Air Quality Indices	**4L**
Module-V: **Air Pollution Control** Control of Gaseous Pollutants: Adsorption, Absorption, Condensation Control of Particulate Pollutants: Settling chambers, Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators Control of Pollution from Automobiles	**5L**
Module-VI: **Physics of Noise** Basics of Acoustics; Sound Pressure, Power and Intensity and their Interrelations	**2L**

Module-VII: **Measurement of Noise** Noise Level; Interrelation between Noise, Pressure, Power and Intensity Levels; Noise Meter; Noise Networks; Frequency Band Analysis; Decibel Addition Measurement of Community Noise: L_N, L_{eq}, L_{dn}, L_{NP}	**4L**
Module-VIII: **Source and Effect of Noise** Psychoacoustics and noise criteria; effects of noise on health; annoyance rating schemes	**1L**
Module-IX: **Noise Pollution Control** Noise Standards and Limits; Methods of Noise Pollution Control	**3L**

Text Books/Reference Books:

Name	Author	Publishers
Air Pollution and Control	Keshav Kant, Rajni Kant	Keshav Kant, Rajni Kant
Environmental Engineering	S.C. Sharma	Khanna Publishing House
Environmental Engineering. Volume-1 and Volume-2.	Garg, S.K. K	Khanna Publishers
Air Pollution	M.N., Rao, H.V. N	Tata McGraw Hill

CO-PO/PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	2	1	3	3	3	1	3	2	2	2	2
CO2	2	3	3	3	2	3	3	2	2	3	2	3	3	2
CO3	3	3	3	3	3	2	3	1	2	1	2	3	3	3
CO4	3	3	3	3	2	1	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	2	3	3	2	3

COURSE NAME: PAVEMENT DESIGN
COURSE CODE: CE703D
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS: 3

Course Outcomes:

- **CO1:** Decide factors affecting selection of type of pavement to be constructed.
- **CO2:** Identify the material to be used for pavement construction.
- **CO3:** Design low volume as well as regular flexible pavement and rigid pavement.
- **CO4:** Determine the quality of the constructed flexible as well as rigid pavement.

Module No.	Course contents	Contact Hours
Module 1	**Characterization of Sub-Grade Soil and Mineral Aggregates**: Introduction, particle size analysis of soils, soil gradation, moisture content, consistency test of soil, methods of soil classification, composition of soil mass, determination of soil compaction, strength determination of soils, strength properties of mineral aggregates.	8L
Module 2	**Bituminous Materials**: Introduction, desirable properties of bitumen, tests on bituminous materials, other binders, engineering properties of bituminous materials, mix design.	8L
Module 3	**Design of Cement Concrete Mixes for Pavements**: Introduction, cement, properties of cement, mineral aggregates, water, admixtures, properties of fresh concrete, test on hardened concrete, design of cement concrete mix, factors considered for durable concrete, the Bureau of Indian Standards Method of Cement Concrete Mix Design, Indian Road Congress Method of Cement Concrete Mix Design (IRC:44-2008), Dry Lean Cement Concrete (MORTH 201), Concrete Mix Design for Rural Roads (IRC:SP:62-2004,SP-72).	8L
Module 4	**Factors Affecting Pavement Design**: Types of pavements, factors affecting design of pavements	4L
Module 5	**Structural Evaluation of Pavements:** Purpose, types, and methods of structural evaluation, structural evaluation by static loading, structural evaluation by steady – state Vibratory Loading, structural evaluation by impulse lading, Models of Falling Weight Deflectometer, structural evaluation of flexible pavement using FWD, back calculation of Layer Moduli from FWD Test data, uses of Back- calculated Pavement Layer Moduli, Structural Evaluation of Rigid Pavement using FWD.	4L
Module 6	**Structural Evaluation of Unbound Granular and Sub-Grade Layers using Dynamic Cone Penetrometer (DCP) :** Development of DCP Test, The Dynamic Cone Penetrometer, material testing with DCP, determination of DCP index values, factors affecting DCP test results, correlation of DCP index values with other standard test values, application of DCP test data, limitation of DCP	4L

Text Books:

1. *Highway Engineering* by R. Srinivasa Kumar

Reference Books:

2. *Principles of Pavement Engineering* by Nick Thom

CO-PO/PSO Mapping:

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

COURSE NAME: PROJECT MANAGEMENT
COURSE CODE: CE704A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: 10+2

Course Objective:

Understand the basic concepts of project management.
Appraise the project using appropriate appraisal techniques.
Design and implement project by considering risk and its evaluation.
Learn the process of project planning and execution.

Course Outcome*:*

CO1 : Learn the techniques of Mathematical and conceptual modeling of real life decision making problems, including the use of modelling and computational tools as well as analytic skills to evaluate the problems.
CO2 : Apply various models in real life case studies and learn about decision making.
CO3 : Develop decision making skills under challenging circumstances through the concept of optimization

Course contents:

Module-I: Introduction to Project Management: What is a project? Evolution of project management, the need of project management, Where is project management appropriate? Characteristics of projects, Characteristics of project management, Projects in contemporary organizations, Project life cycle.	**6L**
Module-II: Project Selection and Appraisal: Brainstorming and concept evolution, Project selection and evaluation, Selection criteria and models, Types of appraisals, SWOT analysis, Cash flow analysis, Payback period, and Net present value	**6L**
Module-III: Project Organization and Planning: Project manager, Cross-functional team, Dedicated project organization, Influence project organization, Matrix organization, Advantages and disadvantages of project organizations, Selection of project organization, Work Breakdown Structure (WBS), Integration of project organization and WBS, WBS and responsibility matrix.	**6L**
Module-IV: Project Scheduling and Resource Management: Gantt chart, Milestone chart, Network techniques: PERT and CPM, AON and AOA representation, Three time estimates, Using probability distributions for time computation, Probability of project completion, Time scale version of network, Early start and late start schedules, Resource allocation, Resource loading and leveling, Constrained resource scheduling, Multi-project scheduling and resource allocation, Crashing a project.	**8L**
Module-V: Computerized PM: Computerized PMIS, Choosing software for project management, using software for project management.	**4L**
Module-VI: Case Studies on Project Management: Modern cases in project management.	**6L**

Reference Books

1. Project Management for Business and technology: Principles and Practice, John M. Nicholas, Pearson Prentice Hall, New Delhi, 2005.
2. A Guide to the Project management Body of Knowledge (PMBOK Guide) 5 th Edition, PMI.
3. Project Management-Case Studies, Harold Kerzner, John Wiley & Sons, New Jersey, 2006.
4. Project and Production Management, A course by National Programme on Technology Enhanced Learning (NPTEL), Arun Kanda and S. G. Deshmukh, IIT Delhi, 2005.
5. Projects: Preparation, Appraisal, Budgeting and Implementation, Prasanna Chandra, Tata McGraw Hill Publishing Company Ltd., New Delh

CO-PO mapping

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

COURSE NAME: CYBER LAW AND ETHICS
COURSE CODE: CE704B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: 10+2

Course Objective:

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession

Course Outcome*:*

CO1 : Understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
CO2 : Learn the rights and responsibilities as an employee, team member and aglobal citizen

Course contents:

Module-I: Introduction: Basics of Law, Understanding Cyber Space, Defining Cyber Laws, Scope and Jurisprudence, Concept of Jurisdiction, Cyber Jurisdiction, Overview of Indian Legal System, Introduction to IT Act 2000, Amendments in IT Act, Cyber Laws of EU – USA – Australia - Britain, other specific Cyber laws	**6L**
Module-II: Computer Ethics, Privacy and Legislation: Computer ethics, moral and legal issues, descriptive and normative claims, Professional Ethics, code of ethics and professional conduct. Privacy, Computers and privacy issue, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT, Legal Policies, legislative background	**6L**
Module-III: Intellectual Property Rights Issues: Copyrights, Jurisdiction Issues and Copyright Infringement, Multimedia and Copyright issues, WIPO, Intellectual Property Rights, Understanding Patents, Understanding Trademarks, Trademarks in Internet, Domain name registration, Software Piracy, Legal Issues in Cyber Contracts, Authorship, Document Forgery	**6L**
Module-IV: Indian IT Act and Standards: Indian IT ACT, Adjudication under Indian IT ACT, IT Service Management Concept, IT Audit standards, ISO/IEC 27000 Series, COBIT, HIPPA, SOX, System audit, Information security audit, ISMS, SoA (Statement of Applicability), BCP (Business Continuity Plan), DR (Disaster Recovery), RA (Risk Analysis/Assessment)	**8L**
Module-V: International Laws governing Cyber Space: Introduction to International Cyber Law, UNCITRAL, Cyber Laws: Legal Issues and Challenges in India, Net neutrality, Role of INTERPOL	**4L**

Reference Books

1. Computer Ethics-Deborah G. Johnson, Pearsons Education
2. Cyber Law Simplified-VivekSood, McGraw Hill Education
3. Cyber frauds, cybercrimes & law in India- Pavan Duggal, Saakshar Law Publications
4. The Internet Law of India: Indian Law Series- Shubham Sinha, CreateSpace Independent Publishing Platform 5. Principles of Information Security- Michael E. Whitman, Herbert J. Mattord, Course Technology

CO-PO mapping

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

COURSE NAME: STUDIES ON SIX SIGMA
COURSE CODE: CE704C
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48 HRS
CREDITS : 4

Pre requisites: Basic concepts of Management and Planning

Course Objective:

1. To translate the selection, application and implementation of a Six Sigma project including roles and responsibility of team members
2. Collect appropriate data from process to support problem solving.
3. Create details flowchart and process maps.
4. Demonstrate ability to control and monitor process.

Course Outcome:

CO1 : Understand requirement of implementation of Six Sigma.
CO2: Relate Six Sigma concept to the overall business mission and objective.
CO3 : Understand Six Sigma methodology including DMAIC.
CO4 : Employ Six Sigma skills to lead a successful process improvement project for a meaningful result

Course contents:

Module 1: Introduction – General History of Six Sigma, Evolution and Value of Six Sigma, The Basics and meaning of Six Sigma, Basic Concepts of variation.	**4L**
Module 2 : Six sigma Roles and responsibilities, Implementing Six Sigma, Six Sigma Roadmap, Process Mapping, Lean Principles and Value Stream Mapping, Selection and defining Six Sigma Projects.	**4L**
Module 3: Becoming a Customer and Market-Driven Enterprise, Voice of the customer, Customer Expectations and Needs, Linking Six Sigma Projects to Strategies	**3L**
Module 4: Attributes of Good Metrics, Using Resources Wisely, Project Management Using the DMAIC and DMADV Models	**3L**
Module 5: The Lean enterprise, The History of Lean, Understanding lean, Lean & Six Sigma, The seven elements of waste	**3L**
Module 6: The Define Phase – Defining a process, Critical to Quality Characteristics, Cost of Poor Quality, Basic Six Sigma Metrics, Pareto Analysis	**3L**
Module 7: The Measure Phase – Process Definition, Cause and effect / Fishbone Diagram, Basic Probability and Statistics, X-Y Diagram, Normal Distribution and Normality, Precision & Accuracy, Process Capability	**4L**
Module 8: The Analyze Phase- Pattern of Variation, Multi-Vari Analysis, Inferential Statistics, Sampling	**4L**

Techniques & Uses, Central Limit Theorem, Hypothesis Testing, Confidence Intervals, Analysis of Variance (ANOVA)	
Module 9: Improve Phase: Simple linear Regression, Correlation, Regression Equations, Residual analysis, Multiple and Non- linear regression, Data transformation, Box Cox.	**4L**
Module 10: The Control Phase: Lean Controls, Control Methods for 5S, Kanban, Poka – Yoka (Mistake Proofing), Statistical process Control (SPC), Data collection of SPC, Six Sigma Control Plans, Cost benefit analysis, Elements of control Plan, Elements of Response Plan.	**4L**

Text / Reference Books:

Name	Author	Publishers
Simplified six sigma methodology tools and implementation	N. Gopala Krishnan	PHI
Eight steps to problem solving- six sigma	Mohit Sharma	Zorba Books
Six Sigma Handbook	PYZBEK	-
ASQ Certified Six Sigma Handbook	American Society of Quality	-

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	1	-	-	-	-	-	-	-	1	2	2	-
CO 2	2	1	1	1	1	-	-	-	-	-	-	1	2	2	-
CO 3	3	3	3	2	2	-	-	-	-	-	-	1	2	2	-
CO 4	3	3	3	3	3	-	-	-	2	2	2	1	2	2	-

COURSE NAME: ECONOMICS FOR ENGINEERS
COURSE CODE: HU(CE)705A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: NIL

Course Objective:

- To develop decision making skills using basic economic Principles
- To educate the students in evaluating various Business Projects

Course Outcome:

CO1 : To learn the identification of various uses for scares resources.
CO2 : To understand key economic concepts and implement them in real life problems.
CO3 : To design sustainable and effective economic models in real life projects.
CO4 : To apply critical thinking skills in analysing financial data and their impacts.

Course contents:

Module – 1: Introduction Economics- Nature, Scope, Uses, Micro Economics and Macro Economics.	**3L**
Module – 2 Theory of Demand and Supply Concept of demand, Determinants of demand, Individual and Market Demand, Law of demand and its Exception; Concept of Supply, Shift in Demand and Supply Curve, Movement along the demand and supply curve, Determinants of equilibrium price and quantity, Elasticity of Demand and Supply.	**5L**
Module – 3 Theory of Production and Costs Concept of Production function, types of Production function, Laws of return to scale and variable Proportion, Basic understanding of different markets, Determination of equilibrium price under perfect competition & monopoly in short run and long run; Price Discrimination.	**8L**
Module-4 Macroeconomic Aggregates and Concepts Concepts of National Income, GDP, GNP, Concept of Business Cycle.	**4L**
Module -5 Inflation Concept, Causes and Remedies of Inflation and Unemployment, basic concept of Philips Curve	**4l**
Module-6 –Theory of Investment Basic concept of Investment, Business Fixed Investment, Accelerator Theory, Tobin's	**4L**
Module -7 Accounting Basic concept of Journal, Preparation of Income Statement and Balance Sheet	**4L**
Module – 8 Cost Volume Profit Analysis Contribution, P/V Ratio, Break-Even Point, Margin of Safety, Short term decision making: Make or Buy, Shut-down point, Export Pricing, Opportunity and Sunk cost.	**4L**

Text / Reference Books:

1. Economics, by Lipsey and Chrystal, Oxford University Press
2. Modern Accountancy, vol.-I-, by Hanif &Mukherjee,
TataMgrowHillReferences:
1. Modern Economic Theory, by K.K. Dewett, S.Chand
2. Principles of Economics, by H.L. Ahuja, S. Chand
3. Engineering Economics, by R.PaneerSeelvan, PHI
4. Economics for Engineers, by Dr. Shantanu Chakraborty &Dr. Nilanjana singharoy, Law Point Pub
5. Macro Economics, by Mankiw, Macmillan Learning

CO-PO mapping

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

COURSE NAME: HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOR
COURSE CODE: HU(CE)705B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS: 3

Pre requisites: 10+2

Course Objective:

To provide an understanding of the basic principles of organisational behaviour so as to acquaint the students with managerial skills and the required inputs with reference to human resource management.

Course Outcome:

CO1: To define and explain the basic concepts of organizational behaviour and motivation
CO2: To explain the essential concepts of organisational conflicts, resolution of conflicts through negotiation, change management and organisational development.
CO3 : To familiarize the various aspects of HR, to deal effectively with people resourcing and talent management and HR functions in an organization.
CO4: To understand the concepts of HRD, its role and importance in the success of organization.
CO5: To develop an understanding towards compensation management and industrial relations.

Course contents:

Module-I: Introduction to HRM and Organizational Behaviour (OB): Human resource management (HRM) at work: Definition – HR Challenge –Management process, Changing environment of Human Resource Management: Work force diversity, Technological trends – Globalization, Strategic planning and HR today: Nature of strategic planning – Building competitive advantage – Human resource as a source of competitive advantage, Definition of organizational behavior (OB) and historical development: Definition –Goals of OB – Challenges and opportunities, OB in a global context: The global economy – Facing the international challenge – Behaviour across cultures	**6L**
Module-II: Foundation of individual behaviour: Biographical characteristics – Ability – Learning – Implication for performance and satisfaction, Values and attitudes: Importance of values – Types of values – Types of attitude –Attitude and consistency, Perception: Defining perception and its importance – Factors influencing perception, Personality & emotions: Personality determinants – Personality traits – Major personality attributes influencing OB, Emotional intelligence: Defining emotions – The six universal emotions – Emotions and national culture – OB applications, Individual decision making: The rational decision-making process – Improving creativity in decision making – Identifying problems – Ethics in decision making	**6L**
Module-III: Understanding and managing group behaviour: Defining & classifying groups: Formal group – Informal group – Command group – Task group – Interest group, Basic group concepts: Roles – Norms – Cohesiveness – Size – Composition – Status, Group decision making: Individual vs. group – Group decision making techniques, Understanding work teams: Team versus groups – Types of teams – Cross functional teams – Creating effective teams, Conflict and inter-group behaviour: Definition of conflict – Transitions in conflict thought – The conflict process – Intergroup relations	**4L**

Module-IV: Recruitment and placement: Nature of job analysis: Definition – Uses of job analysis information, Steps in job analysis, Methods of collecting job analysis information: Interview – Questionnaires –Observation – Quantitative job analysis techniques, Job description and specification: Job identification – Responsibilities and duties – Specification for trained versus untrained personnel, Recruitment and selection process: Introduction – Advertising – Employment agencies – Selection process – Basic testing concepts, Human resource planning and forecasting: Employment planning and forecasting – Factors in forecasting personnel needs – Forecasting supply of inside candidates – Recruiting job candidates	**4L**
Module-V: Training and development: Building employee commitment – Orientation and socialization, Training needs analysis: Task analysis – Performance analysis – Setting training objectives, Training techniques: On-the-job training – Job instruction training – Audiovisual techniques – Programmed learning, Information technology and HR – Training via the internet, Nature and purpose of management development: Definition – Succession planning, Job rotation and management: Coaching – Action learning – Advantage, Performance management & appraisal: Appraisal process – Appraisal methods – Problems and solutions – Role of appraisals in managing performance, Using HR to build a responsive learning organization: HR and systematic problem solving – Learning from experience – Transferring knowledge	**4L**
Module-VI: **Compensation and retention:** Basic aspects of compensation: Compensation at work – Legal considerations in Compensation, Pricing managerial and professional jobs: Basic compensation elements – Compensating professional employees, Current trends and issues in compensation: Skill-based pay – Broad banding, Comparable worth – Pay secrecy – Inflation and salary compression, Financial incentives: Use of financial incentives – Types of incentive plans, Retirement benefits: Social security – Pension plans – Other retirement benefits, Employee service benefits: Job-related service benefits – Executive perquisites – Law for working women, Retention of employeees, Defination- Strategy- Benifits	**4L**
Module-VII: Labour relations & legislation: The labour movement, unions and the law: Introduction – Why do workers organize – Background – Labour law today, Guaranteed fair treatment and employee discipline: GFTP at work – Fairness in disciplining – Discipline guidelines – Discipline without punishment, Managing dismissals: Definition – Grounds for dismissal – Dismissal procedure, Salient provisions under Indian Factories Act: Labour issues – Factory Act 1948, Industrial Disputes Act: Objective – Applicability, Employees State Insurance Act: Definition – Commencement and application, Workmen's Compensation Act: Definition – Employer's liability for compensation, Payments of Bonous Act: applicability- Eligibility- Benefits.	**4L**
Module-VIII: Global HRM & Organizational development (OD): Nature of global HRM: Strategic overview – HR and the international business – HR challenges of international business, Multinational and global corporations: Market imperfections – International power –Criticisms of multinationals, The expatriate manager in multinational corporations: Introduction – Selecting the expatriate manager – Training, OD values and outcomes: Respect for people – Trust and support – Power equalization – Confrontation, Implementation issues in OD and difference in organizational cultures: Improved organizational effectiveness – Greater commitment and involvement – Increased personal and organizational awareness	**4L**

REFERENCE BOOKS:

1. Organizational Behavior-Stephen P. Robbins, Prentice-Hall of India, New Delhi
2. Human Resource Management- Gary Dessler, Pearson Education
3. Human Resource Management- Cynthia D. Fisher, Schoenfeldt& Shaw, Biztantra, New Delhi

TEXT BOOKS

1. K. Aswathappa, Organizational Behaviour, 12thedition, Himalaya, 2016
2. Edwin B. Flippo, Personnel Management, 6thedition, TMH, 2013
3. P. Subba Rao, Management & Organizational Behavior, 2ndedition, Himalaya, 2014
4. C.B. Mamoria& VSP Rao, Personnel Management, 20the dition, Himalaya, 2015
5. Stephen P. Robins, Organisational Behaviour, 11th edition, PHI Learning / Pearson Education, 2008

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	-	-	3	-	1	1	2	2	-
CO2	2	-	-	2	1	2	3	1	1	2	2	2	2	-
CO3	-	2	1	1	2	2	1	1	2	-	-	2	2	-
CO4	1	1	2	-	-		-	-		1	2	2	2	-
CO5	-	-	1	2	1	1	1	-	2	-	1	2	2	-

COURSE NAME: HISTORY OF SCIENCE AND ENGINEERING
COURSE CODE: HU(CE)705C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS: 3

Pre requisites: 10+2

Course Objective:

1. Students will learn the general course of human history in multiple areas of the world.
2. Students will learn to understand the world contextually, that is, to interpret human experiences and the meanings people have given them in relationship to the place and time in which they occurred.
3. Students will learn to understand, analyze, and evaluate both evidence and arguments.
4. Students will learn to explain how and why important events happen and change over time occurs.
5. Students will learn to create knowledge and communicate it to others both orally and in writing.

Course Outcome:

CO1: Students will understand the Beginning and Development in different field of Science in ancient, medieval, and in modern period
CO2: Students will study the biography of different scientist like Baudhayan, Aryabhtatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna etc.
CO3 : Student will study the various research organization like DRDO, CSIR, IRC, ISRO etc.
CO4: Students will be able to study the Medical Science of Ancient India (Ayurveda & Yoga)

Course contents:

Module-I: **Science and Technology- The Beginning**: Development in different branches of Science in Ancient India: Astronomy, Mathematics, Engineering and Medicine; Developments in metallurgy: Use of Copper, Bronze and Iron in Ancient India; Development of Geography: Geography in Ancient Indian Literature	**8L**
Module-II: Developments in Science and Technology in Medieval India: Scientific and Technological Developments in Medieval India; Influence of the Islamic world and Europe; The role of maktabs, madrasas and karkhanas set up; Developments in the fields of Mathematics, Chemistry, Astronomy and Medicine; Innovations in the field of agriculture - new crops introduced new techniques of irrigation etc	**8L**
Module-III: Developments in Science and Technology in Colonial and Independent India:Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company‘s Service; Indian Response to new Scientific Knowledge, Science and Technology in Modern India; Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites and Development of ISRO	**10L**
Module-IV: Prominent scientist of India since beginning and their achievement:Mathematics and Astronomy: Baudhayan, Aryabhtatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna; Medical Science of Ancient India (Ayurveda & Yoga): Susruta, Charak, Yoga &Patanjali; Scientists of Modern India: Srinivas Ramanujan, C.V. Raman, Jagdish Chandra Bose, Acharya Prafulla Chandra Roy, SatyendraNath Bose, MeghnadSaha, HomiJehangirBhabha and Dr.Vikram Sarabhai	**10L**

REFERENCE BOOKS:

1. Binod Bihari Satpathy. “History of Science and Technology in India”. Development. Volume 29.
2. G. Kuppuram. 1990. “History of Science and Technology in India”. South Asia Books.
3. M. Bhardwaj. 2010. “History of Science and Technology in Ancient India”. Bookwin

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	3	-	1	1	2	2	-
CO2	2	3	-	2	1	2	3	1	1	2	2	2	2	-
CO3	3	2	1	1	2	2	1	1	2	-	-	2	2	-
CO4	3	1	2	-	-		-	-		1	2	2	2	-
CO5	2	3	1	2	1	1	1	-	2	-	1	2	2	-

COURSE NAME: MAJOR PROJECT-I

COURSE CODE: CE781

CONTACT: 0:0:8

CREDIT: 4

Prerequisite: Science and Engineering knowledge

It is intended to start the project work early in the seventh semester. The poroject problem is expected to be completed in the seventh semester and the demonstration and report writing will be carried out in the eighth semester. The students in a group of 4 to 6 works on a topic are to be approved by the head of the department under the guidance of a faculty member. The students prepare a comprehensive project report after completing the work to the satisfaction of the supervisor to be submitted at the end of the semester. The progress of the project is evaluated by a committee may be constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report may jointly by external and internal examiners constituted by the Head of the Department.

COURSE NAME: INTERNSHIP
COURSE CODE: CE782
CREDIT: 1.0
Course contents:
Collective Data from 3rd to 7th Semester (Summer/Winter Training during Semester Break & Internship should be done after 5th Semester to 7th Semester). All related certificates to be collected by the training/internship coordinator(s).

COURSE NAME: TECHNICAL SEMINAR PRESENTATION

COURSE CODE: HU(CE)791

CONTACT: 0:0:1

TOTAL CONTACT HOURS: 12

CREDIT: 0.5

Prerequisite: English language

Course Contents:

Forms of Technical Communication: Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration, C.V./Resume writing; Technical Proposal: Types, Structure & Draft.

Technical Presentation: Strategies & Techniques: Presentation: Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Technical Communication Skills: Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and nonverbal means.

COURSE NAME: SKILL DEVELOPMENT- TECHNICAL ARTICLE WRITING
CODE: HU(CE)792
CONTACT HOURS: 0:0:1
CREDIT: 0.5

Course contents:

Writing a Technical Report/Article

(a) Organizational Needs for Reports and types
(b) Report Formats
(c) Report Writing Practice Sessions and Workshops

4th Year 8th Semester									
Sl. No.	**Broad Category**	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Major	CE801	A. Bridge Engineering B. Public Transport System C. Ground Improvement Techniques	3	0	0	3	3
B. PRACTICAL									
5	PROJECT	Major	PR881	Major Project-II	0	0	36	12	6
6	ENGG	Major	CE882	Grand Viva	0	0	2	2	1
Total of Theory, Practical and Mandatory Activities / Courses								25	10

Sem	***Sem wise Credit***	***Year***	***Year wise credit***
1st Sem	17.5	1st YEAR	**40**
2nd Sem	22.5		
3rd Sem	23	2nd YEAR	**44**
4th Sem	21		
5th Sem	24.5	3rd YEAR	**44**
6th Sem	19.5		
7th Sem	22	4th YEAR	**32**
8th Sem	10		
Total Credit (Theory+ Practical)			**160**

COURSE NAME: BRIDGE ENGINEERING
COURSE CODE: CE801 A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS: 3

Pre requisites: Student should have knowledge about how to solve analysis of structural problem, reinforced concrete structure design and steel structure design.

Course Objective: Student will be able to know about the bridges and perform analysis of different types of bridges and also able to design of reinforced concrete and steel bridges of different types.

Course Outcome:

CO1: Students will be able to exhibit the knowledge of the history of bridges and know about the IRC guidelines.
CO2: Students will be able to design the RCC bridges of different type.
CO3: Students will be able to design the Balanced Cantilever Bridges.
CO4: Students will be able to design the steel bridges of different type. schedule, and safety requirements.
CO5: Students will be able to exhibit the knowledge of Composite Bridges and Cable Stayed Bridges.

Course contents:

Module-I: [4L] **Introduction:** Definition and Basic Forms, Component of bridge, classification of bridge, short history of bridge development. I.R.C Loads. Analysis of IRC Loads, Impact factors, other loads to be considered, Importance of Hydraulic factors in Bridge Design.	**4L**
Module-II: [4L] **Reinforced concrete solid slab bridge:** Introduction, General design features, Effective width method. Simply supported and cantilever Slab Bridge, analysis and design.	**4L**
Module-III: [3L] **Box Culvert:** Introduction, Design method and Design example.	**3L**
Module-IV: [4L] **Beam and Slab Bridges:** Introduction, Design of interior panel of slab. Pigeauds method, Design of longitudinal girder, Calculation of longitudinal moment, design example.	**4L**
Module-V: [3L] **Balanced Cantilever Bridges:** General Features, Arrangement of supports, design features Articulation, Design example.	**3L**
Module-VI: [3L] **Steel Bridges:** General features, types of stress, Design example.	**3L**
Module-VII: [3L] **Plate Girder Bridge:** Elements, design, lateral bracing, Box- girder Bridges.	**3L**
Module-VIII: [6L] **Composite Bridges:** General aspects, method of construction, analysis of composite section, shear connectors, design of composite beam.	**6L**
Module-IX: [6L] **Cable Stayed Bridge:** General features, Philosophy of design.	**6L**

Text / Reference Books:

Name	Author	Publishers
Bridge engineering	Krishnaraju	-
Principle & Practice of Bridge Engineering	S.P. Bindra	Dhanpat Rai Pub
Essentials of bridge engineering	D.J. Victor	-
Bridge engineering	Ponnuswamy	-
Design of Bridge Structures	T.R. Jagadesh, M.A. Jayaram	-
Design of concrete bridges	Aswani, Vazirani, Ratwani	-
Design of steel structures	Arya&Ajmani	-
Concrete Structures	Vaziram & Ratwani	-
Structures design and drawing	Krishnamurthy	-
IRC 5, IRC 6, IRC 112, Indian Roads Congress	BIS	
IRS Bridge Rules, IRS Concrete Bridge Code, Research Designs and Standards Organization, Indian Railways	BIS	

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	2	2	3	3
CO2	3	3	3	-	2	-	-	-	-	-	2	2	2	3
CO3	3	3	3	-	2	-	-	-	-	-	2	2	2	3
CO4	3	3	3	-	2	-	-	-	-	-	2	3	3	2
CO5	3	2	2	-	2	-	-	-	-	-	2	3	2	2

COURSE NAME: PUBLIC TRANSPORT SYSTEM
COURSE CODE: CE801B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic knowledge of Civil Engineering

Course Objective:

- Explain different transit modes, routing management activities including demand analysis.
- Provide information on functioning, designing and scheduling of transit terminal design, fleet management, and cost benefit analysis and bus transit operation.
- Provide information on loading and unloading transit platforms, traffic management techniques and IPT service improvements.
- Explain demand management techniques, intersection management techniques, planning for pedestrian, bicycle and parking management.

Course Outcome:

CO1 : Able to remember transit modes, management activities and demand analysis.
CO2 : Capable of designing transit terminal units, fleet management and cost analysis.
CO3 : Capable of planning and scheduling transit terminal platform for loading and un-loading, selecting suitable traffic management techniques.
CO4 : Capable of selecting different demand management techniques, intersection management techniques and small area management.

Course contents:

Module 1: **System and Technologies:** Urban passenger transportation modes, transit classifications and definitions, theory of urban passenger transport modes, rail transit, bus transit, Para transit and ride sharing, designing for pedestrians, trends in transit rider ship and use of different modes.	**8L**
Module 2: **Comparing Alternatives:** Comparing costs, comparative analysis, operational and technological characteristics of different rapid transit modes, evaluating rapid transit **Planning:** Transportation system management, system and service planning, financing public transportation, management of public transportation, public transportation marketing.	**10L**
Module 3: **Transit System Evaluation:** Definition of quantitative performance attributes, transit lane capacity, way capacity, station capacity, theoretical and practical capacities of major transit modes, quantification of performance	**8L**
Module 4: **City Traffic:** Classification of transportation systems, conventional transportation systems, unconventional transportation systems, prototypes and tomorrow's solutions, analysis and interpretation of information on transportation systems, perspectives of future transportation.	**10L**

Text / Reference Books:

Name	Author	Publishers
Public Transportation	George E. Gray and Lester A. Hoel	Prentice Hall, New Jersey
Urban Public Transportation Systems and Technology	Vukan R Vuchic	Prentice Hall Inc., New Jersey
City Traffic - A Systems Digest'	Horst R. Weigelt, Rainer E. Gotz, Helmut H. Weiss	Van Nostrand Reinhold Company, New York
Metropolitan Transportation Planning'	John W. Dickey	Tata McGraw-Hill Publishing Co. New Delhi

CO-PO mapping

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

COURSE NAME: GROUND IMPROVEMENT TECHNIQUES
COURSE CODE: CE801C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Knowledge of Basic Soil Mechanics / Fundamental Geotechnical Engineering

Course Objective: To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques. • To bring out concepts of reinforced earth. • Applications of geotextiles in various civil engineering projects.

Course Outcome:

CO1 : Understand the different ground improvement techniques.
CO2 : Understand the methods of stabilisation
CO3 : Understand the methods and properties of reinforced soil
CO4 : Understand the basic concepts of geosynthetics
CO5 : Understand the basic concept of consolidation of soil
CO6 : Understand the concept of shear strength in soil

Course contents:

Module-I: **Introduction:** Definition, Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement.	**4L**
Module-II: **Mechanical stabilization:** Shallow and deep compaction requirements, Principles and methods of soil compaction, Shallow compaction and methods. Properties of compacted soil and compaction control, Deep compaction and Vibratory methods Dynamic compaction.	**6L**
Module-III: **Hydraulic modification:** Ground Improvement by drainage, Dewatering methods. Design of dewatering systems, Preloading, Vertical drains, vacuum consolidation, Electro-kinetic dewatering, design and construction methods.	**6L**
Module-IV: **Modification by admixtures:** Cement stabilization and cement columns, Lime stabilization and lime columns. Stabilization using bitumen and emulsions, Stabilization using industrial wastes Construction techniques and applications.	**6L**
Module-V: **Grouting:** Permeation grouting, compaction grouting, jet grouting, different varieties of grout materials, grouting under difficult conditions.	**4L**
Module-VI: **In situ soil treatment methods:** Soil nailing, rock anchoring, micro-piles, design methods, construction techniques.	**4L**
Module-VII: **Case studies:** Case studies of ground improvement projects.	**6L**

Text / Reference Books:

Name	Author	Publishers
Foundation Analysis & Design	J.E. Bowels	McGraw Hill
Principles of Foundation Engineering	B.M. Das	Thomson Book
Foundation Design Manual	N. V. Nayak	Dhanpat Rai Publication Pvt. Ltd
Construction and Geotechnical methods in foundation engineering	R.M. Koener	McGraw Hill
Technology in tunnelling and dam construction	A.V. Shroff. & D.L. Shah	Oxford and IBH Publishing Co.Pvt.Ltd
Reinforced Earth	T S Ingold	Thoam Telford
Designing with Geosynthetics	R M Koerner	Prentice Hall

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	3	2	1	2	2	3	2	3	2	2
CO2	3	3	1	2	3	2	1	1	2	3	1	3	3	2
CO3	3	3	2	2	3	3	3	3	1	1	2	3	3	2
CO4	3	3	1	3	1	2	2	1	2	1	1	3	3	2
CO5	3	3	1	1	2	1	2	2	3	2	2	3	2	3
CO6	3	2	3	1	2	2	2	1	2	2	1	1	2	3

COURSE NAME: MAJOR PROJECT-II

COURSE CODE: PR881

CONTACT: 0:0:12

CREDIT: 6

Course Contents:

It is intended to start the project work early in the seventh semester. The poroject problem is expected to be completed in the seventh semester and the demonstration and report writing will be carried out in the eighth semester. The students in a group of 4 to 6 works on a topic are to be approved by the head of the department under the guidance of a faculty member. The students prepare a comprehensive project report after completing the work to the satisfaction of the supervisor to be submitted at the end of the semester. The progress of the project is evaluated by a committee may be constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report may jointly by external and internal examiners constituted by the Head of the Department.

COURSE NAME: GRAND VIVA

COURSE CODE: CE882

CREDIT: 1

Course Contents

The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and all Faculty members of the department. The Comprehensive Viva-Voce is intended to assess the student's understanding of the courses he/ she studied during the 4 years B. Tech. programme.